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Technical Program: Wednesday, November 6

Venue: Electrical Engineering (EE) Building, 1st Floor

08:00 - 08:30
Registration Open
Room: 106 - Multi-Function Room

08:30 - 09:15
Opening Ceremony
Room: 106

Welcome Address
Dr. Andy Chen (General Co-Chair, RASSE 2024, President-Elect, IEEE Systems Council)

Dean Address
Dr. Ching-Chih Tsai (Dean, Electrical Engineering College, National Chung Hsing University)

Council Address
Mr. Walter Downing (President, IEEE Systems Council)

09:15 - 09:45
Keynote Presentation 1: Smart Cities for a Greener Future: Leveraging AI for ESG Transformation...N/A
Dr. Pao-Ann Hsiung (Director, Research Center on AI and sustainable Development, National Chung Cheng University, Taiwan)
Room: 106

09:45 - 10:00
Coffee Break
Room: Multi-Function Room

10:00 - 10:30
Keynote Presentation 2: Digital Humanities Show All Sorts of Crossovers Between Computing and the Arts...N/A
Dr. Jolly Wong (Guest Professor, Macau University of Science and Technology, Macau)
Room: 106

10:30 - 11:00
Keynote Presentation 3: 10th Machine Age...N/A
Stephen Ibaraki (Founding General Partner, REDDS Capital and AI for Good, Canada)
Room: 106

11:00 - 11:30
Keynote Presentation 4: Harnessing AI for Privacy Management and Unstructured Data Processing in the Digital Age...N/A
Dr. Brian Huang (Co-Founder and CTO, iDox.AI, Taiwan)
Room: 106

11:30 - 12:00
Keynote Presentation 5: One-bit Metrology...N/A
Dr. Paolo Carbone (Full Professor, University of Perugia, VP Conferences, IEEE Systems Council, Italy)
Room: 106

12:00 - 13:30
Lunch
Room: Multi-Function Room

13:30 - 15:00
Session 1: Diagnosis and Anomaly Detection
Room: 103

13:30

Vulnerability Assessment of Distribution Networks Based on Hybrid Power Systems and Weather...N/A

Li Yang (Universiti Sains Malaysia (USM), Malaysia)
Jiashen Teh (Universiti Sains Malaysia, Malaysia)
Lai Ching-Ming (National Chung Hsing University, Taiwan)

The vulnerability and resilience of distribution networks are critical challenges in modern power systems research. The variability of renewable energy sources and the stochastic nature of electric vehicle charging increase grid complexity and current direction fluctuations, posing potential risks and severe blackout incidents. This paper introduces an advanced assessment framework to evaluate the vulnerability of hybrid power systems and distribution networks under extreme weather conditions. The framework accounts for the aging effects of energy storage system batteries and incorporates the average risk factor of extreme weather on renewable energy sources. Additionally, the methodology employs a hybrid approach, combining Long Short-Term Memory (LSTM) and Monte Carlo (MC) models, to predict battery degradation rates and uncertainties in renewable energy generation. Empirical analysis on the IEEE 33-node system demonstrates the framework's effectiveness in quantifying the vulnerability of complex grid systems.

13:45

Implementation a Multi-Fault Diagnosis System for Three-Phase Induction Motors Using Machine Learning Techniques...1

Shih-Hsien Hsu (Feng Chia University, Taiwan)
Min-Chieh Lin (Feng Chia University, Taiwan)
Chia-Chieh Tsai (Feng Chia University, Taiwan)

Induction motors (IMs) have been a cornerstone in industrial applications for decades due to their robustness, reliability, and efficiency. However, as the reliance on these motors has increased, so has the necessity for ensuring optimal performance and minimizing downtime. This study applies machine learning (ML) algorithm to diagnose three-phase induction motors with multiple faults. Consequently, the development of advanced fault diagnosis methods has become vital. The research aims to establish a comprehensive detection technique. It includes artificially creating common fault types in induction motors, such as rotor unbalance, stator short circuit, rotor broken bars, and composite failures of three, as the targets for ML diagnosis and judgment. By optimizing the data preprocessing method using fast Fourier transform (FFT) and validating classifiers with k-nearest neighbors (KNN), the study's results show that the preprocessing method optimized with FFT and standard deviation can effectively improve the prediction accuracy and reduce the diagnosis time. Moreover, this method exhibits superior performance in real-time fault diagnosis applications. After FFT processing, KNN accuracy improved from 87.43% to 100%, and classification time reduced by 83.9%, from 97.61 seconds to 15.77 seconds. This method not only boosts accuracy but also shortens classification time, enhancing diagnostic efficiency. FFT significantly improves the model's ability to handle new data.

14:00

Anomaly Detection in Shipboard Operational Technology Systems Using Cyber Analytics...9 (virtual)

Paul F Smith (Naval Postgraduate School, USA)
Preetha Thulasiraman (Naval Postgraduate School, USA)
Giovanna Oriti (Naval Postgraduate School, USA)
Mark Vygoder (University of Wisconsin - Milwaukee, USA)
Jacob D Gudex (Electrical and Computer Engineering, USA)

Modern naval vessels contain complicated operational technology (OT), including control and power systems. The OT of a Navy ship is vulnerable to exploitation and intrusion, resulting in anomalies that can lead to cascading failures. This paper presents a novel method to effectively detect and classify physical intrusions into shipboard operational components, which can manifest in power data. A physics-based model is used to simulate a shipboard power system to create realistic test data while adhering to the Military Interface Standard 1399 (MIL-STD-1399). A long short term memory (LSTM) machine learning algorithm, modeled in Python, is used to detect anomalies in a shipboard OT. We inject synthetic anomalies and use the LSTM model to identify anomalous behavior that may be due to a malicious cyber event. The model generates predictive data, and by comparing the predictive data to current trends, it detects data outliers. We show that our algorithmic framework effectively predicts normal system behavior while identifying deviations indicative of anomalies. The results presented in this paper demonstrate the achievement of high accuracy in anomaly detection using an LSTM. We also provide

insights into how this LSTM model can be used for predictive maintenance of shipboard systems in order to allow for targeted maintenance of components when necessary and not only during fixed schedules. This research is critical for improving the operational readiness of the Naval fleet due to both the application of predicting component failures, and protecting ships from cyber threats.

14:15

Anomaly Detection in 5G Networks Using Transformer-Based Autoencoder...16 (virtual)
Yongsin Kim (Agency for Defense Development, Korea (South))
Preetha Thulasiraman (Naval Postgraduate School, USA)

This paper introduces a novel anomaly detection approach for 5G networks using Transformer-Based Autoencoders (TAE) to address the complex security challenges intrinsic to these environments. As 5G technology becomes increasingly widespread, its associated security vulnerabilities also escalate, particularly when applied to critical energy systems. Marine Corps Air Station (MCAS), Miramar, is one such case study, in which 5G non-standalone (NSA) cellular communications is used to connect disparate energy devices across the facility. The 5G NSA set up has limitations compared to the 5G standalone architecture, particularly in its ability to detect cyber anomalies in energy traffic. In order to enhance the cyber resiliency of such an energy network, we must implement effective anomaly detection methods using machine learning. This study employs a transformer architecture that enhances the anomaly detection capabilities of traditional autoencoders by more effectively capturing complex data interrelationships. Extensive experiments on a simulated 5G dataset validate the efficacy of our approach, which achieves high detection accuracy without the need for outlier removal, thereby effectively identifying and mitigating a variety of security threats. The model's ability to maintain stability without extensive pre-processing underscores its potential for enhancing the cyber resilience of 5G networks, specifically as it pertains to the MCAS Miramar use case.

14:30

Human-Autonomy Command (HAC): Directing and Coordinating Human-Machine Systems as Cognitive Capabilities...24 (virtual)
Arne Norlander (NORSECON & Swedish National Defence University, Sweden)

Joint human-machine agents constitute hybrid capability components, able to accurately and rapidly sense, perceive and interpret relevant events and circumstances in order to sustain and improve decision-making and action, enabling every commander and operator to develop a wide-ranging appreciation of the situation. This calls for technologies that are able to autonomously engage with its environment, without continuous human supervision. In addition to socio-technical aspects of Human-Autonomy Teaming (HAT), it is essential to also pay attention to cognitive aspects of autonomous agents, human operators, and commanders as well. Emergent, Dynamic, Global and Evolutionary (EDGE) operations require flexible, adaptive, and high-performance human and technological (hybrid) cognitive capabilities, sustaining comprehensive operational awareness - shaping, supporting and utilizing cognitive superiority among and between human and machine agents. In order to better understand the capabilities and limitations of Joint Human-Autonomy Systems, including their performance and types of tasks, we need to understand their cognitive aspects. We propose a future-oriented Essence of Human-Autonomy Command (HAC), comprising strategic capability elements with equal relevance and applicability on human and autonomous agents, and grounded in adaptive and versatile command and execution principles, supported by hierarchical knowledge structures, along with agile high-performance organizations, where the Human-Autonomy Command approach is superior regarding managing and maintaining operational availability, versatility, and efficiency.

13:30 - 15:00
Session 2: Microgrid System
Room: 507

13:30

Analysis of Renewable Energy Potential Combinations in Microgrid Systems...33
Chung I-Hua (National Kaohsiung University of Science and Technology, Taiwan)
Chin-Pao Chu (National Kaohsiung University of Science and Technology, Taiwan)

In response to the growing global and local demand for net-zero carbon emissions, this study thoroughly explores the feasibility of implementing microgrid technology in convenience stores across Taiwan to reduce carbon emissions and enhance overall energy sustainability significantly. The research emphasizes the integration of renewable energy sources, specifically solar and wind power, aligning with Taiwan's strategic initiatives in promoting renewable energy development. Utilizing the HomerPro simulation tool, the study conducts an in-depth assessment of various energy combinations, evaluating their performance under various conditions, including different carbon pricing scenarios, grid reliability factors, and essential financial variables such as discount rates and inflation. A total of 256 system configurations were simulated to identify the most economically viable and

environmentally sustainable solutions for these convenience stores. The study provides a comprehensive understanding of the impact of these variables on the financial and operational feasibility of microgrid systems. The findings are crucial for informing policymakers, energy planners, and business owners, offering practical guidance for designing and implementing effective energy strategies within Taiwan's convenience store sector. By advocating for the adoption of microgrid technology, this study contributes to Taiwan's broader goals of achieving carbon neutrality and improving energy security and plays a key role in reducing dependence on conventional grid systems. This work supports transitioning to a more sustainable, resilient, and future-proof energy infrastructure.

13:45

Cost-Effectiveness Analysis of Solar and Wind Power Generation in Microgrid Systems: a Case Study of Changbin Industrial Zone...41

Chung I-Hua (National Kaohsiung University of Science and Technology, Taiwan)

The study centers on a comprehensive cost-effectiveness analysis of solar and wind power generation within the microgrid system located in the Changbin Industrial Zone. This region, characterized by favorable solar irradiance and wind conditions, is an ideal location for developing and implementing renewable energy systems. Through extensive simulations, we examined the impact of temperature fluctuations on photovoltaic (PV) module efficiency and the influence of varying wind turbine heights on energy output. Our findings revealed that temperature plays a crucial role in determining the performance of PV modules, with higher temperatures leading to a noticeable decline in efficiency. Conversely, wind power generation is significantly affected by the height of wind turbines, where increased height results in enhanced energy capture due to stronger and more consistent wind speeds at elevated altitudes. Furthermore, the study underscores the importance of considering seasonal variations, as these can significantly influence the overall efficiency and reliability of renewable energy systems within a microgrid. By optimizing wind turbine heights and incorporating strategies to mitigate the effects of temperature fluctuations on solar panels, the study demonstrates that it is possible to significantly improve the overall power generation efficiency of the microgrid system. Improving efficiency reduces the cost per kilowatt-hour of electricity generated, thereby enhancing the economic viability of renewable energy projects. The insights gained from this analysis are expected to provide valuable guidance for future renewable energy planning, particularly in regions with similar climatic and geographical conditions. Such strategic planning is essential for maximizing the return on investment and ensuring the long-term sustainability of renewable energy systems.

14:00

Economic Feasibility Analysis and Breakeven Point Estimation of Microgrid System Combinations Under Carbon Fee Policies...47

Chung I-Hua (National Kaohsiung University of Science and Technology, Taiwan)

This study delves into the economic feasibility of various energy system combinations under the influence of carbon fee policies, using a convenience store located in the Changbin Industrial Park as a representative case. The primary focus is analyzing the intricate relationship between the Levelized Cost of Energy (LCOE) and carbon fees. In light of the growing importance of sustainable energy practices, this research explores how different combinations of renewable energy sources and storage systems can be optimized within the context of evolving carbon fee regulations. The findings underscore the pivotal role of carbon fees as a decisive factor in determining the economic viability of microgrid systems. Specifically, when the carbon fee escalates to NT $3000/〖tCO〗_2e, certain system configurations, such as GPWL (Grid-Photovoltaic-Wind-Lithium) and GPWF (Grid-Photovoltaic-Wind-Flow Battery), emerge as economically viable options. However, the feasibility of these systems is significantly influenced by the prevailing costs of green electricity procurement, which can either enhance or limit their attractiveness. Moreover, the study introduces a regression analysis model capable of accurately predicting fluctuations in energy costs across different carbon fee scenarios. This model provides a robust analytical tool for decision-makers, enabling them to anticipate the financial implications of policy changes on energy systems. The insights derived from this research are particularly valuable for businesses and policymakers, offering a hopeful vision of a future with cost-effective and sustainable energy solutions.

14:15

Power Sharing and Restoration Control Strategy Based on Line Impedance Estimation and Virtual Impedance Compensation Under AC Islanded Microgrid...N/A

Yi-Hung Liao (National Central University, Taiwan)
Xuan-Sheng Huang (National Central University, Taiwan)
Ting-Hsien Lin (National Central University, Taiwan)

In this paper, a decentralized control strategy for power sharing and restoration mechanism is proposed based on the line impedance estimation for islanded microgrids. The proposed line impedance estimation calculates the line impedance between the distributed energy resources (DERs) and the point of common coupling (PCC). Thus, the negative virtual impedance is utilized to eliminate the line impedance effect, achieving autonomous power sharing when the microgrid enters islanded mode. In addition, through the proposed negative virtual impedance compensation, the voltage and frequency restoration mechanism in the secondary control can be incorporated into the local control, which autonomously restores the frequency and voltage to the nominal values. The proposed method ensures stable operation of an islanded microgrid under communication-less or simple communication, and reduces excessive reliance on communication, especially in the case of communication failure. Furthermore, the virtual inertia can be added into the proposed control method to reduce the rate of change of frequency (ROCOF) when the

load power changes in the droop control, that also improves the reliability of the entire DERs system. Next, the stability of proposed method is also analyzed using impedance-based stability criterion to prove the system stability. Finally, some simulation results are provided to validate the proposed control strategy.

14:30

Optimal Home Energy Management System for a Residential Grid-Connected Microgrid Using Improved Slime Mould Algorithm...55

Syuan-Yi Chen (National Taiwan Normal University, Taiwan)
Pin-Jung Chen (National Taiwan Normal University, Taiwan)
Chi-Cheng Chen (National Taiwan Normal University, Taiwan)
Chih-Ting Wu (National Taiwan Normal University, Taiwan)

This study presents a home energy management system (HEMS) utilizing an improved slime mould algorithm (ISMA) for the efficient energy management of a residential grid-connected microgrid. The studied microgrid comprises a photovoltaic system (PVS), a battery storage system (BSS), two DC-DC converters, a DC-AC voltage source inverter (VSI), a Y-Y three-phase transformer, and varying electricity loads. The proposed ISMA-based HEMS optimizes the power flow ratio among the PVS, BSS, and the utility grid, taking into account factors including load demand, battery's state of charge (SOC), PVS power, time-of-use (TOU) electricity rates, feed-in tariffs, and the electricity costs of both battery and utility grid to minimize overall electricity costs. To achieve the control object, the system incorporates advanced power flow control (PFC) techniques for the voltage source inverter (VSI) and parallel converter system (PCS) within the microgrid. The performance of the ISMA-based HEMS is evaluated through experimental validation on a practical microgrid platform. Results indicate that the ISMA-based HEMS significantly reduces electricity costs compared to rule-based control strategy. The key contributions include the practical development of a grid-connected microgrid with energy storage and renewable energy, the enhancement of SMA's search ability, and the formulation of an energy cost minimization problem considering load demand, battery's state of charge (SOC), PVS power, time-of-use (TOU) electricity rate, and feed-in tariffs. The experimental results demonstrate that the proposed ISMA-based HEMS effectively reduces electricity costs than the conventional RBC-based HEMS.

14:45

Refinement of Generation Schedule and Under-Frequency Load Shedding Protection Scheme for Nangan-Beigan Islanded Power Grid in Taiwan...62

Yu-Jen Lin (I-Shou University, Taiwan)
Sheng-Huei Lee (Chien Hsin University of Science and Technology, Taiwan)
Chia-Chi Chu (National Tsing Hua Univ, Taiwan)

The Nangan-Beigan power grid in Taiwan has faced frequent blackouts in recent years, primarily due to operating at approximately half of its generation capacity, which led to vulnerability during consecutive N-1-1 and extreme N-2 generator tripping events. To address this issue, this power grid occasionally shifted to a mode where a single generator operated at over 70% of its capacity. However, this approach increased the risk of a complete blackout. One effective way to safeguard the power grid from instability is to implement a well-designed load shedding strategy when a generation unit unexpectedly fails. To mitigate this risk, this paper describes the refi nement design of the existing load shedding protection scheme for the Nangan-Beigan power grid. The refined scheme includes an updated generation schedule and an enhanced under-frequency load shedding (UFLS) strategy. This refinement accommodates both the half-capacity operational mode and the higher-capacity mode of single-unit operation. The improved load shedding scheme is more effective since it requires less load shedding as blackout conditions approach compared to the previous scheme. The effectiveness of these refi nements has been demonstrated through comprehensive computer simulations and practical operational data. It is our belief that the insights gained from this refi nement will help power engineers in designing more effective load shedding protection schemes for power grids.

15:00 - 15:30
Coffee Break
Room: Multi-Function Room

15:30 - 17:00
Session 3: Learning Based Method
Room: 103

15:30

Advanced Obstacle Avoidance in Walking Aids: Overcoming the Challenges of Low-Lying Obstacles With Deep Learning...70

Yu-Shao Kao (Tamkang University, Taiwan)
Shih-Ting Wang (National Chung Hsing University, Taiwan)
I-Hsum Li (Chung Hsing University, Taiwan)

An autonomous walking aid is a type of Autonomous Mobile Robots (AMRs) designed to navigate and perform tasks independently. In this paper, we introduce an innovative obstacle avoidance approach for walking aids, with a particular emphasis on avoiding non-stereotypical obstacles such as water puddles. Traditional methods relying on LiDAR, depth sensors, or cameras often struggle with low-lying obstacles due to challenges in detecting reflective surfaces and interpreting complex visual data. To overcome these limitations, we developed two deep learning-based network architectures: the Single-Image Action Network (SIAN) and the Sequence-to-Action Network with Feedback Network (SAN-FN). The first architecture processes a single image to generate an action sequence for obstacle avoidance, while the second architecture takes an image sequence and feedback from wheel velocities to infer real-time action responses. In addition, we employed Gazebo to create a 3D simulation environment and gather training data for deep learning networks, significantly reducing the cost and effort associated with data collection. The first approach achieved a 100% success rate in simulated obstacle avoidance tests involving puddles, while the second approach demonstrated a 76% success rate. This study highlights the significant potential of deep learning in enhancing the obstacle avoidance capabilities of walking aids, particularly in the context of challenging obstacles like water puddles.

15:45

Acoustic Fault Detection in Brushless Direct Current Motors Using Machine Learning for Predictive Maintenance...75

Soe Min Htet (Tatung University, Taiwan)
Chun-Yu Hsiao (Tatung University, Taiwan)

Performance maintenance of Brushless Direct Current (BLDC) motors is crucial due to their widespread applications, ranging from household appliances like fans to critical systems in unmanned aerial vehicles (UAVs). As these motors are integral to various operations, ensuring their reliability and detecting faults early is essential to prevent failures and maintain optimal performance. Numerous studies have been conducted to develop methods for fault detection in BLDC motors, focusing on different aspects such as vibration analysis, current monitoring, and sound analysis. This paper proposes a reliable approach for detecting faults by developing a system that identifies bearing and propeller faults based on the audio analysis of the operational sound of the BLDC motor. Acoustic features were meticulously extracted from the motor's operation sound, and five different machine learning models were trained and evaluated for their effectiveness in fault detection. Among these models, the K-Nearest Neighbors (KNN) and Extreme Gradient Boosting (XGBoost) models achieved a remarkable accuracy of 100%, outperforming the other models. Furthermore, the study identified the top five acoustic features that significantly contributed to the models' high performance, providing valuable insights for further improvements in fault detection systems. This research offers a robust and efficient solution for maintaining the performance of BLDC motors.

16:00

CSGraph2Vec: Distributed Graph-Based Representation Learning for Assembly Functions...79

Wael J. Alhashemi (McGill University, Canada)
Benjamin CM Fung (McGill University, Canada)
Adel Abusitta (Polytechnique Montreal, Canada)
Claude Fachkha (University of Dubai, United Arab Emirates)

Software reverse engineering is an essential but time-consuming undertaking in identifying malware, software vulnerabilities, and plagiarism, especially when access to the source code is limited. The extraction of abstract characteristics that represent malware and work as classifier inputs in traditional machine learning approaches requires feature engineering. The calibre of the features that are extracted has a major impact on how well these algorithms perform. In contrast, end-to-end learning solutions do not require hand-designed features and instead attempt to determine if an executable is harmful or not. However, a certain level of preprocessing remains essential in order to present malware content in a manner that the machine learning algorithm can comprehend. Due to the development of machine learning and deep learning, automating the construction of vector embeddings has become more feasible. This research introduces CSGraph2Vec, a distributed and automated deep learning approach that produces representations of assembly functions. Using the power of the Electra pre-trained language model, as well as message-passing neural networks, CSGraph2Vec efficiently incorporates control flow and semantic information from assembly code. Our model successfully learns significant features that distinguish benign from malicious functions. Through extensive experimentation and evaluation of the malware classification task, we show that our model performs better than several alternative approaches.

16:15

Conservative Power Theory Approach for Feature Extraction in Non-Intrusive Load Monitoring...87

Kuo Lung Lian (National Taiwan University of Science and Technology, Taiwan)

Non intrusive load monitoring offers a cost-effective alternative traditional energy monitoring by disaggregating a household's total energy consumption into individual appliance loads from a single measurement point. This technology enhances energy conservation, demand-side management, and smart grid development However, there are many electric appliances exhibit similar operational characteristics because they share similar front end or have similar core technology. This is one of the most challenging and important task in NILM because there is an increasing trend in electric appliances to use active front ends for better energy efficiency. In this paper, we demonstrate that feature extraction based on conservative power theory (CPT) performs better, compared to Fryze's method in discerning loads with similar core technology or sharing the same front ends. Incorporating a feature extraction layer based on CPT into a deep learning neutral network can achieve an F1 score of 0.946, compared to those based on Fryze's method and the Vanilla case (i.e. no feature extraction layer), which correspond to 0.875 and 0.685, respectively to identify the turn-on and turn-off status of a total of 1023 load combinations. The superior feature extraction capabilities of the CPT make it the preferred choice for applications requiring high accuracy and detailed class-specific analysis.

15:30 - 17:00
Session 4: Vehicle & Iot
Room: 507

15:30

Optimal Route Planning and Energy Consumption Analysis of Electric Logistics Vehicles...91

Chen-Wei Huang (National Taiwan Normal University, Taiwan)
Long-Shan Xiao (National Taiwan Normal University, Taiwan)
Chien-Chiang Tung (National Taiwan University of Science and Technology, Taiwan)
Syuan-Yi Chen (National Taiwan Normal University, Taiwan)

This paper analysis the energy consumption of the traditional vehicle routing problem (VRP), which primarily focuses on minimizing distance, by proposing a more comprehensive route planning method for electric logistics vehicles (ELV). The proposed method is based on the simulated annealing (SA) algorithm and introduces energy consumption parameters to enhance the accuracy and effectiveness of the route optimization. In addition to distance, the study considers a range of factors that influence energy consumption, such as temperature, rainfall, time of day, vehicle load, slope angle, and rolling resistance. By integrating these parameters, the proposed approach transitions from a purely distance-centric model to one that mirrors real-world conditions more closely. The use of SA is crucial in this context, as it helps to avoid local optima and ensures the attainment of a global optimal solution. Moreover, the study conducts simulations by varying the weights assigned to distance and energy consumption while keeping other factors constant. These simulations demonstrate how different weight settings can impact energy consumption, enabling the identification of the most efficient route. The proposed method not only reduces time costs but also minimizes financial losses caused by uncontrollable factors, making it a significant advancement in the field of logistics and transportation.

15:45

An Integrated System Framework for Mitigating Motion Sickness While Enhancing Ride Comfort and Vehicle Handling...N/A

Liang-Yu Lu (National Chung Hsing University, Taiwan)
I-Hsum Li (National Chung Hsing University, Taiwan)
Lian Wang Lee (National Chung Hsing University, Taiwan)

As driving tasks increasingly transition from human to autonomous control, the growing prevalence of passengers, combined with the need to ensure excellent ride comfort under all road conditions and to boost consumer acceptance of autonomous vehicles (AVs). This makes addressing motion sickness in passengers a critical priority in autonomous vehicles. Current research on active suspension systems often overlooks the vertical vibration frequency range of 0.1-0.5 Hz, which is closely linked to motion sickness susceptibility. This paper presents an Active Air Suspension System integrated framework that combines an Active Air Suspension System (AASS) employing a Fluidic Muscle Actuator (FMA) with a Reduced-Order Linear Extended State Observer-based Sliding Mode Control (RLESO-SMC) strategy. This integration is designed to attenuate vertical vibrations in the low-frequency range, thereby reducing motion sickness while enhancing vehicle handling and ride comfort across diverse road conditions. Experimental evaluations conducted under three simulated road conditions, adhering to British Standard 6841:1987 and ISO 2631-1 for motion sickness quantification, demonstrate that the proposed AASS-integrated framework achieves an average reduction in motion sickness incidence by 82% compared to the MacPherson suspension system. Additionally, frequency domain analysis of the road condition simulations indicates that the proposed AASS-integrated framework significantly improves ride comfort and vehicle handling.

16:00

Systems Engineering Approach for Compliant Over-The-Air Update Development...95

Jacqueline Henle (FZI Research Center for Information Technology, Germany)
Eric Sax (Karlsruhe Institute of Technology, Germany)
Stefan Otten (FZI Research Center for Information Technology, Germany)

A broad spectrum of technical innovations influences the automotive industry. Vehicles are increasingly governed by software, enabling continuous development over the entire product life cycle. In this context, software updates, especially those conducted over-the-air (OTA), represent a significant technological advancement. Regularly implementing OTA updates enhances the sustainability of vehicles as they lead to the possibility of keeping cars continuously functional, safe, secure, and performant. Requirements for OTA updates, their development, and implementation are formulated in industry standards and regulations. With the entry into force of UN Regulation 156, manufacturers operating in the member countries must establish processes for the development and overall management of OTA updates. At the same time, there are numerous other standards that apply in the industry. Furthermore, development process models and standardized approaches, such as the V-model for systems and software engineering, are widely adopted. Following the aim to develop a framework that focuses on secure and efficient OTA updates while adhering to legal and industry-specific requirements, a unified process model is presented in this paper. Requirements from the ISO 24089 standard and the UN Regulation 156 are extracted for that purpose. Interrelationships and overlaps between them, and further applicable standards for vehicle design, system, and software development are identified. Processes and work products not yet covered by other norms and legal guidelines are extracted. These activities are then linked content-wise and organizationally to the established V-model. The resulting integrated concept provides a basis for compliant and efficient software update management.

16:15

Product Line Engineering Applied to Perception System Architectures for Autonomous Trains...104

Carsten Thomas and Philipp Jaß (HTW Berlin, Germany)

Autonomous trains rely on on-board perception systems that allow to identify the train's location and route and that are able to detect potential obstacles on the track used by the train. To guarantee the required safety integrity levels for perception systems employing neural networks, N-version perception system architectures may be used that combine parallel processing pipelines, using design, implementation and/or data diversity to detect or even mask individual perception errors. In our paper we present an approach to systematically specify perception system architectures using feature-based product line engineering, and to link the feature and variant models to architectural models of perception systems, in order to automatically create perception system variants. We model architectural features and the related restrictions to specify valid architectures, and define perception architecture variants. Via the connection between the product line engineering models and systems engineering specifications of the computational elements used in the architectures, we can transform the architecture variant specifications into systems engineering architecture models and can automatically generate the software source code and configuration files required for implementation of the architecture variants. Our approach supports the systematic exploration of potential perception system architecture variants and the efficient evaluation of their individual perception quality and robustness against certain classes of perception challenges.

16:30

Toward Autonomous Navigation for Agriculture Robots in Orchard Farming...113

Cong-Thanh Vu (National Cheng Kung University, Taiwan)
Hsin-Chia Chen (National Cheng Kung University, Taiwan)
Yen-Chen Liu (National Cheng Kung University, Taiwan)

The agricultural sector is increasingly embracing automation for key operations such as planting, harvesting, and pesticide spraying. However, the effectiveness of these systems often depends on specific environmental conditions. Navigating through orchards with automated systems using RTK-GNSS or row tracking can be challenging due to factors such as uneven crop distribution, environmental obstacles, and signal instability under tree canopies. In this study, we present the design and development of an autonomous agricultural robot intended to navigate orchards and assist with pesticide spraying tasks. We propose an innovative navigation framework that utilizes visual information from two stereo cameras to identify crops. The localization system integrates sensor fusion, combining RTK-GNSS, visual odometry, and IMU data for enhanced accuracy. Additionally, we introduce a novel hybrid controller based on the Dynamic Window Approach (DWA), enabling the robot to efficiently follow fruit tree rows even when positioning signals are disrupted or trees are not detectable in certain areas. This eliminates the need to switch between control modes such as row following or reference trajectory tracking. The proposed method has been implemented on ROS2 and validated through simulations in various complex environments. Furthermore, real-world experiments were conducted in actual fruit orchards, demonstrating the efficacy of the proposed system. The hardware and software modules are also detailed in this study.

17:00 - 18:30
Session 5: Simulation and Prediction
Room: 103

17:00

A Study of Total Harmonic Distortion of Microspeaker by 3D Finite Element Simulation...N/A

Tzu-Hsuan Lei (Feng Chia University, Taiwan)
Shu-Chien Wu (Feng Chia University, Taiwan)
Kuang-Che Lo (Feng Chia University, Taiwan)
Min-Yuan Wu (Feng Chia University, Taiwan)
Yu-Cheng Liu (Feng Chia University, Taiwan)

The use of computer simulation software to assist in the development of new products and rapid optimization through its models has become a staple of most consumer electronics products. In recent years, research on acoustic simulation models has mainly focused on results in the frequency domain. However, distortion characteristics such as harmonics, which directly affect the human ear, can only be simulated and predicted by time-domain modeling. Therefore, in this paper, the 3D time domain of a cross-system microspeaker including electromagnetic, mechanical and acoustic domains is simulated by a commercial finite-element simulation software from the basic principle of microspeaker operation. The acoustic characteristics of the microspeaker are then measured in a professional electroacoustic measurement laboratory in accordance with international standards, and finally compared with the simulation results to verify the differences. The results show that the three-dimensional simulation model proposed in this paper not only improves the average difference between the low-frequency band and the measurement by about 2.6% compared with the conventional 2D axisymmetric model, but also the average difference between the full-frequency band simulation and the measurement is only 2.9%. This is a major technological breakthrough in the field of electroacoustic finite element method simulation, which has long been lacking in three-dimensional time-domain simulation technology.

17:15

From Platform Specification to Product Simulation: A Novel Application of SysML v2 in Product Line Engineering...121

Heinrich Wagner (Munich University of Applied Sciences HM, Germany)
Anna Arestova (University of Erlangen-Nürnberg, Germany)
Claudio Zuccaro (University of Applied Sciences Munich, Germany)

Product Line Engineering (PLE) methodologies have already established their significance within within the domain of Model-Based Systems Engineering (MBSE) and are gradually being employed in the industry. While Systems Modeling Language (SysML) models are already pivotal as the Single Source of Truth in product development, the use of PLE methodologies has been limited. Our approach extends the application of PLE from the specification of complex product platforms to the simulation of individual products, ensuring a consistent view of variability across different development phases and artifacts. This is facilitated by the adoption of SysML version 2 (v2), the SysML v2 API, and a newly developed model transformation for the OMNeT++ simulation environment. The proposed methodology is validated through a feasibility study focused on a railway in-vehicle network system. The integration of SysML v2 with OMNeT++ creates a seamless workflow that supports the entire product development lifecycle, enhancing modeling capabilities and providing detailed insights into product performance and behavior. This approach not only manages the complexity of modern engineering systems but also ensures that all aspects of product variability are consistently addressed. The study demonstrates the practical applicability and benefits of this approach, leading to more efficient, accurate, and high-quality product development.

17:30

Dynamic Modeling and Control of Hybrid Electric Vessels With a Super-Capacitor and a Lithium Battery...131

Chi-Chang Huang (National Taiwan Normal University, Taiwan)
Chien-Ming Lin (National Taiwan Normal University, Taiwan)
Yu-Hsuan Lin (National Taiwan Normal University, Taiwan)
Chan-Chiao Lin (National Taiwan Normal University, Taiwan)
Yi-Hsuan Hung (National Taiwan Normal University, Taiwan)

This paper presents an innovative dynamic model for a dual-motor vessel utilizing an integrated energy system comprised of a supercapacitor (SC) and a lithium-ion battery. The system aims to enhance energy efficiency under fluctuating power demands. The supercapacitor is strategically employed to handle high-power peaks and transient loads, easing the burden on the lithium battery. This integration improves energy efficiency and extends the battery's lifespan by minimizing excessive discharge cycles and thermal degradation-issues commonly arising from high power demands. The architecture of the system was modeled and simulated in MATLAB/Simulink, offering a detailed representation of key components, including energy sources, transmission systems, traction motors, and propellers. Additionally, nonlinear dynamics of the vessel body were incorporated into the simulation for a more accurate representation of real-world operating conditions. To manage energy distribution efficiently, a multi-mode rule-based control strategy (RBCS) was developed. The RBCS operates in three modes: Supercapacitor Mode, Hybrid

Mode I, and Hybrid Mode II. By integrating the supercapacitor into the energy management system, the load on the lithium battery is significantly reduced, resulting in extended battery life, lower maintenance costs, improved operational reliability, and enhanced vessel performance, particularly in dynamic maritime environments. The adaptability of the system makes it suitable for a variety of maritime applications, where efficient energy management and reduced operational costs are essential factors.

17:45

LOF-Based Hybrid Sampling for Improved Prediction Performance in Imbalanced Medical Datasets...137

Chao-Wei Hsu (National Taipei University of Nursing and Health Sciences, Taiwan)
Liang-Sian Lin (National Taipei University of Nursing and Health Sciences, Taiwan)
Chung-Yueh Lien (National Taipei University of Nursing and Health Sciences, Taiwan)
Hui-Chi Chuang (National Cheng Kung University, Taiwan)
Yi-Ying Tsai (Tamkang University, Taiwan)

The imbalanced medical dataset often fails to promise satisfactory prediction performance in traditional learning models, potentially delaying patient treatments. The imbalanced learning problem often leads to biased predictive results towards majority class due to lack of representative examples in minority class. To address the imbalanced medical data problem, we develop a novel hybrid sampling technique based on Local Outlier Factor (LOF) algorithm for enhancing support vector machine (SVM) models' prediction performance for imbalanced datasets. For majority class data, we employ LOF algorithm to detect and eliminate outliers. For minority class data, we use LOF algorithm to select key samples and employ interpolation approach for creating synthetic minority samples in sparse regions. To evaluate the proposed method's efficacy, two medical datasets are deployed in this paper. Three evaluation indicators: G-mean, F1, and index of balanced accuracy (IBA) are used to measure prediction performance. The two medical datasets are set at imbalanced ratio (IR) as 9 to test classification performance using the proposed method. Additionally, this paper's developed method is compared to IMB (using imbalanced datasets) method and Synthetic Minority Over-sampling Technique (SMOTE) in terms of prediction performance. The experimental results demonstrate the proposed method obtains better prediction performance across two medical datasets.

18:00

Short-Term Load Forecasting Based on Improved Sparrow Search Algorithm...N/A

Jian Shi (Universiti Sains Malaysia, Malaysia)
Jiashen Teh (Universiti Sains Malaysia, Malaysia)
Lai Ching-Ming(National Chung Hsing University, Taiwan)

To address the limitations of single-model prediction methods in integrated energy system load forecasting, such as slow convergence speed, susceptibility to local optima, and low prediction accuracy, a hybrid prediction model is proposed. The approach begins with the application of complementary ensemble empirical mode decomposition (CEEMD) technology to decompose the original load sequence into different intrinsic mode functions (IMFs). The improved sparrow search algorithm (ISSA) is then employed to optimize the two hyperparameters of the least squares support vector machine (LSSVM), establishing the ISSA-LSSVM prediction model. This model is used to predict each IMF individually, and the final prediction value is obtained by superimposing all sub-prediction results. Experimental analysis demonstrates that this model achieves high prediction accuracy.

17:00 - 18:30
Session 6: Advances in Systems Engineering
Room: 507

17:00

Leveraging Retrieval-Augmented Generation for Culturally Inclusive Hakka Chatbots: Design Insights and User Perceptions...141

Chen-Chi Chang (National United University, Taiwan)
Han-Pi Chang (National Central University, Taiwan)
Hung-Shin Lee (United Link Co., Ltd., Taiwan)

In an era where cultural preservation is increasingly intertwined with technological innovation, this study introduces a groundbreaking approach to promoting and safeguarding the rich heritage of Taiwanese Hakka culture through the development of a Retrieval-Augmented Generation (RAG)-enhanced chatbot. Traditional large language models (LLMs), while powerful, often fall short in delivering accurate and contextually rich responses, particularly in culturally specific domains. By integrating external databases with generative AI models, RAG technology bridges this gap, empowering chatbots to not only provide precise answers but also resonate deeply with the cultural nuances that are crucial for authentic interactions. This study delves into the intricate process of augmenting the chatbot's knowledge base with targeted cultural data, specifically curated to reflect the unique aspects of Hakka traditions, language, and practices. Through dynamic information retrieval, the RAG-enhanced chatbot becomes a versatile tool capable of handling complex inquiries that demand an in-depth understanding of Hakka cultural context. This is particularly significant in an age where digital platforms often dilute cultural identities, making the role of culturally aware AI systems more critical than ever. System usability studies conducted as part of our research reveal a marked improvement in both user satisfaction and engagement, highlighting the chatbot's effectiveness in fostering a deeper connection with Hakka culture.

The feedback underscores the potential of RAG technology to not only enhance user experience but also to serve as a vital instrument in the broader mission of ethnic mainstreaming and cultural celebration. This paper demonstrates the potential of RAG technology in crafting culturally aware conversational AI systems that contribute to ethnic mainstreaming and the celebration of cultural diversity.

17:15

Enhancing the Control and Safety Performance and Energy Efficiency of Pneumatic Gait Rehabilitation Systems Using Fractional-Order Adaptive Proxy Sliding Mode Control...N/A

Lian Wang Lee (Department of Mechanical Engineering National Chung Hsing University)
Jin-Yu Yang (National Chung Hsing University, Taiwan)
Kuan Wen (National Chung Hsing University, Taiwan)
I-Hsum Li (Chung Hsing University, Taiwan)

This paper aims to enhance control and safety performance while reducing energy consumption in the pneumatic gait training system. To accurately describe the nonlinear dynamic behavior of pneumatic systems, this study employs the fractional-order properties of gas flow dynamics to derive a fractional-order mathematical model for the pneumatic servo systems. Leveraging this model, we propose a composite control strategy for the pneumatic gait training system. This strategy integrates a Fractional-Order Adaptive Reduced-Order Extended State Observer (FARESO) and a Fractional-Order Adaptive Proxy Sliding Mode Controller (FAPSMC), named FARESO-FAPSMC. By incorporating an adaptive bandwidth scheme and a self-regulating control gain algorithm, FARESO-FAPSMC effectively addresses the issue of unmeasurable unknown states and internal/external disturbances within the pneumatic gait training system. This approach provides excellent gait trajectory tracking performance while ensuring user safety and comfort. The Lyapunov stability criterion has verified that the FARESO-FAPSMC achieves uniformly ultimately bounded (UUB) stable in the closed-loop control of the pneumatic gait training system. Experimental results indicate that compared to an integer-order proxy sliding mode controller based on a reduced-order extended state observer, FARESO-FAPSMC improves the gait trajectory tracking accuracy in pneumatic gait training system by 16±13% and reduces energy consumption by 5.1±1.78%, all while ensuring the critical safety performance required for human-machine interaction.

17:30

Study of on-Board Charger for Electric Board Using a Hybrid-Phase-Shift Control Strategy...147

Ching-Chun Chuang (National Kaohsiung University of Science and Technology, Taiwan)
Jing-Cheng Lin (National Kaohsiung University of Science and Technology, Taiwan)
Po-Ju Shen (National Kaohsiung University of Science and Technology, Taiwan)
Bo-Hao Li (National Kaohsiung University of Science and Technology, Taiwan)
Yu-Jie Chen (National Kaohsiung University of Science and Technology, Taiwan)

This study aims to research an onboard electric board charger with a single-phase shift control method. The on-board electric board charger consists of a two-stage circuit. The front-stage circuit uses the average current method to control a single-phase boost power factor corrector (PFC). After that, we will try to control the PFC operating over the entire input voltage range, with the control IC using the 1653 fixed frequency and average current method. At high line voltages (230V/264V), it needs to achieve a 0.95 power factor (PF). The post-stage circuit adopts a single-phase shift dual active bridge (DAB) converter. The digital/analog signal processing simulation core uses the phase modulation technology to achieve simultaneous phase modulation functions in the DAB converter's high and low voltage side power switches. The phase angle calculation must be modulated according to the leakage inductance value. When the phase shift is the same, the larger the inductance value, the greater the power output. As the circuit losses increase, the efficiency of the boost converter decreases. Ultimately, this study expects to achieve bidirectional power conversion of 1kW at 400V and 50V. Based on the simulation result, the highest efficiency in the forward state of the DAB converter can reach 96%, and the highest efficiency in the reverse state of the DAB converter can reach 97%.

17:45

Benchmarking Variational Autoencoders for Dimensionality Reduction and Application to Medical Heartbeats Data...N/A

Irshad A Buchh (Oracle Corporation, USA & Amazon Web Services, USA)

This report explores the implementation of Variational Autoencoders (VAEs) for dimensionality reduction in multivariate statistics. We benchmark VAEs against traditional methods such as PCA, ICA, and KPCA, using datasets including Iris Flowers, Wine, and Breast Cancer. The study further extends the application of VAEs to non-columnar data, specifically medical heartbeat audio recordings. The results demonstrate the strengths and limitations of VAEs in clustering, manifold learning, and anomaly detection, particularly in the context of medical data. Our findings suggest that while VAEs offer flexible non-linear representations, their performance is highly sensitive to the type of activation function used and the nature of the data. I. LITERATURE REVIEW Variational Autoencoders (VAEs) [1] are a class of generative artificial neural networks commonly used for dimensionality reduction in machine learning applications. The technique extends the application of traditional autoencoders and deep belief networks by introducing techniques from Variational Bayesian Methods [2]. An autoencoder consists of two neural networks: an encoder network and a decoder network [3]. The encoder network takes an input and produces a lower-dimensional representation of the data. The decoder network takes the lower-dimensional representation of the data and learns to reconstruct

the data back into its original vector space. These neural networks can have a varying number of hidden layers, activation functions, and neurons to learn non-linear representations of the data [4], [5].

18:00

Current Sensorless PFC Three-Phase Vienna Rectifier...N/A

Yi-Hung Liao (National Central University, Taiwan)
Bing-Rong Xie (National Central University, Taiwan)
Gia-Thinh Tu (National Central University, Taiwan)

In the utilization of three-phase power, the DC-link voltage of the Vienna rectifier can function as two separate voltage sources, accommodating the need for varied output voltages. The voltage-oriented control is usually used to achieve proportional adjustment of the output capacitor voltage, but this typically requires an increased number of sensors. Therefore, this paper proposes a current-sensorless control for a three-phase Vienna rectifier. To reduce circuit volume and cost, the Vienna rectifier topology is modeled and analyzed, and a current-sensorless control structure is implemented to minimize circuit volume and cost. Considering the limitation of the single voltage loop in the current-sensorless structure, which affects the output transient response, this paper also proposes a feedforward control architecture. By predicting the steady-state condition of the Vienna circuit in advance, error tracking compensation is performed to improve voltage dynamic response and compensate for the non-ideal power semiconductor devices with voltage drop and internal resistance. Additionally, integrating the zero-sequence compensation to achieve mitigation of zero-crossing distortion of the input current in power factor correction as well as active balanced and unbalanced output voltage. Finally, through simulation results and comparison with the implementation of a 2.4 kW Vienna converter, the effectiveness and correctness of proposed method are validated.

18:15

Novel MCDM Scheme for Optimal Design of Low Noise Amplifier...151 (virtual)

Dayarnab Baidya (Indian Institute of Science Education and Research Bhopal, India)
Athul Krishnan (Indian Institute of Science Education and Research, Bhopal, India)
Mitradip Bhattacharjee (Indian Institute of Science Education and Research Bhopal, India)

Optimization is crucial in various design problems. In this direction, an optimization technique is used in designing a Low Noise Amplifier (LNA) for a 4 GHz frequency application. This paper deals with the development of a novel hybridized optimization technique namely, Multi Choice Best Worst Grey Relation Analysis (MCBWGRA) to optimize the LNA circuit for increasing gain (S21), stability factor (K) and lowering input reflection coefficient (S11), reverse voltage gain (S12), output reflection coefficient (S22), and Noise Figure (NF). Firstly, an LNA circuit was designed in Advanced Design System and the Design of Experiments (DOE) was decided using orthogonal arrays (OA), L25. The obtained experimental runs were used to find the optimized output parameters using the proposed technique. After applying the proposed method, the obtained optimized input values are: R3 = 660 Ω, R4= 12 Ω, L3 = 2 nH, C4 = 1.3 pF, C5 = 1.4 pF. In this situation, outputs have magnitudes as S11= -11.395 dB, S22= -19.436 dB, S12= -17.896 dB, S21= 11.246 dB, K = 1.209, NF= 0.877 dB at 4 GHz. A circuit simulation of optimized LNA with microstrip lines and Electromagnetic (EM) Co-simulation was performed to check the output parameters of the optimized schematic simulation. The optimized circuit shows a considerably high increment of 8.51 % in gain and a 1.4 % decrease in noise figure over the unoptimized circuit.

19:00
Conference Reception
Room: Multi-Function Space

Technical Program: Thursday, November 7

Venue: Electrical Engineering (EE) Building, 1st Floor

08:00 - 08:30
Registration
Room: 106 – Multi-Function Room

08:30 - 08:50
Industry Forum Opening
Room: 106

Tony Tsao (Founder and CEO, Global Channel Resources Ltd, Taiwan)

08:50 - 09:30
Invited Speaker 1: Harnessing Powerful Emerging Innovations: Shaping a Brighter Future Together 10th Machine Age Investments and New Age Innovations...N/A
Mr. Stephen Ibaraki (Founding General Partner, REDDS Capital and AI for Good, Canada)
Room: 106

09:30 - 10:00
Invited Speaker 2: Strengthen Cybersecurity with Generated AI...N/A
Dr. Sourabh Khemani (Founder Chairman of CYBERCORP LTD, India)
Room: 106

10:00 - 10:20
Invited Speaker 3: Sustainable Smart Farming: A Case Study of Ecosystem Integration Using AIOT and 3D Visualization...N/A
Dr. Chia-Sheng Chang (Chairman, Top Cloud Technology, Taiwan)
Room: 106

10:20 - 10:40
Invited Speaker 4: Creative Marketing: How Far Can a Crazy Marketer Run?...N/A
Dr. Kong-Fah Cheng (Professor, National Chung Cheng University, Taiwan)
Room: 106

10:40 - 11:00
Coffee Break
Room: Multi-Function Room

11:00 - 12:30
Accelerating Innovation for a Sustainable Future...N/A
Moderator: Stephen Ibaraki (REDDS Capital and AI for Good, Canada)
Room: 106

Keynote Speaker: Accelerating innovation for a positive and profitable future...N/A (virtual)
Ms. Sally Ann Frank (Worldwide Lead – Health & Life Sciences, Microsoft for Startups, USA)

Panelists:
Dr. Pao-Ann Hsiung (National Chung Cheng University, Taiwan)
Dr. Sourabh Khemani (Cybercorp, India)
Ms. Sally Anne Frank (Microsoft for Startups, USA)
Mr. Andy Chen (IEEE Systems Council, Canada)

12:30 - 14:00
Lunch
Room: Multi-Function Room

14:00 - 15:30
The Next Computing Revolution: New Compute and AI Breakthroughs...N/A
Moderator: Dr. Jolly Wong (Macau University of Science and Technology, Macau)
Room: 106

Keynote: AI in Military...N/A
Dr. Ching-Pu Chen (Director, International Bachelors Strategic Communication (IBSC), Taiwan)

Panelists:
Dr. Brian Huang (iDox.AI, Taiwan)
Dr. Chia-Sheng Chang (Top Cloud Technology, Taiwan)
Mr. Tony Tsao (Global Channel Resources Ltd, Taiwan)
Dr. Kong-Fah Cheng (National Chung Cheng University, Taiwan)

15:30 - 16:00
Coffee Break
Room: Multi-Function Room

16:00 - 17:30
Special Session Workshop: Design and Smartly Deploy Sustainability & Decarbonization Features in Science, Engineering, and Technology Education...N/A
Facilitator: Dr. Deepak L. Waikar (Indo-Universal Centre for Engineering Education (IUCEE) Foundation, Singapore)
Room: 106

Speakers:
Dr. CA Vincent Lim (EcoSustainability Group, Singapore)
Dr. Bhaskaran S. (Invosystems Solutions Pte Ltd, Singapore)

19:00
Conference Banquet and Award Presentations
Room: Applied Science and Technology Building