International Conference on Microelectronics

17-20 December, 2023

Khalifa University Abu Dhabi, UAE

Program

IEEE Lebanon Joint Chapter

IE13/ PE31/ CAS04/ PEL35

Welcome Note

On behalf of the Conference Organizing Committee, it gives us a great pleasure to welcome you to the 35th International Conference on Microelectronics (ICM 2023). As General co-chairs of the Organizing Committee, we are honored to welcome you at this ICM edition. The conference is hosted by Khalifa University in Abu Dhabi, UAE, and technically co-sponsored by Westlake University, Hangzhou, China, IEEE R8, IEEE CAS, IEEE Abu Dhabi Section, and IEEE Lebanon Joint Chapter (CAS, PES, IE, PEL). The conference takes place on December 17-21, 2023.

The ICM conference was previously held in many countries such as Jordan, Egypt, Tunisia, Lebanon, Morocco, Algeria, Qatar, etc. It is an international conference that provides a forum for engineers, scientists, and researchers to present their state-of-the-art findings in microelectronics and its numerous applications. The conference is an opportunity for them to interact in a scientific platform and share their experiences in related industry and technology applications. Moreover, we are proud to have FOUR distinguished keynote speakers from academic institutions and Industry: Professor Mohamad Sawn, Westlake University, China; Dr. Shreekant (Ticky) Thakkar Chief Research Officer Secure Systems Research Center Technology Innovation Institute Adjunct Research Professor, EECS, Khalifa University, UAE; Prof. Mohammed Ismail, Professor and ECE Chair, Wayne State University, USA; and Dr. Naim Ben-Hamida, Senior Director, Analog ASIC Development | CIENA.

Also, we have three invited speakers from different academia, where they will talk about “Energy efficient computing based on emerging technologies”, by Dr. Hussam Amrouch, Technical University of Munich (TUM); Dr. Bastien Deveautour, Institute of Nanotechnologies of Lyon; and Rajendra Bishnoi, Delft University of Technology.

In addition, two tutorials (T1: "Flexible and Organic Electronics: A Design Perspective” by Prof. Moustafa Nawito”) and (T2: "Vital Signs Monitoring at Sub mm-Waves and IC Design Techniques in Modern CMOS SOI Technologies") by Drs. Mihai Sanduleanu, Solomon Serunjogi, Mizan Gebremichea.

ICM 2023 has received We received 132 papers regular 4-page IEEE format paper submissions from 30 Countries, covering the various aspects of microelectronics, CAD, Accelerators, etc. Each paper was assessed by at least THREE reviewers. Out of all submissions, 66 papers were accepted and are included in the conference program. All presented papers will be submitted for publication to the IEEE Xplore® digital library and will be indexed in Scopus.

We would like to thank Khalifa University, Westlake University and all IEEE (R8, CAS, Egypt Section, Lebanon Joint Chapter) for their support in organizing and sponsoring this conference. Moreover, a word of thanks is extended to the main conference supporters and sponsors: Khalifa University, TII, Abu Dhabi Convention and Exhibition Bureau, IEEE, IEEE CAS, CAS Egypt Chapter, IEEE UAE Section and IEEE Lebanon Joint Chapter PES/CAS/PEL.

Finally, we would like to express our profound appreciation to all members of the organizing committee for their valuable efforts in making ICM 2023 a successful event. Also, thanks are due to the advisory committee, scientific committee, expert reviewers, and IT technicians.

We would also like to thank the conference participants for their contributions, for their support, and their attendance. We wish you all a successful and fruitful experience, and we hope you will enjoy your stay in Abu Dhabi, in your second home.

Conference co-Chairs

Dr. Hani Saleh, Khalifa University, UAE

Prof. Mohamad Sawan, Westlake University, Hangzhou, China

Keynote Speakers

PROF. MAHAMAD SAWAN
CHAIR PROFESSOR,
WESTLAKE UNIVERSITY, HANGZHOU, CHINA AND
EMERITUS PROFESSOR,
POLYTECHNIQUE, UNIVERSITY OF MONTREAL, CANADA

Title: Closed-loop Neuromorphic Systems-on-chips for Early Diagnosis and Prediction of Brain Diseases

Abstract: Closed-Loop neuromodulation based medical devices intended for efficient diagnosis, treatment and prediction of neurodegenerative diseases are targets to mimic brain regular operation. Consequently, artificial intelligence-based learning techniques are the central parts of these emerging control units to be embedded in proposed neuromodulation systems. This talk covers the implementation of wearable and implantable medical devices based on custom neuromorphic system-on-chip (SoC) integrated platforms. These devices include signal processing methods, design and tests of SoCs and system assembly of bioelectronic closed-loop systems for brain interfaces.
These methods deal with multidimensional design challenges such as efficient power management, very low-power and high-data rate wireless communication methods, and reliable systems. In these neuromodulation applications, priority could be given to non-invasive approaches, however for some healthcare dysfunctions, wearable systems can not apply. Consequently, implantable devices should be used. Also, optoelectronic methods are used to build efficient devices for both non-invasive nanoimaging, and transcranial stimulation. Case studies include several applications such as epilepsy, vision, addictions, and early and fast viruses' detection.

Biography: Mohamad Sawan is Chair Professor in Westlake University, Hangzhou, China, and Emeritus Professor in Polytechnique Montreal, Canada. He is founder and director of the Center of Excellence in Biomedical Research on Advanced Integrated-on-chips Neurotechnologies (CenBRAIN Neurotech) in Westlake University, Hangzhou, China. Also, he is founder of the Polystim Neurotech Laboratory in Polytechnique Montréal. He received the Ph.D. degree from University of Sherbrooke, Canada. Prof. Sawan research activities are bridging micro/nano electronics with biomedical engineering to introduce smart medical devices dedicated to improving the quality of human life.

He is co-founder and was Editor-in-Chief of the IEEE Transactions on Biomedical Circuits and Systems (2016-2019). He hosted the 2016 IEEE International Symposium on Circuits and Systems, and the 2020 IEEE International Medicine, Biology and Engineering Conference (EMBC). He was a Canada Research Chair in Smart Medical Devices (2001-2015), and was leading the Microsystems Strategic Alliance of Quebec, Canada (1999-2018). Prof. Sawan published more than 1000 peer reviewed papers and many books and patents. Among the numerous received honors, Prof. Sawan received the Chinese National Friendship Award, The Lebanese's President Medal of Merit, the Shanghai International Collaboration Award, the Queen Elizabeth II Golden Jubilee Medal. Prof. Sawan is Fellow of the Royal Society of Canada, Fellow of the Canadian Academy of Engineering, Fellow of the IEEE, and "Officer" of the National Order of Quebec.

DR. SHREEKANT (TICKY) THAKKAR
CHIEF RESEARCH OFFICER
SECURE SYSTEMS RESEARCH CENTRE
TECHNOLOGY INNOVATION INSTITUTE
ADJUNCT RESEARCH PROFESSOR,
EECS, KHALIFA UNIVERSITY

Title: Securing the Future: Advanced Safety and Resilience in Autonomous Systems

Abstract: In this talk, we explore the evolving landscape of autonomous and autonomic systems, with a particular focus on vehicles and drones. We delve into the critical aspects of security, safety, and resilience, addressing the challenges posed by both internal and external threats. The discussion will highlight the strategic integration of cutting-edge technologies in building robust, self- regulating systems capable of handling complex operations. We will examine how these systems can adapt to unforeseen challenges, ensuring continual operational effectiveness while prioritizing security and safety. This talk aims to shed light on the future of autonomous technology and its potential to revolutionize the way we perceive and interact with robotic entities.

Biography: Dr. Shreekant (Ticky) Thakkar is Chief Research Officer at the Secure Systems Research Centre at the Technology Innovation Institute (TII), a cutting-edge UAE-based scientific research Centre and Adjunct Research Professor at Khalifa University. In this role, he is responsible for carrying out advanced research that is driving end-to-end security and resilience in cyber physical and autonomous systems of systems (swarm of drones). These includes secure technologies in silicon, edge and mobile and cloud platforms working with open-source ecosystems (Dronecode, RISC-V, Linux, Apache, ROS) and research institutions across USA, Europe, and UAE.

Thakkar's career is punctuated by industry firsts and successes that have strengthened revenue, profit, and competitive advantage for Fortune 500 firms, as well as reach labs, start-ups, and entrepreneurial divisions.

Thakkar is a hands-on leader with an invaluable blend of strategy development and tactical execution; an implementer and dedicated "doer" who delivers corporate vision by building, leading, mentoring, and supporting highly effective, diverse, and collaborative advanced development, engineering/software engineering teams across different geographies.

Before taking on his current role, Thakkar was Chief Scientist and Executive Vice President of Engineering and Technology at the company, now Digital14, a cyber- security leader based in the UAE. In this capacity, he was instrumental in developing an engineering organization of 500 people from a start-up team in four geographical locations, delivering two generations of innovative secure smartphones and applications, and a secure VPN appliance that contributed significantly to the company's annual revenue.

In prior roles, he served as Chief Solutions Architect at Qualcomm Data Technologies, and as the Chief Technology Officer in the Personal Computing Group and as Vice President and Fellow at HP's Emerging Computing Lab. Earlier in his career, Ticky Thakkar completed 21 years at INTEL Corporation in roles including INTEL Fellow and Chief Systems Architect - Mobile Systems Technologies.
Thakkar holds a PhD and an MSc, both in Computer Science, from the University of Manchester. He also earned a BSc in Computer Science and Statistics from University College London. He holds 87 patents and has published 33 papers and over 5000 citations in Google Scholar.

PROF. MOHAMMED ISMAIL

PROFESSOR AND CHAIR ECE ANDFOUNDING DIRECTOR OF THE WINCAS RESEARCH CENTER WAYNE STATE UNIVERSITY, DETROIT, MICHIGAN USA

Title: Seamless Wireless Charging: A Game-Changer for Smart Cities

Abstract: In this presentation, we present the vision of “seamless wireless charging”. It is conceived that seamless charging, similar to what we have today with Wi-Fi for mobile internet, is possible. The technology is there to make it happen and we believe this will be a game changer for smart homes, offices and cities.
We make use of wireless power transfer (WPT) which provides inherent electrical isolation and completely eliminates the existing high-tension power transmission lines, cables, and towers. It reduces board charging cost, weight and volume. Nevertheless, WPT, for say IoT devices or EVs, poses additional challenges and sustainability trade-offs.

To meet the challenges, we present a system , method , and device that provides power to an electrical unit such as an Internet of Things (IoT) device or an electric vehicle (EV) that includes a transmitter that provides power through electromagnetic waves , a receiver , an array that includes a plurality of metamaterial elements , such that the electrical power passes wirelessly from the transmitter to the array , and a smart controller that applies selective phase shifts to each of the metamaterial elements such that the power is transmitted from the transmitter, reflected off the array, and is received in phase at the receiver which converts the electromagnetic waves to an electric current to power the device. If the device moves, it sends a pilot signal to the transmitter which alerts the smart controller to adjust the reflected waves in real-time such that they are always received in phase. The harvested RF power is then converted to DC to charge the device using an appropriate rectenna circuit. We will present the details of the proposed system. Will also review some of the existing and emerging technologies for the wireless charging of IoT devices or EVs when stationary or on the move.

Biography: Mohammed Ismail a prolific author and entrepreneur in the fields of system-on-chip design and test and nanotechnology, spent over 30 years in academia and industry in the US and Europe. He is professor and Chair of the Electrical and Computer Engineering Department at Wayne State University and the Founding Director of the WINCAS Center of Excellence. He is one of the world pioneers in the field of CMOS design of analog, mixed signal and RF integrated circuits and has graduated over 55 PhD students and more than 100 MS students, thesis option.
Prior to joining Wayne State in December 2016, he was a Professor at the Ohio State University in Columbus, Ohio for 20 years and held several appointments in Sweden with KTH, Finland with Aalto University and Nokia Research Center, Norway with NTH and University of Oslo, The Netherlands with Twente University, Japan with Tokyo Institute of Technology and the UAE with Khalifa University. His current research focuses on CMOS analog, RF and mm-wave Integrated circuits, Systems-on-Chip (SoCs) for the Internet of Things (IoTs), Chipsets for 5G/6G wireless communications, automotive electronics, autonomous vehicles and RF energy harvesting solutions for wireless charging.

He cofounded several starts ups, including Spirea AB in Stockholm, Sweden, Firstpass Technologies and Micrys Corp in Columbus, OH and ANACAD in Cairo, Egypt (now part of Siemens) and has led a research team that developed the first CMOS combo 802.11a/b/g Wi-Fi Radio chip. More recently He developed with his colleagues the world first self-powered wearable CMOS device that predicts the onset of a heart attack using advanced machine learning algorithms. He authored or co-authored 23 books and over 200 journal publications, 300 conference papers and has 17 US patents granted and several pending.

Prof. Ismail is the Founding Editor of the Springer Journal of Analog Integrated Circuits and Signal Processing and serves as the Journal's Editor-in-Chief. He served the IEEE in many editorial and administrative capacities. He is the Founder of the IEEE International Conference on Electronics, Circuits and Systems (ICECS), the flagship Region 8 Conference of the IEEE CAS Society and a Co-Founder of the IEEE International Symposium on Quality Electronic Design (ISQED). He received the US Presidential Young Investigator Award from the White House, the Ohio State Lumley Research Award four times, in 1992, 1997, 2002 and 2007 and the US Semiconductor Research Corporation's Inventor Recognition Award twice as well as several best paper awards. More recently, he received the 2018 UNESCO Medal for contributions to nanoscience, Paris, France and the SRC Board of Director Special Recognition for Leadership of Semiconductor Research in the UAE. He is a Fellow of IEEE.

DR. NAIM BEN-HAMIDA
SENIOR DIRECTOR,
ANALOG ASIC DEVELOPMENT | CIENA

Title: Data refinery in the AI era: From silicon processing to optical transport.

Abstract: The data deluge produced by AI traffic, that is increasing by order of magnitude every year, is stressing both electrical and optical interconnect, that are doubling every 2-3 years. Moreover, the energy consumption in the context of exponential growth of traffic is not sustainable. If we continue this trend, the world energy production will be consumed by data. In this talk, a parallel is drawn between energy and data from refinement to transport.

The data centers are the data refineries of the new digital economy and optical fibers are the equivalent of the oil pipelines. An overview of the optical transport technology is presented and how it can be used to reduce cost and loss of transporting energy. Power and cost can be reduced by processing data where the energy is produced and transport lossless bits. Coherent technology for optical systems is at the heart of this efficiency of data transport. This technology is enabled by state- of-the-art 3nm ASICs implementing efficient DSP and high-speed data converters.

Biography: Dr. Naim Ben-Hamida is a senior director of analog ASIC development and Distinguished Engineer at Ciena Corporation. He is responsible for the development of high-speed Serdes and ADC/DACs for optical communication. The latest 3nm IPs delivered by his team enabled the highest performance 1600Gb/s coherent DSP chip for optical modem and the lowest the lowest power 800G ZR chip for coherent pluggable.

He is currently co-supervising PhD and MSA students covering seven research and development projects with six Canadian universities. Dr. Ben-Hamida holds an adjunct professor position with Carleton University. He has published more than 100 international papers and holds more than sixty patents. Prior to Ciena/Nortel, He co-founded Opmaxx Inc, a mixed signal design and test company, where he held a vice president position and led the company to an acquisition. Dr. Ben-Hamida had a PHD and MSA from Ecole Polytechnique de Montreal, and a Bachelor of Science in electrical engineering from Laval university Quebec, Canada

Invited Speakers

Title: Energy efficient computing based on emerging technologies

Overview of talks

Talk-1: In-Memory Computing using Ferroelectric Transistors: Lessons Learnt and Future Trends

Speaker: Hussam Amrouch, Technical University of Munich (TUM), email: amrouch@tum.de

Abstract: In the burgeoning realm of artificial intelligence (AI), the pursuit of In-Memory Computing (IMC) is paramount. This relentless pursuit, aimed at catalyzing ultra-fast and energy-efficient AI computations, is emblematic of the cutting-edge innovations at the nexus of Ferroelectric FET (FeFET) technology. In this talk, we will showcase the latest advancements in FeFETs, spanning from traditional IMC-based hardware accelerators to monolithic 3D integration using advanced back-end-of-line (BEOL) thin-film transistors. We will elucidate the inherent challenges posed by ferroelectric stochasticity along with temperature effects, and demonstrate innovative strategies, such as using thermoelectric devices for advanced on-chip cooling, to mitigate their adverse impacts, paving the way for reliable computing using FeFET-based IMC.

Bio: **Hussam Amrouch** is a W3-Professor heading the Chair of AI Processor Design at the Technical University of Munich. He is, additionally, heading the Brain-inspired Computing at the Munich Institute of Robotics and Machine Intelligence (MIRMI). Further, he is the head of the Semiconductor Test and Reliability at the University of Stuttgart. He received his Ph.D. degree with the highest distinction (summa cum laude) from KIT in 2015. He has around 220 publications (including more than 90 journals) in multidisciplinary research areas starting from device physics to circuit design and HW/SW co-design. His research interest is brain-inspired computing using emerging technologies with a special focus on reliability. He has served in the technical program committees in all major EDA conferences and as a reviewer in many top journals like Nature Electronics, Nature Communications. He is also as Editor at the Nature Scientific Reports journal.

Talk-2: Efficient and Reliable Hardware Architectures based on Vertical Nanowire FETs

Speaker: **Bastien Deveautour**, Institute of Nanotechnologies of Lyon, email: bastien.deveautour@cpe.fr

Abstract: By 2040 computers will need more electricity than the world energy resources can generate, due to the explosion of connected devices and the massive use of data-intensive applications such as DNNs. Moreover, depending on the application, also other metrics have to be considered when designing next-generation computing architectures, such as reliability for safety-critical applications. New computing paradigms and technologies are required to respond to the challenges of data-intensive edge intelligence. To deal with such multi-objective design space, this talk will present the latest research activities on Vertical Nanowire Field-Effect Transistors (VNWFETs), a combination of emerging technologies for the fine interweaving of versatile logic functionality and memory for reconfigurable inmemory computing. Achieving both, ambipolar functionality enhancement for fine-grain flexibility and ferroelectric oxides for non-volatile logic operation, it is a promising technology to deploy 3D computing architectures. We will show how energy efficiency and reliability can be improved by using VNWFETenabled computing-in-memory and approximate computing.

Talk-3: Towards Accurate Memristor-based Neural Networks

Speaker: **Rajendra Bishnoi**, Delft University of Technology, email: r.k.bishnoi@tudelft.nl

Abstract: Memristor-based computation-in-memory (CIM) can achieve high energy efficiency by processing the data within the memory, which makes it highly suitable for neural network implementation for the Edge-AI applications. However, the imperfections in memristor devices lead to computational errors and degraded

inference accuracy. Innovative mapping techniques are one of the efficient ways to overcome this challenge. Such techniques can be directly applied to trained weights or incorporated into training process to obtain resilient weights. In this talk, we present two such mapping-based solutions to improve the accuracy of the CIM-based neural networks, namely the unbalanced bit-slicing scheme and mapping-aware biased training methodology.

Short Bio: **Rajendra Bishnoi** is currently an Assistant Professor with the Computer Engineering Laboratory, Faculty of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology (TUDelft). He received the Ph.D. degree in computer science from the Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, in 2017. He was a Research Leader with the MRAM Group, Chair of Dependable Nano Computing, KIT, for more than two years. From 2006 to 2012, he was a Design Engineer with Freescale (now NXP), where he was a part of the Technical Solution Group in memory and SoC flow. His current research interests include neuromorphic computing, computation-in-memory, and emerging technologies. He was a recipient of the EDAA Outstanding Dissertation Award in 2017

Monday, December 18		
Time	Room B55	Room B107
09:00 am-09:40 am	*Opening Ceremony*	
09:40 am-10:40 am	Keynote Speaker-1: *Emerging AI-based Closed-loop Brain-computer Interfaces : Challenges and Trends*	
10:40 am-11:00 am	CB1: *Coffee Break*	
11:00 am-12:30 pm	s11(A): *Metaverse/AI/IoT/ML/MDL/Security System-I*	s11(B): *Bio-Engineering - Bio-Informatique*
12:30 pm-01:30 pm	LB: *Lunch Break*	
01:30 pm-02:30 pm	Keynote Speaker-2: *Securing the Future: Advanced Safety and Resilience in Autonomous System*	
02:30 pm-03:45 pm	s12(A): *Complex Hardware Systems, AI and Robotics*	s12(B): *Biomedical Engineering - Bio-Informatique*
03:45 pm-04:00 pm	*Coffee Break*	
04:00 pm-05:30 pm	s13(A): *Semi-Conductor Systems*	s13(B): *CAD*

Tuesday, December 19		
	Room B55	Room B107
09:00 am-10:00 am	Keynote Speaker-3: *Seamless Wireless Charging: A Game-Changer for Smart Cities*	
10:00 am-10:30 am	*Coffee Break*	
11:00 am-12:30 pm	S21(A): *ASIC-FPGA*	S21(B): *Metaverse/AI/IoT/ML/MDL/Security System-II*
12:30 pm-01:30 pm	LB2: *Lunch Break*	
01:30 pm-02:30 pm	Keynote Speaker-4: *Data refinery in the AI era: From silicon processing to optical transport*	
02:30 pm-03:45 pm	S22(A): *Smart Sensors/Sensor Networks & Cyber-physical Systems Security*	S22(B): *Analog and RF Circuit Design Techniques*
03:45 pm-04:00 pm	CB: *Coffee Break*	
04:00 pm-04:45 pm	S23(A): *General-1*	S23(B): *General-II*
04:45 pm-05:30pm	SS: *Energy efficient computing based on emerging technologies*	
05:30 pm-05:45 pm	*Closing Ceremony, Awards*	
07:00 pm-09:00 pm	Gala Dinner: *Dusit Thani Abu Dhabi, Onyx BallRoom*	

Sunday, December 17

Sunday, December 17 9:00 - 12:15 (Asia/Dubai)

Tutorila-1: Flexible and Organic Electronics: A Design Perspective

Prof. Moustafa Nawito,

Room: B55

The aim of this tutorial is for the audience to gain a comprehensive overview of the topic of flexible and organic electronics with a specific focus on circuit design. In the first part the history of the development of organic materials as well as the functional and fabrication principles of OLEDs, OTFTs and OPVCs will be presented. The second part is dedicated to the design of organic and inorganic flexible electronic circuits. The state of the art as well as recent developments will be presented, as well challenges and possible future solutions. To deepen the understanding, a comparison between organic electronics and well- known, established processes in the semiconductor industry, such as CMOS technology, will be made at appropriate points during the seminar. A basic understanding of semiconductor devices and circuits is the only prerequisite.

Sunday, December 17 9:00 - 12:15 (Asia/Dubai)

Tutorial-2: Vital Signs Monitoring at Sub mm-Waves and IC Design Techniques in Modern CMOS SOI Technologies

Mihai Sanduleanu, Solomon Serunjogi, Mizan Gebremichea

Room: B107

Continuous monitoring of human vital signs, such as breathing rate (BR) and heart rate (HR), is essential for the early identification and even forecasting of disorders that may have an impact on a patient's wellness. There are 2 methods of sensing human vital signs, namely, the contact-based sensing and the contact-less sensing. The traditional clinical detection of vital signs is done through contact-based techniques such as the electrocardiography or Photoplethysmography. Even though these techniques provide accurate vital signs (e.g. electrocardiogram or ECG), they require the attachment of contact probes to the body of the patient, which may not be practical for long-term monitoring.

Conversely, wireless vital signs detection utilizing radars has the particular advantage of not requiring the attachment of electrodes to the subject's body, hence not limiting movement and removing the danger of skin irritation. Additionally, it eliminates the requirement for wires and restricts access to patients, particularly for young children and the elderly. Several radar designs have been reported in the literature for the detection and monitoring of human heart rate (HR) and breath rate (BR), including the continuous-wave (CW) radars, frequency-modulated continuous-wave (FMCW) radars, stepped-frequency continuous-wave (SFCW) radars and pulse-based radars. FMCW radars offer the possibility of detecting the range of the subject unlike CW, which is useful in detecting multiple subjects for surveillance. Moreover, they use relatively simpler signal processing algorithm, compared to their pulse-based radar counterparts.

As the HR and BR detection accuracy and the range are proportional to the center carrier frequency and the bandwidth, respectively, FMCW vital signs radars typically need to operate in the millimeter-wave frequency band to obtain good micro-doppler and range resolutions. Nevertheless, the performance of the crucial components, such as the voltage-controlled oscillator (VCO) with low phase noise and wide tuning range presents a bottleneck to the development of wideband mm-wave and sub-mm-wave FMCW radars. As the operating frequency approaches the transit frequency (fT), which is constrained by the parasitic capacitance of the transistors, all performance metrics of the VCO—including output signal amplitude, tuning range, phase noise, and power consumption—unavoidably deteriorate. Additionally, the low-quality factor (Q) of varactors and interconnection losses further hamper their performance.

The purpose of the workshop is to introduce different methods for Vital Signs Monitoring with the emphasis of LFMCW Radar techniques and present the challenges of an integrated solution at sub mm-Waves (160GHz). First of all, the design trade-offs at system level will be presented, followed by circuit design like, LNA, PA, PLL (IQ-VCO, Frequency dividers, Charge pump), Mixers. Thereafter, different algorithms for extracting breathing rate and heart rate are discussed

Monday, December 18

Monday, December 18 9:00 - 9:40 (Asia/Dubai)

Opening Ceremony

Rooms: B55

Monday, December 18 9:40 - 10:40 (Asia/Dubai)

Keynote Speaker-1: Emerging AI-based Closed-loop Brain-computer Interfaces: Challenges and Trends

Prof. Mohamad Sawan

Rooms: B55

Chair: Abdallah Kassem

Closed-Loop neuromodulation based medical devices intended for efficient diagnosis, treatment and prediction of neurodegenerative diseases are targets to mimic brain regular operation. Consequently, artificial intelligence-based learning techniques are the central parts of these emerging control units to be embedded in proposed neuromodulation systems. This talk covers the implementation of wearable and implantable medical devices based on custom neuromorphic system-on-chip (SoC) integrated platforms. These devices include signal processing methods, design and tests of SoCs and system assembly of bioelectronic closed-loop systems for brain interfaces. These methods deal with multidimensional design challenges such as efficient power management, very low-power and high-data rate wireless communication methods, and reliable systems. In these neuromodulation applications, priority could be given to non-invasive approaches, however for some healthcare dysfunctions, wearable systems can not apply. Consequently, implantable devices should be used. Also, optoelectronic methods are used to build efficient devices for both non-invasive nanoimaging, and transcranial stimulation. Case studies include several applications such as epilepsy, vision, addictions, and early and fast viruses' detection.

Monday, December 18 10:40 - 11:00 (Asia/Dubai)

Coffee Break

Rooms: B55, B107

Monday, December 18 11:00 - 12:30 (Asia/Dubai)

s11(A): Metaverse/AI/IoT/ML/MDL/Security System-I

Room: B55

Chairs: Abdulmotaleb El Saddik, Tales Cleber Pimenta

Handwritten Signature Recognition Using Deep Learning
Basmala Mustafa Ahmed, Radwa E Taha, Omar Fahmy and Shereen Moataz Afifi

Efficient CNN Hardware Architecture Based on Linear Approximation and Computation Reuse Technique
Mohammed Tolba, Hani Saleh, Baker Mohammad, Mahmoud Al-Qutayri, Ayman Hroub and Thanos Stouraitis

A CMOS Analog Neuron Circuit with A Multi-Level Memory
Melvin D Edwards II, Nabil Sarhan and Mohammad Alhawari

Deep Image Deraining
Laila Hegazy, Shereen Moataz Afifi and Omar Fahmy

Acoustic Device for Detecting Red Palm Weevil Using Deep Learning and IoT
Maryam Mostafa Ebrahim Atia, Amr Gouda, Mohammed A.-Megeed Salem and Mohamed Abd El Ghany

Enhancing Traffic Management with Embedded Machine Learning for Vehicle Detection
Mohamad Sofian Abu Talip, Mohd. Zulhakimi Ab. Razak, Mahazani Mohamad, Anis salwa Mohd khairuddin, Tengku Faiz Tengku Mohmed Noor Izam and Azizul Azizan

Monday, December 18 11:00 - 12:30 (Asia/Dubai)

s11(B): Bio-Engineering - Bio-Informatique

Room: B107

Chair: Ghada Alsuhli

Modified Arnold Transform and DNA Manipulation for Chaos-Based RGB Image Encryption
Marwan Ahmed Fetteha, Wafaa Sayed, Lobna Said and Ahmed Madian

Aloe Vera Tissue Modeling and Parameter Identification Using Meta-Heuristic Optimization Algorithm
Mohamed Ghoneim, Dalia A. Fathi, Lobna Said, Ahmed Madian and Magdy A Bayoumi

Convolutional Autoencoder for Real-Time PPG Based Blood Pressure Monitoring Using TinyML
Noor Faris Ali, Mousa Hussein, Falah Awwad and Mohamed Atef

Multi-Class Classification of Melanoma on an Edge Device
Aser Ali, Radwa E Taha, Ranpreet Kaur and Shereen Moataz Afifi

Deep/ Federated Learning Algorithms for Ultrasound Breast Cancer Image Enhancement
Sarah Mohamed Elsayed Waly, Sw, Radwa E Taha, Mohamed Abd El Ghany and Mohammed A.-Megeed Salem

AS-LR Emergency Detection Scheme for Biomedical Applications
Nadine Bou Dargham, Abdallah Kassem and Mustapha Hamad

Monday, December 18 12:30 - 1:30 (Asia/Dubai)

Lunch Break

Rooms: Restaurant

Monday, December 18 1:30 - 2:30 (Asia/Dubai)

Keynote Speaker-2: Securing the Future: Advanced Safety and Resilience in Autonomous System

Dr. Shreekant (Ticky) Thakkar

Rooms: B55

Chair: Baker Mohammed

In this talk, we explore the evolving landscape of autonomous and autonomic systems, with a particular focus on vehicles and drones. We delve into the critical aspects of security, safety, and resilience, addressing the challenges posed by both internal and external threats. The discussion will highlight the strategic integration of cutting-edge technologies in building robust, self-regulating systems capable of handling complex operations. We will examine how these systems can adapt to unforeseen challenges, ensuring continual operational effectiveness while prioritizing security and safety. This talk aims to shed light on the future of autonomous technology and its potential to revolutionize the way we perceive and interact with robotic entities.

Monday, December 18 2:30 - 3:45 (Asia/Dubai)

s12(A): Complex Hardware Systems, AI and Robotics

Room: B55

Chairs: Mihai Sanduleanu, Minoru Watanabe

Computational-Based Advanced Encryption Standard (AES) Accelerator
Enas Abulibdeh, Hani Saleh and Baker Mohammad

An SDR Transmitter Baseband-To-IF IC with Digital Out-Phasing Exponential Modulation in a 65nm CMOS LPE
Mihai Sanduleanu

A Review on Hyperdimensional Computing
Maram Abdulrahman, Sandy Wasif, Miran Wael, Eman Azab, Maggie Mashaly, Mohamed Abd El Ghany and Hussam Amrouch

Deep Neural Network Inference Processor
Khaled Salah and Ali Hegazy

A State-Of-The-Art Design: Applying Forward Kinematics to Improve Patient Positioning in Radiosurgery
Alaa Saadah, Donald Medlin, Jad Saud, Xiao Ran Zheng and Husi Géza

Monday, December 18 2:30 - 3:45 (Asia/Dubai)

s12(B): Biomedical Engineering - Bio-Informatique

Room: B107

Chair: Mohammed Tolba

A Self-Aware Power Management Model for Epileptic Seizure Systems Based on Patient-Specific Daily Seizure Pattern
Shiva Maleki Varnosfaderani, Mohammad Alhawari, Rihat Rahman and Sarhan Nabil

Parkinson's Disease Detection Using Voice Features and Machine Learning Algorithms
Rumana Islam, Esam Abdel-Raheem and Mohammed Tarique

EEG Experiment Flow Control Using FPGA as an Alternative to Commercial Devices
Cristian Y Olivares and Norelli Schettini

An ECG-Based Blood Pressure Estimation Using U-Net Auto-Encoder and Random Forest Regressor
Elham Alaa Aldein, Mohamed Abdelraheem, Usama Mohammed and Mohamed Atef

Examining the Performance of Melanoma Classification Using Superpixel Segmentation: A Comparative Analysis
Faezeh Mohammadi Aydoghmishi, Sudipta Modak, Esam Abdel-Raheem and Luis Rueda

Monday, December 18 3:45 - 4:00 (Asia/Dubai)

Coffee Break

Rooms: B55

Monday, December 18 4:00 - 5:30 (Asia/Dubai)

s13(A): Semi-Conductor Systems

Room: B55

Chair: Mohamad Sofian Abu Talip

Spatial Multiplexing MIMO for Remote Areas Employing MMSE Parallel Interference Cancellation for Non-Orthogonal GFDM
Danilo Gaspar, Vanessa Mendes Rennó, Luciano Leonel Mendes, Tales Cleber Pimenta and Shahab Ehsanfar

Comparison of ANFIS and ANN for Small-Signal Modelling of GaN HEMT Up to 40 GHz
Bagylan Kadirbay, Saddam Husain, Anwar Hasan Jarndal and Mohammad Hashmi

Efficient Implementation of a 4x4 Enhanced Pipeline Multiplier Using Electric EDA Tool
Khader Mohammad and Nirmeen Al-Sheikh

Design and Simulation of Dual-Metal-Gate Tunnel Field Effect Transistor with Biomolecule Sensing Applications
M Salim Wani, Hend I Alkhammash and Sajad A. Loan

Design and Fabrication of Nanofibrous Membrane and Microelectrodes for Highly Robust Biocompatible Humidity Sensing
Afaque Manzoor Soomro, Faheem Ahmed and Muhammad Waqas

InGaAs Self-Switching Diode with Suppressed Harmonics for High Frequency Applications

Bhavya Sharma, Sahil Garg, Priyanka Singh, Supriya Garg, Gourab Das, Deepak Sharma, Neena Gupta, Arun Kumar Singh, Sanjeev Kumar and Shahrir Rizal Kasjoo

Monday, December 18 4:00 - 5:30 (Asia/Dubai)

s13(B): CAD

Room: B107

Chair: Eman Hasan

Secured and Optimized Hardware Accelerators Using Key-Controlled Encoded Hash Slices and Firefly Algorithm Based Design Space Exploration
Anirban Sengupta, Aditya Anshul, Chirag Kothari and Sumer Thakur

On Structure Design Optimization of GaN Based Semiconductor Device for Reduced Trapping
Arivazhagan Lakshmanaperumal and Anwar Hasan Jarndal

Fault Simulation Framework Using PyUVM
Mohamed Ahmed El-Adawy, Eng, Mina Hanna Fayez, Micheal Safwat Sahyon, Omar Hossam El-Din,

Mohamed Ahmed ElShafie, Mohamed Taha, Islam Ahmed, Hannan Ahmed Kamal and Mohamed Gamal Talaat

AUTG: An Automatic UVM-Based TestBench Generator for VLSI Chip Design Verification
Mohammad Ismael, Ayman Hroub and Abdellatif Abu-Issa

A Sub-1dB Noise Figure Ku Band GaN Low Noise Amplifier for Space Applications
Husna Hamza and Anwar Hasan Jarndal

A Low-Power Analog Integrated Gaussian-Based Neural Network Classifier with Application to Hepatitis Disease Recognition
Vassilis Alimisis, Nikolaos P. Eleftheriou and Paul Peter Sotiriadis

Tuesday, December 19

Tuesday, December 19 9:00 - 10:00 (Asia/Dubai)

Keynote Speaker-3: Seamless Wireless Charging: A Game-Changer for Smart Cities

Dr. Mohammed Ismail

Rooms: B55

Chair: Baker Mohammed

in this presentation, we present the vision of "seamless wireless charging". It is conceived that seamless charging, similar to what we have today with Wi-Fi for mobile internet, is possible. The technology is there to make it happen and we believe this will be a game changer for smart homes, offices and cities.
We make use of wireless power transfer (WPT) which provides inherent electrical isolation and completely eliminates the existing high-tension power transmission lines, cables, and towers. It reduces board charging cost, weight and volume. Nevertheless, WPT, for say IoT devices or EVs, poses additional challenges and sustainability trade-offs.
To meet the challenges, we present a system , method , and device that provides power to an electrical unit such as an Internet of Things (IoT) device or an electric vehicle (EV) that includes a transmitter that provides power through electromagnetic waves , a receiver , an array that includes a plurality of metamaterial elements , such that the electrical power passes wirelessly from the transmitter to the array , and a smart controller that applies selective phase shifts to each of the metamaterial elements such that the power is transmitted from the transmitter , reflected off the array, and is received in phase at the receiver which converts the electromagnetic waves to an electric current to power the device. If the device moves, it sends a pilot signal to the transmitter which alerts the smart controller to adjust the reflected waves in real-time such that they are always received in phase. The harvested RF power is then converted to DC to charge the device using an appropriate rectenna circuit. We will present the details of the proposed system. Will also review some of the existing and emerging technologies for the wireless charging of IoT devices or EVs when stationary or on the move.

Tuesday, December 19 10:00 - 10:30 (Asia/Dubai)

Coffee Break

Rooms: B55

Tuesday, December 19 11:00 - 12:30 (Asia/Dubai)

S21(A): ASIC-FPGA

Room: B55

Chairs: Vassilis Alimisis, Ilya Kavalchuk

An Adaptive Analytical FPGA Placement Flow Based on Reinforcement Learning
Charlotte Barnes, Sam Vermeulen, Shawki Areibi and Gary Grewal

Supporting Dynamic Control-Flow Execution for Runtime Reconfigurable Processors
Hassan Nassar, Rafik Youssef, Lars Bauer and Joerg Henkel

Fast Parallel Multiple Access Distributed Arithmetic (FPMA-DA) Reconfigurable FIR Filter
Ahmed Hany Bayoumi, Sr, Hossam A. H. Fahmy and Sameh Ahmed Assem Mostafa Ibrahim

Hardware Acceleration for Deep Learning Model
Shereen Moataz Afifi, Abdelrhman Abdallah and Radwa E Taha

Efficient Mux-Based Multiplier for MAC Unit
Huruy T Tesfai, Hani Saleh, Mahmoud Meribout, Thanos Stouraitis, Baker Mohammad and Mahmoud Al-Qutayri

Development and Optimization of a Planar Wideband Ultrathin Absorber Based on Equivalent Circuit Model Analysis
Yasmine Abdalla Zaghloul

Tuesday, December 19 11:00 - 12:30 (Asia/Dubai)

S21(B): Metaverse/AI/IoT/ML/MDL/Security System-II

Room: B107

Chair: Mohammad Alhawari

Augmented Reality as an Educational Tool: Integrating the Virtual and the Real
Eder C Maciel, Miller H Fernandes, Tales Cleber Pimenta, Jaqueline C Carvalho and Marcos A Carvalho

The Influence of Artificial Intelligence in Society
Tales Cleber Pimenta, Milene S Moreira and Douglas T Silva

Fusing IP Vendor Palmprint Biometric with Encoded Hash for Hardware IP Core Protection of Image Processing Filters
Anirban Sengupta, Aditya Anshul, Sumer Thakur and Chirag Kothari

Emotion Recognition and Authentication Based on Electroencephalogram (EEG) Signals
Khader Mohammad, Maen Mohammad, Saleem Hamoo and Mohammad Abbas

Hyperdimensional Computing Versus Convolutional Neural Network: Architecture, Performance Analysis, and Hardware Complexity
Eman Hassan, Baker Mohammad and Meriem Bettayeb

PSO-GA Based Federated Learning for Predicting Energy Consumption in Smart Buildings
Nader Bakir, Ahmad Samrouth and Khouloud Samrouth

Tuesday, December 19 12:30 - 1:30 (Asia/Dubai)

Lunch Break

Rooms: Restaurant

Tuesday, December 19 1:30 - 2:30 (Asia/Dubai)

Keynote Speaker-4: Data refinery in the AI era: From silicon processing to optical transport

Dr Naim Ben-Hamida

Rooms: B55

Chair: Hani Saleh

The data deluge produced by AI traffic, that is increasing by order of magnitude every year, is stressing both electrical and optical interconnect, that are doubling every 2-3 years. Moreover, the energy consumption in the context of exponential growth of traffic is not sustainable. If we continue this trend, the world energy production will be consumed by data. In this talk, a parallel is drawn between energy and data from refinement to transport. The data centers are the data refineries of the new digital economy and optical fibers are the equivalent of the oil pipelines. An overview of the optical transport technology is presented and how it can be used to reduce cost and loss of transporting energy. Power and cost can be reduced by processing data where the energy is produced and transport lossless bits. Coherent technology for optical systems is at the heart of this efficiency of data transport. This technology is enabled by state-of-the-art 3nm ASICs implementing efficient DSP and high-speed data converters.

Tuesday, December 19 2:30 - 3:45 (Asia/Dubai)

S22(A): Smart Sensors/Sensor Networks & Cyber-physical Systems Security

Room: B55

Chairs: Fakhreddine Ghaffari, Thanos Stouraitis

Optimizing Charging Schedules for WRSNs: A Multi-Criteria Decision-Making Approach with Multiple Charger Vehicles
Samah Abdel Aziz, Ammar Hawbani, Wang Xingfu, Abdelrahman Samy Ismail, Nasir Saeed, Saeed Alsamhi, Liang Zhao and Ahmed Y Al-Dubai

Exploring H2S Gas Sensing with Graphene Nanoribbon Field Effect Transistors: A Semi-Empirical Simulation Approach
Asma Wasfi, Mohamed Atef and Falah Awwad

DRAM Bitline as A Delay Path for Potential PUF
Enas Abulibdeh, Leen Younes, Baker Mohammad and Hani Saleh

Real-Time Switched Capacitor Based Power Side-Channel Attack Detection
Leen Younes, Baker Mohammad, Dima Kilani and Hani Saleh

An Embedded Real-Time Driver Monitoring System Based on AI and Computer Vision
Leila Sharara, Alexandros Politis, Mohammed Ismail and Lubna Alazzawi

Tuesday, December 19 2:30 - 3:45 (Asia/Dubai)

S22(B): Analog and RF Circuit Design Techniques

Room: B107

Chair: Meriem Bettayeb

Development, Optimization, and Application of ML Based Modeling of Printed VO2 RF Switch
Ahmad Khusro, Mohammad Hashmi and Muhammad Akmal Chaudhary

2.45GHz Low-Power Diode Bridge Rectifier Design
Gabriel Koubar, Fayrouz Haddad, Wenceslas Rahajandraibe, Sawsan Sadek and Bouchra Nessakh

A 0.3-V 10-nW CMOS OTA with Feedforward Body-Driven Structure
Hirokazu Yoshizawa

A High PSRR CMOS Voltage and Current Reference in One Circuit Without Amplifier for Low Power Applications
Ashutosh Pathy, Andleeb Zahra, Zia Abbas and Amir Ahmad

A Low-Power Analog Integrated Deep Spatio-Temporal Inference Network with Application to Digit Classification
Vassilis Alimisis, Nikolaos P. Eleftheriou and Paul Peter Sotiriadis

Tuesday, December 19 3:45 - 4:00 (Asia/Dubai)

Coffee Break

Rooms: B55

Tuesday, December 19 4:00 - 4:45 (Asia/Dubai)

S23(A): General-I

Room: B55

Chair: Mohammed Umair Khan

Regional CubeSat Communication and Constellation Design Evaluation
Khaled Mohammed, Hamzeh Abu Qamar, Ruhul Amin Khalil and Nasir Saeed

Innovative Hardware Architecture for Zero Emission Sea Drones
Ilya Kavalchuk, Saad Bin Zafar and Shahid Islam

Layout-Based Reliability Analysis of openMSP430 Register File Under External Radiations
Vivek Bansal, Otmane Ait Mohamed and Fakhreddine Ghaffari

Tuesday, December 19 4:45 - 5:30 (Asia/Dubai)

SS: Title: Energy efficient computing based on emerging technologies

Rajendra Bishnoi (Talk-3**)**, Sumit Diware, Anteneh Gebregiorgis, Simon Thomann, Sara Mannaa, **Bastien Deveautou**r (Talk-2), Cedric Marchand, Alberto Bosio, Damien Deleruyelle, Ian O'Connor, **Hussam Amrouch** (Talk-1) and Said Hamdioui

Talk-1: In-Memory Computing using Ferroelectric Transistors: Lessons Learnt and Future Trends

Talk-2: Efficient and Reliable Hardware Architectures based on Vertical Nanowire FETs

Talk-3: Towards Accurate Memristor-based Neural Networks

Tuesday, December 19 4:00 - 5:30 (Asia/Dubai)

S23(B): General-II

Room: B107

Chair: Huruy Tesfai

A Novel Architecture of CXL Protocol Data Link Layer for Low Latency Memory Access
Basma Hesham Salah, M. Watheq El-Kharashi, Mona Safar and Mohamed AbdElSalam Hassan

The Electric Crisis of Brazil in 2021: Origins and a Solution Proposal
Milene S Moreira and Tales Cleber Pimenta

A Fully-Differential Low-Noise Instrumentation Amplifier for Electrical Impedance Tomography
Ibrahim Alkhalifa and Yaqub Mahnashi

Radiation-Hardened Stabilized Power Supply Based on Bipolar Transistors
Takato Tanizawa and Minoru Watanabe

An Analog Integrated, Low-Power, Area-Efficient, Gilbert, Modulo-Based Classifier with Application to Lung-Cancer Classification
Vassilis Alimisis, Nikolaos P. Eleftheriou, Savvas Leventikidis and Paul Peter Sotiriadis

Ultra-Low Power Self-Polarized Dynamic Threshold Telescopic OTAs Circuits for Biomedical Applications
Dalila Laouej, Houda Daoud and Mourad Loulou

Tuesday, December 19 5:30 - 5:45 (Asia/Dubai)

Closing Ceremony, Awards

Rooms: B55

Tuesday, December 19 7:00 - 9:00 (Asia/Dubai)

Gala Dinner: Dusit Thani Abu Dhabi, Onyx BallRoom

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