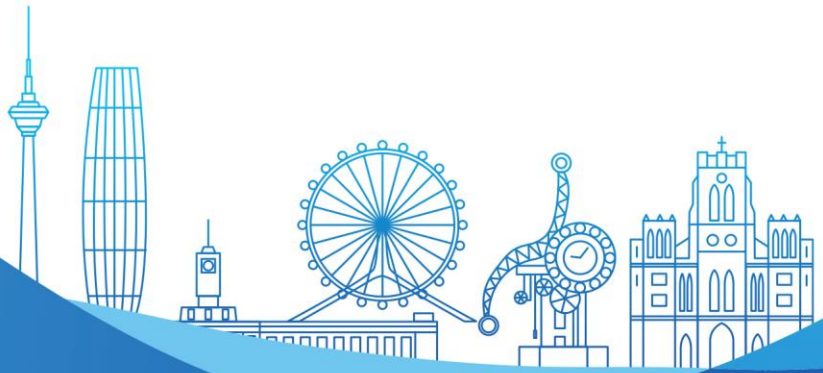
FIRST 2023
INTERDISCIPLINARY CONFERENCE

The FIRST Interdisciplinary Conference 2023

October 30-31, 2023 Tianjin, China

CONFERENCE BROCHURE

Contents



Conference Introduction

Theme:
Interdisciplinarity: The Fusion of Technologies (Semiconductor, Artificial Intelligence, Internet-of-Things, and Communications)

The inaugural FIRST international conference will be held online on Monday, 30th and Tuesday 31st October 2023. Many world-renowned professors, experts and researchers in communication and semiconductor technologies and other related fields at home and abroad will attend this conference. This international conference aims to discuss the open problems and present new solutions that address the challenges of future communication systems, artificial intelligence, internet-of-things, and chip design. Specifically, the role of semiconductors in future communications will be presented and how can the semiconductor and communication industry emerge stronger after the pandemic will be discussed.

This FIRST international conference will be open to relevant enterprises and experts in the field of semiconductors and integrated circuits, providing a professional multi-disciplinary and multi-field exchange and cooperation platform for enterprises, universities and research institutes in the field of semiconductors and integrated circuits, providing innovative ideas for today's increasingly complex and difficult product development, combining cutting-edge scientific research and product innovation more effectively. At the same time, it lays a solid foundation for more in-depth school-enterprise cooperation.

General Chair
Prof. Kiat Seng YEO
IEEE Fellow, Singapore Academy of Engineering Fellow,
Singapore National Academy of Science Fellow, AAIA Fellow

Conference Information

◆ Venue

The conference will be held online, the online meeting is open to registered representatives, the instructions for participation are as follows:

1. Enter the timetable page of official website on PC: https://www.aconf.org/conf_194081/timetable/session/194141.html

2. Click *Enter meeting room*.

3. Enter the participant code

4. How to obtain the participant code
Before the conference, the participant code will be sent by email to the email address you submitted during registration, and the short message will be sent to the mobile phone number you submitted during registration.

◆ Organizer

Tianjin University

◆ Sponsors

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IEEE Tianjin AP/MTT/SSC Joint Chapter

Schedule

DAY 1
30th October 2023 (Monday)

Beijing Time	Event
09:00 - 09:30	Opening Address / Welcome Speech Professor Gong Jinlong Standing Committee Member of the Party Committee, Vice President of Tianjin University
09:30 - 10:30	**Keynote 1:** Self-Evolving and Transformative (SET) Protocol Architecture for 6G **Professor Lin CAI** University of Victoria
10:30 - 11:30	**Keynote 2:** Where Technologist and Entrepreneur Meet to Stimulate Academic Spin-Offs **Professor T. Russell HSING** The Chinese University of Hong Kong
11:30 - 12:30	Lunch
12:30 - 13:30	**Keynote 3:** Passive-Intensive Bluetooth LE Receiver for Internet of Everything **Professor Pui-In MAK** University of Macau
13:30 – 14:30	**Keynote 4:** Stacked Intelligent Metasurfaces Enabled Joint Computing and Communication in the Wave Domain **Professor Chau YUEN** Nanyang Technological University, Singapore
14:30 - 15:00	Tea Break
15:00 - 16:00	**Keynote 5:** CMOS Frequency Generation - From RF to Millimeter-Wave and Sub-THz **Professor Howard Cam LUONG** Hong Kong University of Science and Technology
16:00 - 17:00	**Keynote 6:** Machine Learning for Optimized Use of Network Resources **Professor Kin K LEUNG** Imperial College London

17:00	End of Program for Day 1

DAY 2
31th October 2023 (Tuesday)

Beijing Time	Event
09:30 - 10:30	**Keynote 7:** Applications of Phase Change Material (PCM) Technology in Tunable Filters and in Other Reconfigurable Microwave and Millimeter-Wave Devices **Professor Raafat MANSOUR** University of Waterloo
10:30 - 11:30	**Keynote 8:** Analog and Mixed-Signal CMOS Circuits at the core of the A/D Interface in the Internet-of-Everything (IoE) **Professor Rui Paulo Da Silva MARTINS** University of Macau
11:30 - 12:30	Lunch
12:30 - 13:30	**Keynote 9:** Signal Integrity Design for Air-filled Interconnect in 5G/6G Communication Network **Professor Tzong Lin WU** National Taiwan University
13:30 – 14:30	**Keynote 10:** Electromagnetics in Medicine: Current Status and Challenges of Wireless Power Transfer, Antennas and Wireless Sensing **Professor Yongxin GUO** National University of Singapore
14:30 - 15:00	Tea Break
15:00 - 16:00	**Keynote 11:** A Knife Cuts Both Ways – Attacks and Defenses of Deep Neural Networks **Professor Chip Hong CHANG** Nanyang Technological University, Singapore
16:00 - 17:00	**Keynote 12:** Fusion of Technologies **Professor Kiat Seng YEO** Tianjin University
17:00	End of Program for Day 2

Keynotes

◆ Keynote 1

Beijing Time: October 30th 09:30-10:30
Title: Self-Evolving and Transformative (SET) Protocol Architecture for 6G

Professor Lin CAI
IEEE Fellow, NSERC E.W.R. Steacie Memorial Fellow, Engineering Institute of Canada (EIC) Fellow, Professor of University of Victoria，College Member of Royal Society of Canada

Biography

Lin Cai is a Professor with the Department of Electrical & Computer Engineering at the University of Victoria. She is an NSERC E.W.R. Steacie Memorial Fellow, an Engineering Institute of Canada (EIC) Fellow, a Canadian Academy of Engineering (CAE) Fellow, an IEEE Fellow, and a Royal Society of Canada's College Member, and a 2020 "Star in Computer Networking and Communications" by N2Women. Her research interests span several areas in communications and networking, focusing on network protocol and architecture design supporting emerging multimedia traffic and the Internet of Things. She has co-founded and chaired the IEEE Victoria Section Vehicular Technology and Communications Joint Societies Chapter. She is an elected member of the IEEE Vehicular Technology Society (VTS) Board of Governors, 2019 – 2024, and served as its Vice President. She is the Associate Editor-in-Chief for IEEE Transactions on Vehicular Technology and a Distinguished Lecturer of both the IEEE VTS Society and the IEEE Communications Society.

Abstract

The fusion of digital and real worlds in all dimensions will be the driving force for future sixth-generation (6G) wireless systems. Ubiquitous in-time and on-time communication services between humans, machines, robots, and their virtual counterparts are essential, and they expand from the ground to air, space, underground, and deep sea. 6G systems are not only data pipelines but also large-scale distributed computing systems with integrated sensing, processing, storage, communication and computing capabilities. It is challenging to build ubiquitous and intelligent 6G systems, handling stringent quality-of-service (QoS) requirements, providing a rich set of communication modes, including unicast, multicast, broadcast, in-cast, and group-cast, and supporting user-centric mobile applications. In this talk, we introduce a new protocol architecture, Self-Evolving and Transformative (SET) architecture that can provide a wide range of control functions, and be intelligently configured for different types of 6G applications and networking environments. Its design principles, potentials, and open issues are discussed. We also introduce a use case applying the architecture to develop a mobility-aware multi-path QUIC protocol for satellite networks.

◆ Keynote 2

Beijing Time: October 30th 10:30-11:30
Title: Where Technologist and Entrepreneur Meet to Stimulate Academic Spin-Offs

Professor T. Russell HSING
IEEE Life Fellow and Fellows for the British Computer Society, AAIA and SPIE. Adjunct Professor in the Chinese University of Hong Kong, and also Visiting Professor in UC Davis

Biography

Dr. T. Russell Hsing is IEEE Life Fellow and Fellows for the British Computer Society, AAIA and SPIE. He accumulated rich R&D experiences of 40+ years as technical staff, research/engineering director and executive director through affiliations with Burroughs, Xerox, GTE Labs, Telco Systems Fiber Optics Corporation, TASC and Bellcore/Telcordia/Ericsson since 1977. He is currently Adjunct Professor in the Chinese University of Hong Kong, and also Visiting Professor in UC Davis. During his tenure at Telcordia, he has co-established two significant R&D centers with President and Vice President of Bellcoe / Telcordia in Taipei , and Poznan (Poland). Both centers focused on advanced ICT partnering with local institutions to win significant contract funding from both commercial and local government sources. Since late 2012, he has been visiting professors at numerous universities around the world including mianland China, US, Singapore, India, Korea, Ireland, China Hong Kong and China Taiwan. He was Board Member for the Open Fog Consortium in 2016-2018. He has been teaching the courses of "Technology Entrepreneurship: From IP to IPO" (since 2014) and "Internet Economics" (since 2017). His research interests include AI- Powered Fog/Edge Computing & Networking and Platform, Internet Economics, Fogonomics, Vehicular Telematics & Services, Wireless 5G/6G , Quantum Communication research, Next Generation IoT Services/ Applications, and Academic Spin-offs. Currently he is Advisory Board Member for the IEEE Fog/Edge Industrial Community. He is now Board Advisor/Mentor for few academic spin-offs in US, Taiwan China, Ireland and Poland.

Abstract

As indicated by Professor John L. Hennessy (Former President of Stanford University), "High-technology companies are both an important part of our world's economic growth story as well as the place where many young entrepreneurs realize their dreams".

Starting from an old photo which was taken over around 1982, the speaker will first share his own story on how and why to develop the world's first prototype of "Touch Phone (1982)", with audiences. He will then couple his R&D experiences of over 36 years in the US industry and 10 years in academia across the world with his global touch and involvements with several startups. This talk will blend technology, liberal art, creativity, innovation, business and management together to guide the audiences to go through an interdisciplinary process from "Curiosity > Opportunity> Business Model> Risk Management> Technology Commercialization and Business Innovation". A Case study will be also discussed. At the end of this talk, the speaker hopes that the audiences will have a first-hand feeling to understand how technologist and entrepreneur transfer their curiosity, hard work, and ambition at the very early stage into decisive actions of establishing their own enterprise, and then eventually expand it to one of the top Fortunate 500 corporations in the world.

In the meantime, the creation of academic spin-offs from universities research labs and research institutes are now playing a key mechanism of the technology commercialization for IPRs-based research prototypes. University spin-offs are now starting to play a critical role for economic development, Commercializing university technologies and also helping university with their major missions of research and teaching.

Based on speaker's own experiences as corporate technical staff, director and executive director for 26 years and then visiting professor (since 2012); Hopefully this talk might be able to stimulate audience's entrepreneurial spirit, and ultimately encourage some of faculty members and students to make their dreams of having their own Technology Start-Ups through Academic Spin-offs.

◆ Keynote 3

Beijing Time: October 30th 12:30-13:30

Title: Passive-Intensive Bluetooth LE Receiver for Internet of Everything

Professor Pui-In MAK

IEEE Fellow; IET Fellow; RSC Fellow; Deputy Director (Research) Institute of Microelectronics of University of Macau; Chinese Academy of Sciences Overseas Expert

Biography

Professor of the University of Macau, Vice President of the Institute of Microelectronics, Deputy Director of Research of the State Key Laboratory of Analog and Mixed Signal VLSI. IEEE Fellow, IET Fellow and overseas review experts of the Chinese Academy of Sciences. Graduated from the University of Australia with a bachelor's degree (3 years) and a doctoral degree (3 years) in Electrical and Computer Engineering. Focusing on research in the fields of RF and analog circuits, we are internationally recognized experts in the field of integrated circuits.

Abstract

The fundamental elements MOS switch, capacitor and inductor (transformer) are revitalized for their potentials to passive-ize the critical RF and analog functions of the wireless radios, aiming to alleviate the obvious tradeoff between the noise, linearity and power consumption. Imagine a low-noise amplifier (LNA) using no transconductance (gm) can be highly linear, while the voltage gain, input-impedance matching and noise figure (NF) are the metrics to innovate. We demonstrate how a Bluetooth LE receiver using no gm can achieve high linearity, and high RF-to-baseband gain (>30dB) to suppress the noise effect of the subsequent circuitry, yielding an outstanding SFDR of 77dB at a sub-300μW power budget. These examples pace the way to build a greener world of energy-autonomous wireless radios for the Internet-of-Everything (IoE) era.

◆ Keynote 4

Beijing Time: October 30th 13:30-14:30

Title: Stacked Intelligent Metasurfaces Enabled Joint Computing and Communication in the Wave Domain

Professor YUEN Chau

IEEE Fellow; Professor of Nanyang Technological University, Singapore; Editor-in-Chief for *Springer Nature Computer Science*

Biography

IEEE Fellow, Associate Professor, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. Currently serving as the editor in chief of *Springer Nature Computer Science*, as well as the editor of *IEEE Transactions on Vehicular Technology*, *IEEE System Journal*, and *IEEE Transaction on Work Science and Engineering*.

Abstract

We propose a new wave-based computing architecture called stacked intelligent metasurfaces (SIM) to enable joint computing and communication in electro-magnetic (EM) domain. An SIM is fabricated by stacking an array of programmable metasurface layers, where each layer consists of many low-cost passive meta-atoms that can individually manipulate EM waves. By appropriately configuring the passive meta-atoms, an SIM can automatically accomplish advanced computation tasks as the EM wave propagates through it, while reducing both the energy consumption and processing delay. In this talk, we will illustrate the application of SIM in multiple-input multiple-output (MIMO) and multi-user MIMO wireless communications.

◆ Keynote 5

Beijing Time: October 30th 15:00-16:00
Title: CMOS Frequency Generation - From RF to Millimeter-Wave and Sub-THz

Professor Howard Cam LUONG
IEEE Fellow; Professor of Hong Kong University of Science and Technology; Associate Editor of IEEE Solid-State Circuits Letters (SSCL) and IEEE Virtual Journal on RFIC; Technical program committee member of IEEE International Solid-State Circuits Conference (ISSCC)

Biography

Howard Cam LUONG, IEEE Fellow, Professor at the Hong Kong University of Science and Technology, Associate Editor in Chief of IEEE Solid State Circuit Letters (SSCL) and IEEE RFIC Virtual Journals, and Member of the Technical Planning Committee of the IEEE International Solid State Circuit Conference (ISSCC). The research direction is mixed signal and analog integrated circuits for integrated circuits and system RF wireless communication.

Abstract

Recent convergence of technologies have inspired and enabled many interesting emerging applications - including 5G/6G communications, artificial intelligence, Internet of Everything, bioelectronics, imaging, and sensing - but at the same time have imposed unprecedented challenges for systems-on-chip designs. As ubiquitously required in each and every of these systems, a clock or frequency generator needs to achieve higher and higher performance in terms of high frequency, low phase noise, wide frequency tuning range, and low power consumption.

This talk will review recent design challenges and potential solutions to realize such signal generators covering ultra-wide frequency range from RF and mmW to sub-THz and beyond. Detailed description and comparison to traditional designs will be discussed. Finally, designs and measurements of several clock generators with state-of-the-art performance will be presented as case studies.

◆ Keynote 6

Beijing Time: October 30th 16:00-17:00
Title: Machine Learning for Optimized Use of Network Resources

Professor Kin K LEUNG
IEEE Fellow; Professor of Electrical and Electronic Engineering, and Computing Departments, Imperial College London

Biography

Kin K. Leung received his B.S. degree from the Chinese University of Hong Kong, and his M.S. and Ph.D. degrees from University of California, Los Angeles. He joined AT&T Bell Labs in New Jersey in 1986 and worked at its successor companies until 2004. Since then, he has been the Tanaka Chair Professor in the Electrical and Electronic Engineering (EEE), and Computing Departments at Imperial College in London. He serves as the Head of Communications and Signal Processing Group in the EEE Department at Imperial. His current research focuses on optimization and machine-learning techniques for system design and control of large-scale communications, computer and sensor networks. He also works on multi-antenna and cross-layer designs for wireless networks.

He is a Fellow of the Royal Academy of Engineering (2022), IEEE Fellow (2001), IET Fellow (2022), and member of Academia Europaea (2012). He received the Distinguished Member of Technical Staff Award from AT&T Bell Labs (1994) and the Royal Society Wolfson Research Merits Award (2004-09). Jointly with his collaborators, he received the IEEE Communications Society (ComSoc) Leonard G. Abraham Prize (2021), the IEEE ComSoc Best Survey Paper Award (2022), the U.S.–UK Science and Technology Stocktake Award (2021), the Lanchester Prize Honorable Mention Award (1997), and several best conference paper awards. He currently serves as the IEEE ComSoc Distinguished Lecturer (2022-23). He was a member (2009-11) and the chairman (2012-15) of the IEEE Fellow Evaluation Committee for the ComSoc. He has served as guest editor and editor for 10 IEEE and ACM journals, and chaired the Steering Committee for the IEEE Transactions on Mobile Computing. Currently, he is an editor for the ACM Computing Survey and International Journal on Sensor Networks.

Abstract

Optimization techniques are widely used to allocate limited resources in communication networks. The speaker will start by showing the well-known Transport Control Protocol (TCP) as a distributed solution to achieve the optimal bandwidth allocation. Unfortunately, factors such as multiple grades of service, variable transmission power, and tradeoffs between communication and computation often make the optimization problem for resource allocation non-convex. New distributed solutions are needed to solve these problems.

As an example, the speaker will consider in-network data processing in sensor networks where data are aggregated along the way as they are transferred toward the end user. Finding the optimal solution is NP-hard, but for specific settings, the problem can lead to a distributed framework for achieving the optimal tradeoff between communications and computation costs.

For the afore-mentioned problems, gradient-based iterative algorithms are commonly used as a solution technique. Much research focuses on improving the iteration convergence. However, when the system parameters change, it requires a new solution from the iterative methods. The speaker will present a new

machine-learning method by using two Coupled Long Short-Term Memory (CLSTM) networks to quickly and robustly produce the optimal or near-optimal solutions to non-convex, constrained optimization problems over a range of system parameters. Numerical examples for allocation of network resources will be presented to confirm the validity of the proposed method.

◆ Keynote 7

Beijing Time: October 31th 09:30-10:30

Title: Applications of Phase Change Material (PCM) Technology in Tunable Filters and in Other Reconfigurable Microwave and Millimeter-Wave Devices

Professor Raafat MANSOUR
IEEE Life Fellow; Fellow of the Canadian Academy of Engineering (CAE); Fellow of the Engineering Institute of Canada (EIC); Professor of Electrical and Computer Engineering at the University of Waterloo

Biography

Raafat Mansour is a Professor of Electrical and Computer Engineering at the University of Waterloo and holds Tier 1 - Canada Research Chair (CRC) in Micro-Nano Integrated RF Systems. He held an NSERC Industrial Research Chair (IRC) for two terms (2001-2005) and (2006-2010). Prior to joining the University of Waterloo in January 2000, Dr. Mansour was with COM DEV Cambridge, Ontario, over the period 1986-1999, where he held various technical and management positions in COM DEV's Corporate R&D Department. Professor Mansour holds 44 US and Canadian patents and more than 420 refereed IEEE publications to his credit. He is a co-author of a 23-chapter Book published by Wiley and has contributed 7 chapters to five other books. Professor Mansour founded the Centre for Integrated RF Engineering (CIRFE) at the University of Waterloo https://uwaterloo.ca/centre-integrated-rf-engineering/. It houses a clean room and a state-of-the-art RF test and characterization laboratory. He was as the Technical Program Chair of the 2012 IEEE International Microwave Symposium (IMS). Professor Mansour is a Fellow of the IEEE, a Fellow of the Canadian Academy of Engineering (CAE), a Fellow of the Engineering Institute of Canada (EIC). He was the recipient of the 2014 Professional Engineers Ontario (PEO) Engineering Medal for Research and Development and the 2019 IEEE Canada A.G.L. McNaughton Gold Medal Award.

Abstract

Microwave and Millimeter-wave switches are key components in communication systems. They are used for signal routing and for realizing a wide range of reconfigurable microwave and millimeter-wave devices. Phase Change Materials (PCM) have been widely used in optical storage media and non-volatile memory device applications. Over the past recent years, there have been interest in exploiting the PCM materials such as germanium telluride (GeTe) and metal insulator transition materials such as vanadium oxides (VO2) for RF applications. The principle of operation of PCM devices is based on the ability of the material to transform from a high-resistivity state (amorphous phase) to a low-resistivity state (crystalline phase) and vice versa with the application of short duration pulses. Several orders of magnitude in resistivity change can be achieved by PCM technology allowing the realization of highly miniature microwave and millimeter-wave switches. In addition to miniaturization, GeTe based switches offer latching functionality and ease of monolithic integration with other RF circuits. This talk will address recent developments in PCM switches and their applications to the realization of reconfigurable filters, switch matrices, phase shifters, variable attenuators, and reflective intelligent surfaces. It outlines major design considerations for tunable filters presenting techniques to realize tunable filters that maintain filter performance over tuning range, illustrating examples of tunable filters tuned only a by single tuning element. The talk also addresses existing tuning technologies, providing a comparison between Semiconductor, MEMS and PCM tuning elements in terms of linearity, insertion loss, suitability for use at millimeter-wave frequencies and ease of integration with high-Q filters. Very recent results for PCM-based reconfigurable acoustic filters are also presented.

◆ Keynote 8

Beijing Time: October 31th 10:30-11:30

Title: Analog and Mixed-Signal CMOS Circuits at the core of the A/D Interface in the Internet-of-Everything (IoE)

Professor Rui Paulo Da Silva MARTINS
IEEE Fellow; Expert in Microelectronics; Academician of Academy of Sciences of Lisbon, Portugal; Vice President (Global Affairs); Chair Professor of University of Macau; Dean of Institute of Microelectronics, University of Macau

Biography

Rui Paulo da Silva Martins, born on April 30, 1957 in Lisbon, Portugal, is a microelectronics expert and a member of the Institute of Electrical and Electronics Engineers (IEEE Fellow). He is also an academician of the Lisbon Undergraduate College in Portugal, Vice President (Global Affairs) of the University of Macau, Chair Professor, and Dean of the Institute of Microelectronics at the University of Macau. Research interests include electronics, analog and mixed signal ultra large scale integrated circuits, etc.

Abstract

China imported in the recent past more “sand” than oil, meaning silicon transformed into electronic chips, quite crucial in a moment where the quest is no longer for energy (oil), as in the past, but for computing power (silicon). The national high demand for state-of-the-art integrated circuits is driving research and development in the run after a Chinese CPU (Electronics Brain). Besides the Brain, all Electronics needs its Senses that are at the core of the Analog/Digital Interface with Audio, Vision & Sensors, essential for the Internet of Everything – IoE, because a brain does not work without a sensing system. University of Macau (UM) and its State Key Laboratory of Analog and Mixed-Signal VLSI are prominent and now renowned for its excellence and expertise in the design of innovative circuits for the analog/digital interface, contributing to address also A/D Interface Independency. In a recent book entitled “Analog and Mixed-Signal Circuits in Nanoscale CMOS” we presented the most critical building blocks of such interface that are high-performance radios, power-efficient RF and mm-Wave circuits, ultra-low-voltage clock references, low power and high-performance data converters, integrated energy harvesting interfaces, fully integrated power converters and low-dropout regulators. All these circuits need to exhibit high quality performance with low power consumption, high energy-efficiency and high speed, thus enabling a reliable and consistent development of the IoE while enlarging its frontiers. There is a huge pressure in the design area with a high demand for analog design engineers, opening a vast field of opportunities and challenges that imply a continuous knowledge update. Then, UM is contributing to stimulate and well-equip the mind of future skillful analog design engineers in state-of-the-art designs adequate for most applications.

◆ Keynote 9

Beijing Time: October 31th 12:30-13:30

Title: Signal Integrity Design for Air-filled Interconnect in 5G/6G Communication Network

Professor Tzong Lin WU

IEEE Fellow; Associate Dean and Distinguished Professor at Department of Electrical Engineering & Graduate Institute of Communication Engineering, National Taiwan University (NTU)

Biography

IEEE Fellow, Vice Dean and Distinguished Professor of Electrical Engineering at the Graduate School of Communication Engineering, Taiwan University. The main research direction is electromagnetic compatibility/interference, chip packaging circuit board co design for signal and power integrity, microwave circuit component design, and electrical analysis of 3D chips.

Abstract

Driven by the evolution of commercial applications and user experience, the demand of 5G/6G high-speed communication is increasing rapidly in recent years. Data transmission in millimeter-wave (mm-wave) and subterahertz (sub-THz) is gaining interest to provide widely available bandwidth and meet the requirement for higher capacity and lower latency. Interconnects with low power loss and good signal integrity are necessary for 5G/6G communication network. Among all competitors, air-filled interconnect may play an essential role for 5G/6G applications. Air-filled substrate integrated waveguide (AFSIW) offers an extremely low-loss solution for inner-board transmission. And air-filled dielectric waveguide (AFDW) provides a low-loss solution for intra-device transmission with short-to-medium distance. Moreover, highly-integrated multi-lane AFDWs are expected to achieve communication with even higher throughput. However, the interference issue is critical. To enhance signal integrity of multi-lane AFDW, photonic crystal fence (PCF) can be applied compactly with AFDWs and provide significant crosstalk reduction. These techniques take a key step for the technical race in the 5G/6G high-speed communication in the near future.

◆ Keynote 10

Beijing Time: October 31th 13:30-14:30

Title: Electromagnetics in Medicine: Current Status and Challenges of Wireless Power Transfer, Antennas and Wireless Sensing

Professor Yongxin GUO

Fellow of IEEE; Singapore Academy of Engineering; Full Professor at National University of Singapore (NUS); Director, Center for Peak of Excellence on Smart Medical Technology at NUS Suzhou Research Institute; Co-Director, Center for Smart Sensing and Artificial Intelligence, NUS Chongqing Research Institute

Biography

Dr. Yongxin Guo is currently a Full Professor at the Department of Electrical and Computer Engineering, National University of Singapore (NUS). Concurrently, He is Director, Center for Peak of Excellence on Smart Medical Technology at NUS Suzhou Research Institute and Co-Director, Center for Smart Sensing and Artificial Intelligence, NUS Chongqing Research Institute. He has authored or co-authored over 500 international journal and conference papers, 4 book chapters and 1 book. He holds over 60 granted/filed patents in USA, China and Singapore. His current research interests include RF sensing, antennas and electromagnetics in medicine; wireless power for biomedical applications and internet of things; wideband and small antennas for wireless communications; and RF and microwave circuits and MMIC modelling and design. He has graduated 20 PhD students at NUS.

Dr. Guo is a Fellow of IEEE and Singapore Academy of Engineering. He is serving as Editor-in-Chief, IEEE Journal of Electromagnetics, RF and Microwave in Medicine and Biology. He is a Distinguished Lecturer for IEEE Antennas and Propagation Society (2022-2024). He received the CityU HK 1st EE Outstanding Alumni Award in 2022. He was the recipient of 2020 IEEE Microwave and Wireless Components Letters Tatsuo Itoh Prize of the IEEE Microwave Theory and Techniques Society. He is serving as IEEE Biomedical Engineering Award Committee and served as the IEEE Fellow Evaluation Committee for IEEE Engineering in Medicine and Biology Society (2019-2020). Dr Guo was the Chair for IEEE AP-S Technical Committee on Antenna Measurement in 2018-2020. He has served as General Chair/Co-Chair for a number of international conferences/workshops.

Abstract

Electromagnetics in medicine has played a crucial role in early diagnosis, long-term monitoring and medical treatment. Numerous applications in medical diagnostics and therapeutics ranging from cardiac pacemakers to emerging devices in visual prosthesis, brain computer interfaces and body area networks have spurred electronic engineers to propose new wireless medical devices. Wireless implantable medical devices (IMDs) provide an opportunity to improve the patient health monitoring and treatment. To extend the lifespan without incorporating a bulky battery and to facilitate the miniaturization of IMDs, the wireless power transfer (WPT) technology and antenna miniaturization and multifunction have played an essential role. On the other hand, smart wireless sensing has increasingly been adopted in medical applications for monitoring, detecting and tracking of medical condition developments. In this presentation, solutions and developments on WPT, antenna and wireless sensing for biomedical applications will be presented.

◆ Keynote 11

Beijing Time: October 31th 15:00-16:00

Title: A Knife Cuts Both Ways – Attacks and Defenses of Deep Neural Networks

Professor Chip Hong CHANG

IEEE Fellow; Professor at the School of Electrical and Electronic Engineering of Nanyang Technological University, Singapore

Biography

Chip Hong Chang is a Professor at the School of Electrical and Electronic Engineering of Nanyang Technological University, Singapore. He held joint appointments as Assistant Chair of Alumni of the School of EEE from 2008 to 2014, Deputy Director of the Center for High Performance Embedded Systems from 2000 to 2011, and Program Director of the Center for Integrated Circuits and Systems from 2003 to 2009. He was conferred the 2022 VISTA award of excellence in hardware security. He has coedited six books, published 13 book chapters, more than 120 international journal (more than 80 are IEEE) papers and around 200 refereed international conference papers (mostly IEEE). His current research interests include hardware security, AI security, biometric security, trustworthy sensing and hardware accelerators for post-quantum cryptography and edge computational intelligence. He has delivered more than 50 keynotes, plenary, tutorials and invited seminars. Dr. Chang currently serves as the Senior Area Editor of IEEE Transactions on Information Forensic and Security (TIFS), and Associate Editor of the IEEE Transactions on Circuits and Systems-I (TCAS-I) and IEEE Transactions on Very Large Scale Integration (TVLSI) Systems. He has held key appointments in the organizing and technical program committees of more than 70 international conferences (mostly IEEE). He is the 2018-2019 IEEE CASS Distinguished Lecturer, a Fellow of the IEEE, IET and AAIA.

Abstract

The flourishing Internet of Things (IoT) has rekindled on-premises computing to allow data to be analyzed closer to the source. Neural architecture search, open-source deep neural network (DNN) model compilers and commercially available toolkits have evolved to facilitate rapid development and deployment of Artificial Intelligence (AI) applications. This “model once, run optimized anywhere” paradigm shift in deep learning computations introduces new attack surfaces and threat models that are methodologically different from existing software-based attacks. Model integrity is a primary pillar for AI trust to ensure that the system delivers and maintains the desirable quality of service and are free from unauthorized deliberate or inadvertent manipulation of the system throughout the lifetime of their deployment. A superior and well-trained DNN classifier is not only an intellectual property (IP) of high market value but also consists of private and sensitive information. Unfortunately, existing DNN hardware implementations mainly focus on throughput and energy efficiency optimization, which can unintentionally introduce exploitable vulnerabilities. The situation is aggravated by the trend of outsourcing model training, renting cloud computing platforms, and deploying partially or fully trained third-party models for AI application development and edge inference. This talk will present some of our research works on the attacks and defenses of DNNs.

◆ Keynote 12

Beijing Time: October 31th 16:00-17:00
Title: Fusion of Technologies

Professor Kiat Seng YEO
IEEE Fellow; Singapore Academy of Engineering Fellow; Singapore National Academy of Science Fellow; AAIA Fellow; Advisor (Global Partnerships) of Singapore University of Technology and Design; Distinguished Professor of School of Microelectronics, Tianjin University

Biography

IEEE Fellow, Academician of the Singapore Academy of Sciences, Academician of the Singapore Academy of Engineering, and AAIA Fellow, previously served as Associate Provost for Research and International Relations and Chairman of the University Research Board (URB) at the University of Technology and Design (SUTD) in Singapore. Currently serving as Advisor (Global Partnerships) at SUTD, Distinguished Professor at the School of Microelectronics at Tianjin University, and Head of the Interdisciplinary Discipline of Integrated Circuit Science and Engineering.

Abstract

Fusion of technologies starts with interdisciplinarity which draws knowledge from different fields and creates new areas by working across boundaries. Product development is becoming exceedingly complex and innovative products require unrelated technologies combined in new ways.

This talk begins with an introduction of STEM education and interdisciplinary learning. As teaching and research are the yin and the yang of successful universities, it is important to understand the teaching-research connections. If you have teaching without research, you risk of not creating new knowledge. If you have research without teaching, you risk of imparting past knowledge. So, what are the new skill sets and attributes in preparing young people to excel and succeed in the 21st century? To answer this question, a new education model in a new era is proposed.

In addition, the fourth industrial revolution will change the world dramatically. The impact will be far greater than its three predecessors. Specifically, many existing PMET (Professional, Manager, Executive and Technician) jobs as well as traditional universities, technologies and industries will disappear. Together with the pandemic, they will accelerate the pace of digital transformation as well as create new job opportunities and growth areas.

Finally, this talk will present new research areas. These exciting transformations will change how we think about research collaborations. It will also change the nature and direction of our research. What are the challenges of modern education? What are the next big things? How is it going to affect us? This talk will attempt to answer these questions.

Introduction to Tianjin University

Tianjin University is the oldest institution of higher education in the modern history of China. Founded in 1895 as Peiyang University, Tianjin University's 128-year history is the epitome of the progress of modern Chinese higher education, embodying the Chinese people's indomitability through challenging times. During its growth spanning three centuries, the University has been a pioneer in several fields, from the first aero engine in China to the first Hydraulics Laboratory established in China. TJU take each step as it comes, and grow throughout the years into the leading research and teaching institute it is today.

Over the long history spanning three centuries, Tianjin University's development and progress is indebted to the innovation and dedication of our leaders since our first day in 1895 with our founder Sheng Xuanhuai and the first President Charles Danniel Tenney.

Tianjin University has been a pioneer in several fields. During our long history, many notable scholars have studied in Tianjin University's halls, enriching the culture of the university and sending forth new graduates into the world with the skills and knowledge they need to contribute to society. We have been lucky enough to see great minds from the fields of engineering, law and education walk through the gates of the university and go out and make an impression on the world, poet Xu Zhimo, the first Chinese judge at the Court of International Justice in the Hague Wang Chonghui, and economist Ma Yinchu, among many others.

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