SigTelCom 2019

2019 3rd International Conference on Recent Advances in Signal Processing, Telecommunications & Computing (SigTelCom) Program

Time	Ho Tay	Hoan Kiem	Truc Bach
Thursday, March 21			
07:00 am-08:00 am	*Registration*		
08:00 am-08:15 am	*Opening Ceremony*		
08:15 am-09:00 am		*Keynote speaker #1: Wireless Evolution Towards 5G and Beyond*	
09:00 am-09:45 am		*Keynote speaker #2: Energy-Quality Scalable Integrated Systems - Preserving Energy Downscaling in the Decade Ahead*	
09:45 am-10:15 am	*Coffee break*		
10:15 am-11:30 am	S3: *Signal Processing*	S1: *Emerging Areas in Wireless Communications*	S2: *Electronics and Control Systems*
11:30 am-01:30 pm	*Lunch break*		
01:30 pm-02:15 pm		*Keynote speaker #3: Embedding Strategic Intelligence in Wireless Communications and Sensing Systems*	
02:15 pm-03:00 pm		*Keynote speaker #4: Integrated Magnetic Probe and Application for Device Diagnosis*	
03:00 pm-03:30 pm	*Coffee break*		
03:30 pm-04:45 pm	S6: *Signal Processing*	*Tutorial: From iterative algorithms to deep learning*	S5: *Special Session*
04:15 pm-04:45 pm		S4: *Invited Paper*	
04:45 pm-05:45 pm	S9: *Fixed and Wireless Networks*	S7: *Emerging Areas in Wireless Communications*	S8: *Telecommunications Systems and Networks*
06:00 pm-09:00 pm	*Banquet*		

Thursday, March 21

Thursday, March 21 7:00 - 8:00

Registration

Thursday, March 21 8:00 - 8:15

Opening Ceremony

Thursday, March 21 8:15 - 9:00

Keynote speaker #1: Wireless Evolution Towards 5G and Beyond

Fumiyuki Adachi

Room: Hoan Kiem

Abstract: Mobile communications network has now evolved into the 4th generation (4G). An increasing popularity of broadband services demands a significant improvement in the spectrum efficiency and energy efficiency. Promising approach is to enhance the radio access network by using MIMO technology. After briefly overviewing the evolution of mobile communications network, we will overview the recent advances in distributed MIMO RAN. A number of distributed antennas are deployed over a traditional macro-cell area covered by a macro-cell base station (MBS). They are connected to the MBS by the optical mobile fronthaul. Distributed MIMO RAN exploits the spatial distribution of both antennas and users. Some of distributed antennas near a user terminal are selected to perform distributed MIMO cooperative transmission. A new frequency band, e.g. the mm wave band, where abundant bandwidth remains unused, will be utilized. Therefore, there exists high Doppler shift, which cases the channel estimation problem. Furthermore, adjacent macro-cells are loosely connected, and hence, the inter-cell interference (ICI) problem will be produced. In this talk, we will present adaptive channel estimation and adaptive ICI coordination (ICIC). Finally, we will discuss about RAN evolution into beyond 5G.

Biography: Fumiyuki Adachi received the B.S. and Dr. Eng. degrees in electrical engineering from Tohoku University, Sendai, Japan, in 1973 and 1984, respectively. In April 1973, he joined the Electrical Communications Laboratories of Nippon Telegraph & Telephone Corporation (now NTT) and conducted various researches on digital cellular mobile communications. From July 1992 to December 1999, he was with NTT Mobile Communications Network, Inc. (now NTT DoCoMo, Inc.), where he led a research group on Wideband CDMA for 3G systems. Since January 2000, he has been with Tohoku University, Sendai, Japan. His research interests are in the area of wireless signal processing (multi-access, equalization, antenna diversity, adaptive transmission, channel coding, etc.) and networking.

He is an IEEE Life Fellow and an IEICE Fellow. He was a recipient of the IEEE Vehicular Technology Society Avant Garde Award 2000, IEICE Achievement Award 2002, Thomson Scientific Research Front Award 2004, Ericsson Telecommunications Award 2008, Prime Minister Invention Award 2010, KDDI Foundation Excellent Research Award 2012, C&C Prize 2014, IEEE VTS Stuart Meyer Memorial Award 2017, and IEEE ComSoc RCC Technical Recognition Award 2017. He is listed in Highly Cited Researchers 2001 (https://clarivate.com/hcr/researchers-list/archived-lists/).

Thursday, March 21 9:00 - 9:45

Keynote speaker #2: Energy-Quality Scalable Integrated Systems - Preserving Energy Downscaling in the Decade Ahead

Massimo Alioto

Room: Hoan Kiem

Abstract: The historical 100X/decade energy down-scaling is currently being threatened by the end of Moore's law, and the limited prospective energy gains from approaches that have been already exploited extensively (e.g., heterogeneous systems, ultra-low voltage, parallelism). Major shifts from traditional sensing/processing paradigms are now mandatory, and new design dimensions and tradeoffs that enable further energy reductions need to be explored.

In this talk, energy-quality (EQ) scalable circuits and systems are introduced as a viable direction to continue the historical exponential energy down-scaling. EQ-scalable systems dynamically and explicitly trade off energy and quality from sensor to circuit, architecture, algorithm, and up to system level. Recent and novel approaches are discussed to minimize the energy at run time, based on the actual quality target that is set by the specific task, the context, and the specific dataset at hand. In this talk, quality is treated as an explicit knob, eliminating the quality slack that is traditionally imposed by worst-case design across different applications, contexts, datasets, and the pessimistic design margin to counteract process/voltage/temperature variations. Interesting convergence with machine learning and other important applications is discussed to provide an insight into the inter-dependence of algorithms, architectures and circuits. Several silicon demonstrations are illustrated to quantify the benefits offered by energy-quality scaling, and to identify the challenges that need to be solved to fulfill its potential.

Biography: Massimo Alioto is Associate Professor at the ECE Department of the National University of Singapore, where he leads the Green IC group and the Integrated Circuits and Embedded Systems area. Previously, he held positions at the University of Siena, Intel Labs - CRL (2013), University of Michigan - Ann Arbor (2011-2012), University of California - Berkeley (2009-2011), EPFL - Lausanne.

He is (co)author of 250+ publications on journals and conference proceedings, and three books with Springer. His primary research interests include ultra-low power VLSI circuits and systems, self-powered systems, near-threshold circuits for green computing, widely energy-scalable integrated systems, hardware security, and circuit techniques for emerging technologies.

He is the Editor in Chief of the IEEE Transactions on VLSI Systems (2019-2020), and Deputy Editor in Chief of the IEEE Journal on Emerging and Selected Topics in Circuits and Systems (2018). Prof. Alioto was the Chair of the "VLSI Systems and Applications" Technical Committee of the IEEE CASS (2010-2012), Distinguished Lecturer (2009-2010), and members of the Board of Governors (2015-2020). He served as Guest Editor of numerous journal special issues, Technical Program Chair of several IEEE conferences (ISCAS 2022, SOCC, PRIME, ICECS, VARI, NEWCAS, ICM), and TPC member (ISSCC, ASSCC). Prof. Alioto is an IEEE Fellow.

Thursday, March 21 9:45 - 10:15

Coffee break TOP

Thursday, March 21 10:15 - 11:30

S1: Emerging Areas in Wireless Communications TOP

Room: Hoan Kiem

10:15 ***A Chip Timing Recovery Scheme for Walsh-Hadamard Code Division Multiplexing***

Yuta Kato and Toshiharu Kojima (The University of Electro-Communications, Japan)

Walsh-Hadamard (WH) code division multiplexing (CDM) is CDM employing WH code as spreading codes. This paper addresses chip timing recovery in band-limited WHCDM using Nyquist pulse shaping. In direct-sequence spread spectrum communications employing pseudo-noise (PN) spreading code, chip timing recovery is achieved with delay-locked loop (DLL). DLL recovers the chip timing on the basis of the impulse-like autocorrelation of PN codes. However, WH code has many side lobes in its autocorrelation function. This makes it impossible to apply DLL to WHCDM. In this paper, we propose a novel chip timing recovery scheme for band-limited WHCDM. The proposed scheme detects the chip timing by using the cross-correlation between the received signal and the WH code whose autocorrelation has the period of twice the chip duration. The results of computer simulation show that the proposed scheme achieves excellent chip synchronization performance.

10:30 ***Out of Band Analysis in various 5G-NR Downlink Waveforms with Different Numerologies***

Nguyen Tien Hoa (Hanoi University of Science and Technology, Vietnam); Trung-Kien Nguyen (Electronics and Telecommunications Research Institute, Korea); Nguyen Qua (School of Electronics and Telecommunications, Vietnam); Le Ha (Viettel IC Design Center, Vietnam)

The standardization of the first phase 5G system in Release 15 named New Radio (NR) will soon move on to the standalone version with intention to bring it commercially to the market around 2020. This paper investigates the impact of power amplifier in OFDM-based waveforms including CP-OFDM, F-OFDM and W-OFDM. We first derive a mathematical model for these OFDM-based waveforms. Then we analyze the impact of power amplifier (PA) to the out-of-band (OOB) waveform, which is a critical component in the densely spectrum with different channel widths using scalable numerologies. It is shown that W-OFDM and F-OFDM are more suitable than. The provided results of this paper thus facilitate knowledge of design and practice for further NR features. As the simulation results,without PA clipping, the W-OFDM and F-OFDM present better OOB characteristics than CP-OFDM, while applying PA clipping both of them shows the similar performance. Additionally, another W-OFDM design with PA clipping shows advantages that suitable for 5G NR waveform.

10:45 ***Proposing adaptive PN sequence length scheme for testing non-destructive structure using DS-UWB***

Nguyen Huyen and Pham Thanh Hiep (Le Quy Don Technical University, Vietnam)

The ultra wideband (UWB) technology has many advantages in positioning, measurement systems, however powers of UWB signals rapidly reduces while traveling in propagation environments, especially in concrete or soil propagation environment. Therefore, we proposes an adaptive pseudo random (PN) sequence length searching method of direct sequence ultra wideband (DS-UWB) transmission system for reducing signal processing time while remaining the quality of detection. The proposed scheme measures the depth of non-destructive structure using variable PN sequence length, and then based on the calculated distance errors, the minimum PN sequence length is determined. Simulation results show that both processing time and accuracy could be improved by the proposed scheme.

11:00 ***An Efficient Design of Precoding and Equalization to Reduce BER of Multi-path MIMO Channels***

Bui Quoc Doanh and Pham Thanh Hiep (Le Quy Don Technical University, Vietnam); Do Thanh Quan (Yokohama National University, Japan & Le Quy Don Technical University, Vietnam); Ta Chi Hieu (Le Quy Don Technical University, Vietnam)

The block transmission via multi-path MIMO channels has attracted much interest of many researchers because of its wide applications. In this paper, authors propose an approach to decrease the BER of the multi-path MIMO channels based on an effective combination of precoding and equalization. The logical analysis and simulation results demonstrate that the proposal design can take advantage of channel energy, therefore, reduce the BER. In comparison with the conventional design, the proposal design can improve the system performance in some scenarios.

11:15 ***Proposal of Combination of NOMA and Beamforming Methods for Downlink Multi-users systems***

Hoang Vinh and Vu Son (Le Quy Don Technical University, Vietnam); Hoang Tran Manh (Faculty Telecommunication, Vietnam); Pham Thanh Hiep (Le Quy Don Technical University, Vietnam)

In this paper, a downlink multi-users (MUs) system, where the MUs are clustered into several clusters based on the located regions, is taken into consideration. A combinition of beamforming and no-orthogonal multiple access (NOMA) methods is proposed and the base station (BS) communicates instantaneously with all users in multiple clusters by the proposed method. The close-form expressions of outage probability and ergodic capacity are derived to evaluate our proposed method. The derived analytical results are verified by Monte Carlo simulations and the proposed method is compared with conventional orthogonal multiple access (OMA) method. The results indicate that our proposed method can improve the performance of downlink MUs systems more than the OMA method.

S2: Electronics and Control Systems TOP

Room: Truc Bach

10:15 ***Two-in-One Indoor Living Environment Monitoring System using Arduino, NodeMCU and Xbee S2***

Duc Huynh and Huu-Phat Tran (Hoa Sen University, Vietnam)

This paper presents the combination of wireless sensor network and cloud platform to setup a real-time living environment monitoring and remote electric device controlling system inside a building. This system, designed based on multi-tier architecture, will be used for monitoring living environment, and management of lighting control and air conditioning systems at Hoa Sen University. The ultimate goal is to create the best working environment while reducing energy consumption. The network based on IEEE802.15.4/ZigBee standard consists of a coordinator responsible for forming network, several routers and end-devices. Each node is composed of Arduino or NodeMCU ESP8266 board, Xbee module, DHT22 sensor and relay. Router and end-device collect environmental data and transmit its own data to coordinator or data gateway thanks to Xbee module. Then gateway will transmit all data to cloud application server for processing and storage via MQTT protocol. This system allows users to monitor environmental parameters at different times and control electric devices from web browser or mobile application.

10:30 ***A Wide-band Reference-less Bidirectional Continuous-Rate Frequency Detector***

Tho Nguyen Huu (Le Quy Don Technical University, Vietnam); Ha Pham Manh (Vietnam Telecommunications Authority, Vietnam); Hanh Hoang Hong and Quang Nguyen-The (Le Quy Don Technical University, Vietnam)

This paper presents a wide-band half-rate frequency locked loop (FLL) circuit in 180 nm CMOS process. The bidirectional FLL includes a coarse frequency detector (CFD) and a fine frequency detector (FFD) to automatically detect a change in input data rate, acquires the new frequency without the need for an external reference clock or any programming. A modified CFD is proposed to reduce the frequency acquisition time. The simulation shows the FLL achieves wide lock range of 400Mb/s-to-2.6Gb/s and frequency acquisition time of 1.73 µs.

10:45 ***Building quasi-time-optimal control laws for ball and beam system***

Long Hoang (Le Quy Don Technical University, Vietnam); Nguyen Chiem (236 Hoang Quoc Viet, Vietnam); Hai-PHan Nguyen (Le Quy Don Technical University Hanoi, United Kingdom (Great Britain)); Truong Dang Khoa, Kien Le and Pham Thuy (Le Quy Don Technical University, Vietnam)

In this paper, the methodology for rapid impact control of Ball and Beam system is compared and the results are compared with the LQR method. Ball and Beam system is a large nonlinear, system parameters are difficult to determine accurately and easily determine the impact of noise. In this design method, the model of the system needs to be transformed into a Jordanian model, and use the differential transform to bring the system in the form of a quasi-time-optimal equation. When synthesis of control laws does not need to linearize the system, this is the superiority of this method. In addition, the control system ensures that the system optimizes the time corresponding to the desired output value while also ensuring a stable system with variable parameters and noise interference. The simulation results illustrate the theory and show the effectiveness of the proposed design.

11:00 ***Improving the accuracy of the autonomous mobile robot localization systems based on the multiple sensor fusion methods***

Nguyen Lan Anh (Le Quy Don Technical University, Vietnam); Trung Dung Pham (Military Technical Academy, Vietnam); Trung Dung Ngo (University of Prince Edward Island, Canada); Xuan-Tung Truong (Le Quy Don Technical University, Vietnam)

Localization system plays an important role in navigation frameworks of autonomous mobile robots. Because, it provides a significant information for the remainder systems of the navigation frameworks. Recently, to improve the accuracy of the robot pose estimation in dynamic environments, the mobile robots are equipped with a variety of sensors, such as wheel encoders, a global positioning system (GPS) sensor, and an inertial measurement unit (IMU) sensor. In this paper, we propose an improved localization system for autonomous mobile robots using multiple sensor fusion techniques. In order to accomplish that, an extended Kalman filter (EKF) algorithm is utilized to fuse the data from the wheel encoders, global positioning system sensor and inertial measurement unit sensor. The simulation results show that, our proposed localization system is able to provide higher accuracy of estimating mobile robot's pose than conventional systems.

11:15 ***Auto-Adjusted Pulse Width Circuit To Improve Memristor Variations In Reconfigurable High-Pass Filter***

Huan Minh Vo and Hiep Thanh Nguyen (Ho Chi Minh University of Technology and Education, Vietnam)

Having many advantages, memristors have been studied for applications in many fields such as neuromorphic computing, non-volatile memory, memory and digital logic gates. Specially, memristor can be used to design the reconfigurable filters with various cut-off frequencies. However, because of their tiny sizes, they have a lot of process variations, especially memristor thickness. These effects vary low memristance state much more than a high memristance state. To minimize these memristance variations, an auto-adjusted pulse width circuit is designed to create expected memristance for high-pass filters regardless of various thickness variations. Therefore, the pulse width will automatically be adjusted even in case of thin or thick thickness memristor compared with nominal thickness memristor. By doing so, the high-pass fillers are reconfigurable and achieve high memristance accuracy with stable cut-off frequency in various variation conditions. They also save unnecessary power loss due to shorter programming time.

S3: Signal Processing

TOP

Room: Ho Tay

10:15 ***Background Calibration of Multiple Channel Mismatches in Time-Interleaved ADCs***

Yen Hoang Thi, Van-Thanh Ta, Han Le Duc, Manh Duong Quang and Van-Phuc Hoang (Le Quy Don Technical University, Vietnam)

Time-Interleaved Analog-to-Digital Converter (TIADC) is a promising approach to meet the requirement of very high speed wireless communication systems. However, mismatches between the channels of TIADCs generate unwanted distortions in the output spectrum. This paper demonstrates a fully digital background calibration technique to identify and compensate three all deviations which are offset, gain and timing mismatches for TIADCs. In which, offset mismatch is corrected by computing the average of the output samples of each channel. The gain and timing mismatches are compensated by using LMS algorithm and the modulation matrix m[n]. The simulation results show that the performance of the ADC is improved by 41.32 dB for SNDR and 64.6 dB for SFDR.

10:30 ***A Rank-Deficient and Sparse Penalized Optimization Model for Compressive Indoor Radar Imaging***

Van Ha Tang and Van-Giang Nguyen (Le Quy Don Technical University, Vietnam)

This paper proposes a rank-deficient and sparse penalized optimization method for addressing the problem of through-wall radar imaging (TWRI) in the presence of structured wall clutter. Compressive TWRI enables fast data collection and accurate target localization, but faces with the challenges of incomplete data measurements and strong wall clutter. This paper handles these challenges by formulating the task of wall-clutter alleviation and target image reconstruction as a joint rank-deficient and sparse regularized minimization problem. In this problem, the rank-deficient regularization is used to capture the low-dimensional structure of the wall signals and the sparse penalty is employed to represent the sparseness image of the desired targets. We develop a

proximal gradient-based algorithm to solve the large-scale optimization problem, which simultaneously removes unwanted wall clutter and reconstruct an image of indoor targets. Real radar datasets are used to validate the effectiveness of the proposed rank-deficient and sparse regularized optimization approach.

10:45 ***An improved volume coherence optimization method for forest height estimation using PolInSAR images***

Pham Nghia, Cuong Thieu Huu, Minh Xuan, Van Nhu Le and Cuong Dang (Le Qui Don Technical University, Vietnam)

Forest height is one of the most important forest vertical structure parameter for many forest management and monitoring activities. In recent years, some researchers have introduced a great number of methods to estimate forest height using the PolInSAR image. One of the most widely used methods for forest height estimation, which is the three-stage inversion process. However, the optimal volume coherence value determination is an important challenge for the classical three-stage method. In this method, the complex coherence value of the HV channel is used for forest height estimation. Therefore, the estimated forest height is usually lower than the actual forest height. Moreover, when determining the ground-phase coefficient, this method used a lot of channel coherence coefficients, which increased the amount of calculation complexity. The proposed method in this paper, we determined the optimum volume coherence coefficient of the system by comparing the polarization channels and using the optimal complex unitary vector. The experimental results show that the accuracy of forest height is significantly improved by the proposed method.

11:00 ***Distorted Image Reconstruction Method with Trimmed Median***

Dang N. H. Thanh (Hue College of Industry, Vietnam); Nguyen Van Son (Military Weapon Institute, Vietnam); V. B. Surya Prasath (Cincinnati Children's Hospital Medical Center & University of Cincinnati, USA)

The distorted image reconstruction is an interesting problem that has many applications in practice. The distorted images are usually corrupted by scratches, dust, noise, human actions and/or environment factors. In this paper, we propose a distorted image reconstruction method based on the trimmed median. This method is effective for images corrupted by scratches caused by human, environment etc. In the experiment, we generate masks to simulate the scratches and apply them over the reference original images to make the distorted images. This way is necessary to assess the image quality after recovering by the peak signal-to-noise ratio and the structure similarity metrics. We also compare the proposed method with the harmonic method.

11:15 ***Practical Considerations of IMU Data Generator***

Bac Nghia Vu, Khanh Nhu Nguyen and Mung Huy Vu (Center of Avionics Systems Viettel Aerospace Institute, Vietnam)

Research in inertial navigation field constantly have to deal with sources of sensor errors. Therefore, an IMU (Inertial Measurement Unit) data simulator is mandatory to save the time of logging data, isolate the sensor errors. The IMU data simulator is also more flexible in generating inertial data of different types of trajectory. An IMU simulator contains a gyroscope data generator and an accelerometer data generator. In general, the gyroscope and acceleration data are generated by taking derivative of attitude and position. There are three different ways to generate gyroscope data depending on how the attitude is presented. This paper shows the practical problems, which have to confront in the implementation of the IMU data generator. That is noise appearing in the derivative of input data. The method to remove derivative noise shows that the noise is rejected with maximum shape preservation of trajectory. Further, an investigation is carried out to show which methods should be used to generate gyroscope data for maximum input motion preservation.

Thursday, March 21 11:30 - 1:30

Lunch break

Thursday, March 21 1:30 - 2:15

Keynote speaker #3: Embedding Strategic Intelligence in Wireless Communications and Sensing Systems

Sangarapillai Lambotharan

Room: Hoan Kiem

Abstract: With the development of the Internet of Things and an abundance of sensors, it is expected that the number of connected devices will reach 50 billion globally by 2020. All these devices will need to operate in a radio congested environment and will compete for the scarce frequency spectrum. This competition for resources between fixed and mobile users presents major challenges to future generation wireless systems and needs a mathematical framework for its solution. Likewise, in emergent wireless networks and sensor systems, there is competitive demand for higher data rates, efficient spectrum utilization and autonomous operation.

The talk presents the successful application of game theoretic methods in economics, political science and evolutionary biology, to embed strategic operation in such wireless communications and sensing systems. In particular, the focus will be on the application of these methods to enable wireless and sensor systems to adapt to changes in their environment, optimise operational parameters in a distributed manner and interact strategically to mitigate disturbances caused by malicious transmitters. The talk will be concluded by presenting a collection of current and future application scenarios including 5G networks, distributed radars, smart grids and data mining.

Biography: Sangarapillai Lambotharan is Professor of Digital Communications and the Head of Signal Processing and Networks Research Group at Loughborough University, UK. He received his PhD degree in Digital Signal Processing from Imperial College London, UK in 1997. His previous appointments include Visiting Scientist at Cornell University, Lecturer at King's College London, Senior Lecturer at Cardiff University and Research Engineer at Motorola. He has published more than 200 technical journal and conference articles in signal processing for communications, in particular on mathematical optimizations for cognitive radio and MIMO networks. He is a member of the editorial board of IET Signal Processing. His current research interests include massive MIMO, radars, data mining, smart grids, machine learning, game theory and convex optimizations. He is a Senior Member of IEEE and a Fellow of IET.

Thursday, March 21 2:15 - 3:00

Keynote speaker #4: Integrated Magnetic Probe and Application for Device Diagnosis

Kunihiro Asada

Room: Hoan Kiem

Abstract: The spatial resolution of coil-based magnetic probe is determined by the coil size. A smaller coil has a higher spatial resolution but a weaker level of output signal, which results in a worse signal-to-noise (S/N) ratio. A solution of this trade-off problem is integration of a small coil with a low-noise amplifier on a semiconductor chip. In this presentation, firstly, structures and fabrication procedure of our integrated magnetic probes will be introduced along with their characteristics. Next, an estimation method of current distribution from measurement data of the magnetic probe is introduced, as a theoretical basis of the integrated magnetic probe application. It is a reverse modeling from magnetic field data to current distribution in circuit. Though it is a straightforward procedure to calculate magnetic field based on a known current distribution in general, a practical problem is the existence of noise. Here a method to estimate most-likely current distribution from magnetic field with random noise will be introduced under the constraint of KCL. Finally, two examples of application will be shown. The first example is measurement results of gate leak current in power devices (IGBT), where the location of the leakage has been successfully detected based on "valley detection method" with a good agreement of a microscopic device diagnosis. The second example is an analysis of power network integrity of LSI. By comparing a normal chip with an abnormal chip with missing VIAs in power network, the magnetic probe has successfully detected subtle differences in magnetic fields, which has been translated to an abnormal power current map analytically. Both the above examples show that the integrated magnetic probe has a potential to be utilized for improving device reliability and fabrication technologies.

Biography: Dr. Kunihiro Asada is Emeritus Professor of the University of Tokyo, Japan. He received the BS, MS and PhD from the University of Tokyo in 1975, 1977 and 1980, respectively. In 1980 he joined the Faculty of Engineering, the University of Tokyo. From 1985 to 1986 he stayed at Edinburgh University as a visiting scholar. From 1990 to 1992 he served as the editor of IEICE Transactions on Electronics. In 1996 he established VLSI Design and Education Center (VDEC) in the University of Tokyo and served as the Director of VDEC from 2000 to 2018. He also served as the Chair of IEEE/SSCS Japan Chapter in 2001 -2002 and the Chair of IEEE Japan Chapter Operation Committee in 2007-2008. He is currently a managing director of the Takeda Foundation and the Chair of the Young Takeda Award Committee. His research interest is design and analysis of integrated systems and devices. He is a member of IEEE, IEICE and IEEJ.

Thursday, March 21 3:00 - 3:30

Coffee break

TOP

Thursday, March 21 3:30 - 4:15

Tutorial: From iterative algorithms to deep learning

TOP

Ami Wiesel

Room: Hoan Kiem

Abstract: Deep neural network and machine learning have recently revolutionized all fields of engineering. The most significant progress is probably in image processing and speech, but these trends are penetrating other applications as wireless communication, radar and tomography. The switch from classical signal processing to modern deep learning involves many challenges. The first is technical and simple, yet daunting for experienced researchers. This is the transition to modern numerical toolboxes which are more suitable for learning tasks, e.g., the migration from Matlab to Python. A more fundamental change is that the applications mentioned above all have a well understood physical model that should be exploited in the design. This leads to a switch from model based design to data driven design, and, more importantly the shift to architecture based design. Another significant change is that standard machine learning methods are not suitable for parametric signal processing, and must be re-learned from scratch each time the parameters change. These challenges led researchers to consider hybrid approaches that exploit the benefits of both worlds: the network's architectures are based on unfolding iterative signal processing algorithms, while deep learning allows more degrees of freedom and more expression power. Iterations are transformed into layers, and algorithms are succeeded by networks (see also the related concept of Recurrent Neural Networks). The resulting architectures allow a single training for multiple parametric models and achieve state of the art accuracy vs complexity tradeoffs. The goal of this tutorial is to introduce these ideas to engineers with a strong background in classical signal processing and zero experience in deep learning.

Biography: Ami Wiesel received the B.Sc. and M.Sc. degrees in electrical engineering from Tel-Aviv University, Tel-Aviv, Israel, in 2000 and 2002, respectively, and the Ph.D. degree in electrical engineering from the Technion - Israel Institute of Technology, Haifa, Israel, in 2007. He was a postdoctoral fellow with the Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, USA, during 2007-2009. He is currently an Associate Professor in the Rachel and Selim Benin School of Computer Science and Engineering, Hebrew University of Jerusalem, Israel.

Website: http://www.cs.huji.ac.il/~amiw/

Thursday, March 21 4:15 - 4:45

S4: Invited Paper

TOP

Room: Hoan Kiem

4:15 ***Toward Performance-Portable Finite Element Methods on High-Performance Systems***

Sergei Gorlatch (University of Muenster, Germany); Jens Hunloh (Unievrsity of Muenster, Germany); Vladyslav Kucher (University of Muenster, Germany)

We aim at performance portability of finite-element methods for solving PDEs (Partial Differential Equations) on high-performance systems, i.e., ensuring that the same application code achieves good performance across a broad class of parallel architectures, including multi-core CPUs and many-core GPUs from different vendors. We achieve this goal by extending the popular PDE solving framework DUNE and integrating it with our parallel programming framework PACXX. We describe the implementation of our approach and we show how it allows the application programmers to use single C++ source code by compiling it using different back-ends of the PACXX framework, with competitive performance as compared to manually optimized original DUNE kernels.

Thursday, March 21 3:30 - 4:45

S5: Special Session

Room: Truc Bach

3:30 ***Super Steep Subthreshold Slope "PN-Body-Tied SOI-FET" for Ultralow Power IoT Edge Systems and RF Energy Harvesting***

Jiro Ida (Kanazawa-Institute of Technology, Japan); Takayuki Mori (Kanazawa-Institute of Technology, Vietnam); Shun Momose (Kanazawa-Institute of Technology, Japan)

We have proposed the super steep subthreshold slope (SS) "PN-Body-Tied SOI-FET (PNBTFET)". It shows the perfect DC characteristics as a steep SS device, which is one of hot topics on the current research of Si devices. It shows SS<1mV/Dec over 5 decades of the drain current with an ultralow drain voltage down to 0.1V. The steep SS on N-channel and also on the P-channel PNBT-FET have already been demonstrated. The CMOS with PNBT-FETs will open LSI with the ultralow power supply voltage around 0.1V, which is promising for the ultralow power IoT edge systems. The ultralow voltage rectification of the 10mV amplitude has also been confirmed with the MOS diode of the PNBT-FET. It is also promising for high efficiency rectification on RF energy harvesting. The research status on the PNBT-FET was reviewed, here.

3:45 ***Beat Sensors for Smart Environment Monitoring Systems***

Koichiro Ishibashi, Duangchak Manyvone and Miho Itoh (The University of Electro-Communications, Japan); Van-Phuc Hoang and Van-Lan Dao (Le Quy Don Technical University, Vietnam)

This paper introduces Beat Sensors, which are suitable for monitoring air pollution as low power and small size IoT sensors. Ethanol Beat Sensor is realized to monitor the ethanol concentration from 0 to 200 ppm at almost 20 ppm resolution. Beat Sensor has large potential to address issues of air pollutions. Moreover, the long distance (LoRa) communication protocol is applied to build a smart and energy efficient monitoring system.

4:00 ***Hardware-enabled AI for Embedded Security: A New Paradigm***

Adrien Facon (Secure-IC S.A.S., France); Sylvain Guilley (Telecom ParisTech & Secure-IC, France); Xuan-Thuy Ngo and Thomas Perianin (Secure-IC S.A.S., France)

As chips become more and more connected, they are more exposed (both to network and to physical attacks). Therefore one shall ensure they enjoy a sufficient protection level. Security within chips is accordingly becoming a hot topic. Incident detection and reporting is one novel function expected from chips. In this talk, we explain why it is worthwhile to resort to Artificial Intelligence (AI) for security event handling. Drivers are the need to aggregate multiple and heterogeneous security sensors, the need to digest this information quickly to produce exploitable information, and so while maintaining a low false positive detection rate. Key features are adequate learning procedures and fast and secure classification accelerated by hardware. A challenge is to embed such security-oriented AI logic, while not compromising chip power budget and silicon area. This talk accounts for the opportunities permitted by the symbiotic encounter between chip security and AI.

4:15 ***New Fair Identity Based Encryption Scheme***

Margaux Dugardin and Adrien Facon (Secure-IC S.A.S., France); Sylvain Guilley (Telecom ParisTech & Secure-IC, France); Xuan-Thuy Ngo and Karine Lorvellec (Secure-IC S.A.S., France)

In 1984, Shamir presented the first Identity Based cryptography scheme resolving the public key sharing using signatures. Identity Based Encryption (IBE) remained an open problem for many years. Boneh and Franklin or Cocks presented some IBE schemes. IBE scheme was improved by Malek with a sender authentication in addition to the encryption. We improve this solution by solving the key escrow problem. The trusted center has access on a partial private key in our solution. This method allows to guarantee the data confidentiality between the sender and the recipient. Even if an attacker retrieves the master key of the trusted center, the data confidentiality is guaranteed for the previous and next exchanges.

4:30 ***Non-contact Vital Sign Measurement with Medical Radar and its Clinical Applications***

Guanghao Sun (The University of Electro-Communications, Japan)

Technology for non-contact measurement of vital signs (i.e., heartbeat, respiration, and body temperature) has attracted significant attention as these parameters are important for understanding health states. Recently, the technology for sensing biological information has progressed, novel bio-sensors have been developed. Reports regarding methods for measuring vital signs using microwave radar, thermography, RGB cameras, and ToF sensors have also been published. These methods have wide-ranging clinical applications, including in systems for monitoring the elderly, identification of sleep apnea, detection of infectious disease, and measurement of stress levels.

S6: Signal Processing

Room: Ho Tay

3:30 ***Simulation Platform for Transfer Alignment***

Bac Nghia Vu (Center of Avionics Systems Viettel Aerospace Institute, Vietnam); Tuan Van Nguyen (Viettel Aerospace Institute, Vietnam); Bien Trong Hoang (Center of Avionics Systems Viettel Aerospace Institute, Vietnam)

Alignment is mandatory for any inertial navigation system (INS) before running in the navigation phase. It is a process, that the INS finds its own attitude including roll, pitch and heading. During motion, the transfer alignment (TA) is used. Transfer alignment is a method of finding the initial attitude of a slave INS by using a master INS, which is a more precise external INS system. The paper presents a simulation platform for designing the TA algorithm. The platform contains the master INS and slave INS. The master and the slave are mounted to different places in a vehicle and also have the different orientation, so the master data and slave data are different. The core of the platform is transfer functions, which describe the relationship between the master and the slave data. In this paper, the transfer functions will be mathematically demonstrated and verified by simulation. The simulation platform provides all sensor data and navigation data, which is needed for designing TA algorithm.

3:45 ***Removing Long Echo Delay Using Combination of Jitter Buffer and Adaptive Filter***

Dinh Van Phong (Vietnam National University, Vietnam); Tran Duc-Tan (VNU University of Engineering and Technology (VNU-UET), Vietnam); Hieu Nguyen The, Tinh Nguyen Huy and Quan Dinh Viet (Viettel Group, Vietnam)

Echo in telephone transmission systems is a serious problem. It affects and distorts the desired speech. Echo cancellation methods have studied for a few decades and standardized in ITU G.168. The core theory in echo cancellation methods is using an adaptive filter which uses one of these algorithms: LMS (least mean square), NLMS (normalized least mean square), RLS (Recursive least squares), etc to remove the echo. In fixed conditions, these algorithms are efficient to remove echo. However, in some real telecom environments, with long echo delays, we must increase the filter length to a big value. But, it's not efficient in performance due to its high computation in the system. In this paper, we propose a solution that uses a jitter buffer along with an adaptive filter to compensate long echo delays. This solution demonstrated its efficiency in Viettel Network both on voice quality and system performance.

4:00 ***Complexity Controlled Side Information Creation for Distributed Scalable Video Coding***

Xiem Hoang (VNU-UET, Vietnam); Le Dao Thi Hue (VNU University of Engineering and Technology (VNU-UET), Vietnam); Quang Hoang and Vien Du (Hanoi University of Industry, Vietnam); Nguyen Hong Vu (Vietnam Research Institute of Electronics, Informatics and Automation, Vietnam)

Distributed scalable video coding (DSVC) has recently been gaining many attentions due to its benefits in terms of computational complexity, error resilience and scalability, which are important for emerging video applications like wireless sensor networks and visual surveillance system (VSS). In DSVC, the side information creation plays a key role as it directly affects to the DSVC compression performance and the encoder/decoder computational complexity. For many VSS applications, the energy of each VSS node is usually attenuating along the time, making the difficulty in transmitting surveillance video in real time. To address this problem, we propose a novel complexity controlled side information creation solution to adaptively adjust the DSVC complexity based on the energy condition in each VSS node. To achieve this, first, the complexity associated to the side information creation is modeled using a linear regression function. After that, the complexity associated to each part of side information creation process controlled with a user parameter. Experiments conducted for a rich set of video surveillance data have revealed the benefits of the proposed complexity control solution, notably for both the encoder and decoder sides.

4:15 ***Network Coding with Multimedia Transmission: A Software-Defined-Radio based Implementation***

Nguyen Linh-Trung (Vietnam National University, Hanoi, Vietnam); Tran Thi Thuy Quynh (VNU University of Engineering and Technology, Vietnam); Ly V. Nguyen (San Diego State University, USA); Tran Khoa (VNU University of Engineering and Technology, Vietnam)

Recently, network coding (NC) has been considered as a breakthrough to improve throughput, robustness, and security of wireless network. Although there have been many theoretical studies on performance of NCs, there have been few experiments with pure NC schematics. This paper presents the first implementation of NC with multiple media transmission,which uses layered coding. The implementation is real-time and based on Software Define Radio (SDR) technique. The experimental results show that, by combining NC and source coding, we can control quality of received images on demand.

4:30 ***Novel Spectrum Sensing Algorithm for Detecting OFDM Signals***

Tingting Wang, Dongmei Li and Shibing Zhang (Nantong University, P.R. China)

In this paper, a novel spectrum sensing algorithm, which is based on the principle of likelihood ratio detection, is proposed to detect OFDM signals. In the algorithm, a detection statistics is constructed with the correlation of cyclic prefix of OFDM signals. And then, the likelihood functions of the detection statistics in two hypotheses, the primary user is present or absent are approximated with the Gram-Charlier series expansion. Finally, the spectrum sensing decision is made by comparing the likelihood functions. It overcomes the predicament that the decision threshold is difficult to trade off the spectrum detection probability and false alarm probability in traditional autocorrelation detection algorithm. Simulation results show that the algorithm proposed has about 4~8 dB advantage over the traditional autocorrelation detection algorithm.

Thursday, March 21 4:45 - 5:45

S7: Emerging Areas in Wireless Communications

TOP

Room: Hoan Kiem

4:45 ***Secrecy Performance Analysis of Energy Harvesting Aware Relaying Networks with Adaptive Power Splitting and Relay Selection Scheme***

Dac-Binh Ha (Duy Tan University, Vietnam); Anh-Tuan Tran (Ho Chi Minh City University of Transport, Vietnam); Dung Tran (Duy Tan University, Vietnam); Yoonill Lee (Purdue University Northwest, USA)

This paper investigates the physical layer secrecy performance of radio frequency (RF) energy harvesting (EH) relaying networks based on the combination of Time Switching-Adaptive Power Splitting (TSAPS) and Best Relay Selection (BRS) schemes. Specifically, this system consists of one source, one destination and multiple energy-constrained decode-andforward (DF) relays which help the source transmit information to the destination in the presence of a passive eavesdropper. The relays harvest RF energy from the source to forward information to the destination by using activated energy, power splitting ratio self-adjustment policy and best relay selection scheme. The exact closed-form expressions of secrecy outage probability for random relay selection and best relay selection are derived by using the statistical characteristics of Rayleigh fading channels. In addition, the comparison to random relay selection is presented to verify the efficiency in terms of secrecy outage probability of this proposed protocol. Finally, the numerical and simulation results are also provided to evaluate the impact of the key parameters on secrecy performance and to confirm the correctness of our analysis.

5:00 ***Uplink Spectral Efficiency of Cell-free Massive MIMO with Multi-Antenna Users***

Trang C. Mai, Hien Ngo and Trung Q. Duong (Queen's University Belfast, United Kingdom (Great Britain))

We consider a cell-free massive MIMO system with multi-antennas at both access points (APs) and users. Then, the uplink spectral efficiency (SE) of this system with data power control at users and zero-forcing (ZF) combining at the APs is analyzed. The numerical results show that, the SE of cellfree system with ZF combining outperforms the system with maximum ratio (MR) combining. Moreover, additional antennas at users also benefit the system's SE when there are some active users in the system.

5:15 ***Performance of Cooperative NOMA System with a Full-Duplex Relay over Nakagami-m Fading Channels***

Hang Nguyen Thi Thu (Nam Dinh University of Technology Education, Vietnam); Nam Xuan Tran (Le Quy Don Technical University, Vietnam)

In this paper, we investigate the outage performance of a system combining techniques of non-orthogonal multiple access (NOMA) and full-duplex (FD) in cooperative communication over Nakagami-m fading channels. The NOMA-user with better channel condition play a role of a decode-and-forward (DF) relaying node to assist the NOMA-user with worse channel condition in forwarding its messages. The closed-form expressions for outage probability of two users are derived with a realistic assumption that residual self-interference (RI) suppression and successive interference cancellation (SIC) are imperfect. The

mathematical results afford some insights into the impact of RI parameter, imperfect SIC coefficient and multipath fading factor on the system. The Monte-Carlo simulation results verify the accuracy of theoretical analysis and provide an clear system observation.

5:30 ***Outage Probability of Two-Way Full-Duplex Relay System With Hardware Impairments***

Ba Cao Nguyen and Nam Xuan Tran (Le Quy Don Technical University, Vietnam); Dinh Tan Tran (Telecommunication University, Vietnam)

In this paper, we analyze performance of a full-duplex (FD) decode-and-forward (DF) two-way relay system, where two terminal nodes exchange information via a relay node over a same frequency band and time slot. Unlike previous works on two-way full-duplex relay systems, we consider a system which is affected by both hardware impairments and residual interference due to imperfect self-interference cancellation (SIC) at the full-duplex nodes. We derive exact outage probability based on the signal to interference plus noise and distortion ratio of the considered system. Our analysis based on numerical results show significant performance degradation due to transceiver impairments. The outage probability is caused to fall to an irreducible floor even at low residual self-interference. Finally, Monte Carlo simulations are also used to validate numerical results.

S8: Telecommunications Systems and Networks

TOP

Room: Truc Bach

4:45 ***An Organic RRAM Chip Fabricated Using Ink-jet Printer and its Readout Circuit for Data Storage***

Toan Dao (University of Transport and Communications, Vietnam)

A RRAM has been recently emerged because of its high potential for future semiconductor memory technologies in 4.0 era. This article demonstrates a 1616 crossbar-structured organic RRAM array fabricated from a composite of Au nanoparticle and P3HT polymer matrix and an electrode layer made using a commercial inkjet printer of Epson T60. Electrical measurements indicated that the memory device can be reversibly switched at a voltage pulse of -5/5 V for 1 µs. The typical device exhibited highly reliable with the stable retention time characteristics with a large on/off current ratio of 2×103 at 0.5 V. In addition, in order to demonstrate practical application of the organic RRAM device in data storage, an encoder system including a socket, readout circuit and a computer program was constructed. The difference in the resistance state of organic RRAM array can be sensed and converted to the binary values of "1" or "0" in ASCII table code thanks to the encoder system. The method described here can be contributed in the progress of study on the emerging memory for smart devices

5:00 ***High-resolution phased shifter, attenuator based on combination of coupler and digital step attenuator in the 3.4-4.2 GHz frequency range***

Dai Pham (Le Quy Don Technical University, Vietnam); Tuan Luu and Hai Le (Institute of System Integration, MTA, Vietnam); Phong Le (Le Quy Don Technical University, Vietnam)

This paper proposes a low-cost and high-resolution solution to combine phase shift and attenuation of signals. The method exploits couplers and digital step attenuators (DSA) to control phase and attenuation via setting appropriate levels of the DSAs on two I/Q channels of RF signals. The design and simulation are employed in the 3.4-4.2GHz frequency range to enhance the beam-forming quality of transceiver modules in systems with a phased-array antenna.

5:15 ***Content Delivery on IP network: Service Providers and TV Broadcasters business repositioning***

Francesco Vatalaro, Gianfranco Ciccarella and Alessandro Vizzarri (University of Rome Tor Vergata, Italy)

This paper examines the main drivers for evolution in the next years in the market of content delivery which is driven by the rapid increase in the UBB provision in the access networks worldwide. This bandwidth increase has a strong impact in the network architecture at the core and metro transport stages. It will induce new players to be directly involved in Quality of Experience provision, so pushing the advent of two-sided platform business models. We consider both cases of VoD and live streaming (linear TV) over IP networks and that of future MoVAR (Mobile Virtual and Augmented Reality) services, pointing out some main transmission challenges.

5:30 ***Analysis of Local Secure Connectivity of Legitimate User in Stochastic Wireless Networks***

Dung Le The (Chungbuk National University, Korea); Hoa Tran (Danang University of Education and Technology, Vietnam); Nguyen Thi Thai Hoa (Faculty Telecommunication, Vietnam); Seong Gon Choi (Chungbuk National University, Korea)

In this paper, we investigate the local secure connectivity in terms of the probability of existing a secure wireless connection between two legitimate users and the isolated security probability of a legitimate user in stochastic wireless networks. Specifically, the closed-form expressions of the probability that there is a secure wireless communication between two legitimate users are derived first. Then, based on these equations, the corresponding isolated secure probability are given. The characteristics of local secure connectivity are examined in four scenarios combining from the wireless channel conditions (deterministic/Rayleigh fading) and the eavesdropper configurations (non-colluding/colluding). All the derived mathematical equations are validated by the Monte-Carlo simulation. The obtained numerical results in this paper reveal some interesting features of the impact of eavesdropper collusion, wireless channel fading, and density ratio on the secure connection probability and the isolated security probability of legitimate user in stochastic networks.

S9: Fixed and Wireless Networks

TOP

Room: Ho Tay

4:45 ***Energy Efficient Design for Coded Caching Delivery Phase***

Thang Xuan Vu, Lei Lei and Symeon Chatzinotas (University of Luxembourg, Luxembourg); Björn Ottersten (University of Luxembourg, Luxembourg); Trinh Anh Vu (Vietnam National University, Vietnam)

Edge-caching is a promising technique to improve the network performance in terms of delivery latency and network congestion during peak-traffic times. Between the two fundamental methods, coded caching has received much attention due to its significant gain over the uncoded counterpart. In this paper, we propose an energy-efficient beamforming design for coded caching delivery phase in wireless networks context. In particular, by exploiting the broadcasting capability of the wireless channels and taking into the cache size, a multi-group multicast based transmission scheme is employed to deliver multiple coded messages to different subgroups of users simultaneously. Numerical results show a significant energy consumption reduction of the proposed design compared to the conventional scheme in the small and medium cache size regime.

5:00 ***Flow-Based Network Tomography Agent for Software Defined Data Center***

Elham Dehghan Biyar (Istanbul Technical University, Turkey); Bahtiyar Karanlik (Sekom Yazilim AS, Turkey); Berk Canberk (Istanbul Technical University, Turkey)

In software defined networking (SDN) data centers, collecting real-time routing information of different traffic flows for tomography of data centers requires an up-to-date knowledge of every link. However, traditional techniques are mostly not covering traffic matrix (TM) estimation for specific traffic types. This paper proposes an approach to construct a tomography agent to estimate and manage traffic flows through the data center network. For this aim, we regenerated the traffic matrix according to three different traffic types (bandwidth-sensitive, delay-sensitive, best-effort) and taking into account delay infor- mation obtained from the Markov chain M/G/1 priority queuing method both for link count and traffic matrix. Consequently, after regeneration step, we use Expectation Maximization approach for iteratively estimate the traffic matrix. In addition, regarding to estimated traffic matrix, by using Max-Min fairness method and definition of flow utility function, our simulation results in reduction in end-to-end routing delay and also flow utility enhancement.

5:15 ***A Lightweight Watermark Scheme Utilizing MAC Layer Behaviors for Wireless Sensor Networks***

Nguyen Van Truong (Pots an Telecommunications Institute of Technology, Vietnam); Trong-Minh Hoang (Posts and Telecommunications Institute of Technology, Vietnam); Nguyễn Sỹ (Post and Telecommunication Institute of Technology, Vietnam); Hau Bui Van (Feng Chia University, Taiwan)

Security is a major concern in wireless sensor network designing which suffers from many stringent hardware and software restrictions. It has attracted a large amount of attention from the research circle as security requirements became more and more indispensable in the Internet of Thing (IoT) evolution. An effective security mechanism is essential for deploying sensor networks. This paper proposes a security technique based on MAC behaviors for lightweight digital watermarking which aims to attain confidentiality and authentication for data. Embedded watermark values are constructed by information from MAC layer parameters which are simple to implement and resistant to attack. The numerical results and security analysis show proficiency of the proposed watermark scheme and evaluate the tradeoff between watermark detection probability and energy consumption of the network model.

5:30 ***Performance Anomalies of Smartphone-based Mobile Wi-Fi Hotspots***

Osama M. F. Abu-Sharkh (Princess Sumaya University For Technology, Jordan)

In this work, we tackle the ubiquitous provision of internet connections for users in smart cities by analyzing the mobile Wi-Fi hotspots and their performance from several aspects. We first discuss the capabilities and operational characteristics of these networks and the limitations they have when compared with other similar IEEE802.11 modes. We then conduct experiments to analyze their performance considering the following: operational frequency band, channel bandwidth, maximum number of connected devices, received signal strength, coverage and connection speed. The obtained results show many performance anomalies of such networks.

Thursday, March 21 6:00 - 9:00

Banquet TOP

There will be the bus to pick up all guests. This bus will depart at 6.15 pm in front of the conference venue.