Program

Time	Lotus	Rose
Monday, January 9		
07:00 am-08:00 am	***Registration***	
08:00 am-08:30 am	***Opening Ceremony***	
08:30 am-10:00 am	***Keynote speaker #1: Mobile Ad Hoc Networks for Wide-Area Deployment***	
10:00 am-10:30 am	***Coffee break***	
10:30 am-12:00 pm	***Tutorial #1: Advanced Photonic Technologies for Future Wireless Communications and Imaging***	
12:00 pm-01:30 pm	***Lunch break***	
01:30 pm-03:00 pm	TSN:1: ***Telecommunications Systems and Networks***	SP:1: ***Signal Processing***
03:00 pm-03:30 pm	***Coffee break***	
03:30 pm-05:00 pm	SP:2: ***Signal Processing***	CT:1: ***Computing Technologies***
07:00 pm-09:00 pm	***Dinner***	
Tuesday, January 10		
08:00 am-09:30 am	***Keynote speaker #2: Distributed MIMO Cooperative Signal Transmission for 5G***	
09:30 am-10:00 am	***Coffee break***	
10:00 am-11:30 am	TSN:2: ***Telecommunications Systems and Networks***	***Tutoria #2: Applications of Mobile Robots and Drones in Future Wireless Communication Systems***

11:30 am-01:30 pm	***Lunch break***	
01:30 pm-03:00 pm	TSN:3: ***Telecommunications Systems and Networks***	ECS:1: ***Electronics & Control System***
03:00 pm-03:30 pm	***Coffee break***	
03:30 pm-05:18 pm	***Invited talk: In-band Full-duplex Radios: Networking and Security Issues***	TSN:5: ***Telecommunications Systems and Networks***
04:30 pm-05:18 pm	TSN:4: ***Telecommunications Systems and Networks***	
07:00 pm-09:00 pm	***Banquet***	

Monday, January 9

Monday, January 9, 07:00 - 08:00

Registration TOP

Monday, January 9, 08:00 - 08:30

Opening Ceremony TOP

Monday, January 9, 08:30 - 10:00

Keynote speaker #1: Mobile Ad Hoc Networks for Wide-Area Deployment Details TOP

Kenichi Mase

An overview of the evolution of intelligent transport system supported by advances in information and communication technologies is presented. A concept and conditions of wide-area ad hoc network (WANET) are presented. Routing protocols for mobile ad hoc networks are reviewed with regard to WANET. Various node networking including fixed node networking, balloon node networking, automobile node networking, and unmanned aircraft (UA) node networking are described. With regard to fixed node networking and balloon node networking, implementation examples and operation experiences are discussed. With regard to automobile node networking, routing protocols are discussed based on a survey of geographic routing protocols for vehicular ad hoc networks. With regard to UA node networking, a system for surveillance of a wide disaster-affected area from the air supported by electric vehicle is considered. Finally a perspective on the evolution of WANET is presented.

Kenichi Mase received the B. E., M. E., and Dr. Eng. Degrees in Electrical Engineering from Waseda University, Tokyo, Japan, in 1970, 1972, and 1983, respectively. He joined Musashino Electrical Communication Laboratories of NTT Public Corporation in 1972. He was Executive Manager, Communications Quality Laboratory, NTT Telecommunications Networks Laboratories from 1994 to 1996 and Communications Assessment Laboratory, NTT Multimedia Networks Laboratories from 1996 to 1998. He was Professor, Faculty of Engineering, Niigata University and Graduate School of Science and Technology, Niigata University from 1999 to 2013. He is now Professor Emeritus, Niigata University. He received IEICE Best Paper Award in 1994, Best Letter Award in 2014, Achievement Award in 2014, Distinguished Achievement and Contributions Award in 2016, the Telecommunications Advanced Foundation Award in 1998, IEEE CQR Chairman's Award in 2010, and Best Paper Award, International Academy, Research, and Industry Association in 2013. His research interests include communications network design and traffic control, quality of service, mobile ad hoc networks and wireless mesh networks. He is an IEEE and IEICE Fellow.

Monday, January 9, 10:00 - 10:30

Coffee break TOP

Monday, January 9, 10:30 - 12:00

Tutorial #1: Advanced Photonic Technologies for Future Wireless Communications and Imaging

Details TOP

Atsushi Kanno, Pham Tien Dat, and Toshimasa Umezawa

Abstract

High-speed metro and access networks are indispensable to provide broadband services, especially bandwidth-hungry services and future 5G mobile networks to end users. Such networks should not serve only low-mobility users, but also those on fast-moving objects such as high-speed trains. Advanced wireline and wireless network solutions with ultra-high capacity, low transmission delay, high energy efficiency, and low cost need to be developed to support a wide range of applications and requirements in future networks. The convergence of wireline and wireless networks should also be considered to simplify the network configuration, management, and to realize new features and functions. Advanced photonic-based transmission systems are thus of critical importance to facilitate future mobile and wireless communications. In addition, high-performance imaging would play an important role to enhance safety and security of public infrastructure including airports, railways, etc. High-resolution radars can be constructed by the use of millimeter-wave and terahertz-wave where wide radio frequency resource is available. To cover wide ranges, a combination of radio and optical technologies via radio-over-fiber technology would be very useful to distribute and collect radio-wave information. This tutorial will present technical challenges, possible paths, and enabling system/device technologies for future mobile transport networks, including mobile backhaul and fronthaul. It will also discuss photonic-based millimeter-wave and terahertz-wave radar systems and related technologies for applications to public services, disaster recovery, etc.

Tutorial Duration

90 minutes

Tutorial Outline

- Challenges of future mobile transport networks;
- Photonics based solutions for future mobile fronthaul/backhaul systems;
- Photonic-based linear-cell millimeter-wave systems for moving objects;
- High-speed wireless communication and high-precision radar/imaging using advanced photonic technologies;
- Advanced photonic device technologies for high-speed communications and wireline-wireless convergence.

Biography

Atsushi Kanno received B.S., M.S., and Ph.D. degree in science from the University of Tsukuba, Japan, in 1999, 2001, and 2005, respectively. In 2005, he was with the Venture Business Laboratory of the Institute of Science and Engineering, University of Tsukuba, where he was engaged in research on electron spin dynamics in semiconductor quantum dot structures using the optical-polarization-sensitive Kerr effect measurement technique. In 2006, he joined the National Institute of Information and Communications Technology Japan. He is working on microwave/millimeter-wave/terahertz photonics for communication and imaging and ultrafast optical communication systems. He is a member of the Institute of Electronics, Information and Communication Engineers (IEICE), the Japan Society of Applied Physics (JSAP), and the Institute of Electrical and Electronic Engineers (IEEE).

Pham Tien Dat received the B.Eng. (Hons.) degree in electronics and telecommunication engineering from Posts and Telecommunications Institute of Technology, Vietnam, in 2003, and the M.Sc. and Ph.D. degrees in science of global information and telecommunication studies from Waseda University, Japan, in 2008 and 2011, respectively. He worked as a Researcher at Research Institute of Posts and Telecommunications, Vietnam from 2003 to 2006. In 2011, he joined the National Institute of Information and Communications Technology, Japan. His research interests are in the field of microwave/millimeter-wave photonics, radio over fiber and optical wireless systems. Dr. Pham is a member the Institute of Electrical and Electronic Engineers (IEEE).

Toshimasa Umezawa received B.E. and M.E. degrees in electronics from Nagaoka University, Niigata, Japan, in 1984 and 1986, respectively. From 1987 to 2011, he worked for the Yokogawa Electric Corporation; he was with the Central Research Laboratory and with the Photonics Business Department. In 1992, he was a visiting scholar in the Department of Applied Physics, Stanford University, and he received a Ph.D. degree in electronics from Tokyo University, Tokyo, Japan, in 1995, where he was engaged in research on superconductor devices, photonics devices, and their applications. In 2011, he joined the National Institute of Information and Communications Technology (NICT), Tokyo, Japan. His current research interests are E/O devices and photonic integrated circuits and millimeter-wave photonics.

Monday, January 9, 12:00 - 13:30

TOP

Lunch break

Monday, January 9, 13:30 - 15:00

TOP

SP:1 Signal Processing

Room: Rose

1:30 ***Beamformer and Time Split Design for Wireless Powered Multi-antenna Cooperative Systems***

Han Liang and Caijun Zhong (Zhejiang University, P.R. China); Himal A Suraweera (University of Peradeniya, Sri Lanka); Gan Zheng (Loughborough University & University of Luxembourg, United Kingdom); Zhaoyang Zhang (Zhejiang University, P.R. China)

This paper investigates a three-node cooperative wireless powered communication system consisting of a multi-antenna hybrid access point (H-AP), a single-antenna relay and a single-antenna user. The H-AP first beams energy to the energy constrained relay and user in the downlink and then the relay assists the user using the harvested power for information transmission in the uplink. To maximize the throughput, we investigate the optimal energy beamforming vector and the time split between harvest and cooperation. In addition, suboptimal designs are also studied to reduce the computational complexity, where closed-form expressions are derived for the energy beamforming vector and the time split. Our results show that, the closed-form suboptimal energy beamforming vector and time split yields near optimal performance and implementing multiple antennas at the H-AP can significantly improve the system performance.

1:48 ***Dictionary learning based on sparse representations for resting-state functional MRI data analysis***

Hien M. Nguyen (Vietnamese-German University, Vietnam)

Functional Magnetic Resonance Imaging (fMRI) has been valuable to the current understanding of brain function and pre-operative evaluation of patients. In the recent years, the technique has been increasingly applied to the cases when the subject is at rest, also referred to as the resting-state fMRI. Resting-state fMRI measures spontaneous fluctuations in the blood oxygen

level-dependent (BOLD) signal to investigate the functional topology of the brain. It is possible to identify various anatomically distinct areas of the brain that demonstrate synchronous BOLD fluctuations at rest, also referred to as the brain functional networks. Conventional approach to extract these functional dynamics is the data-driven Independent Component Analysis (ICA) method. In this work, we propose to utilize sparse representations for identifying functional connectivity networks. Specifically, fMRI signals are decomposed into morphological components which have sparse spatial overlap. Allowing sparse spatial overlap between components is a more physically plausible assumption to the statistical independence assumption of the conventional ICA method. The dictionary is learnt from the data using a K-SVD algorithm. Human experimental results show that the proposed MCA-KSVD method can be used as an alternative to the conventional ICA method.

2:06 ***Analysis of the Least Squares Approach to Broadband Beamspace Beamforming***

Yuling Li (University of Leeds, United Kingdom); Desmond McLernon (The University of Leeds, United Kingdom); Syed Ali Raza Zaidi (University of Leeds, United Kingdom)

In this paper, we present a comprehensive comparison of different structures for broadband beamforming. We focus on both the tapped delay line (TDL) and the least squares (LS), beamspace approaches. Through simulations we confirm the superiority of the beamspace method (i.e., less complex and better frequency invariance). However, its anti-jamming ability is reduced due to non-orthogonal beams. We show how to mitigate this via a reduced rank approximation of the autocorrelation matrix.

2:24 ***Sparse Reconstruction of Time-Frequency Representation using the Fractional Fourier Transform***

Nguyen Yen (University of Leeds, Vietnam & Electronics and Electrical, unknown); Desmond McLernon (The University of Leeds, United Kingdom); Mounir Ghogho (University of Leeds & International University of Rabat, United Kingdom); Syed Ali Raza Zaidi (University of Leeds, United Kingdom)

This paper describes a novel method to approximate instantaneous frequency of non-stationary signals through an application of fractional Fourier transform (FRFT). FRFT enables us to build a compact and accurate chirp dictionary for each windowed signal, thus the proposed approach offers improved computational efficiency, and good performance when compared with chirp atom method.

2:42 ***A Floating-point FFT Twiddle Factor Implementation Based on Adaptive Angle Recoding CORDIC***

Phuong-Thao Vo (The University of Science, Hochiminh City, Vietnam); Trong-Thuc Hoang (The University of Science, Hochiminh City & The Faculty of Electronics and Telecommunications, Vietnam); Pham Cong-Kha (The University of Electro-Commununications (UEC), Japan); Duc-Hung Le (The University of Science Ho Chi Minh City, Vietnam)

In this paper, a single-precision floating-point FFT Twiddle Factor (TF) implementation is proposed. The architecture is based on Adaptive Angle Recoding CORDIC (AARC) algorithm. The TF design is built and verified on Altera Stratix IV FPGA chip and 65nm SOTB synthesis. The FPGA implementation has 103.9 MHz maximum frequency, throughput result of 16.966 Mega-Sample per second (MSps), and resources utilization of 7,747 ALUTs and 625 registers. On the other hand, the SOTB synthesis has 16,858 standard cells on an area of 86,718 um2, 166 MHz maximum frequency, and the speed of 27.107 MSps. The accuracy results are 1.133E-10 Mean-Square-Error (MSE) and about 26 part-per-million (ppm) maximum error-ratio.

TOP

TSN:1 Telecommunications Systems and Networks

Room: Lotus

1:30 ***Wireless Vehicular Networks in Emergencies: A Single Frequency Network Approach***

Andrea Tassi (University of Bristol, United Kingdom); Malcolm Egan (Université Blaise Pascal, France); Robert J Piechocki and Andrew Nix (University of Bristol, United Kingdom)

Obtaining high quality sensor information is critical in vehicular emergencies. However, existing standards such as IEEE 802.11p/DSRC and LTE-A cannot support either the required data rates or the latency requirements. One solution to this problem is for municipalities to invest in dedicated base stations to ensure that drivers have the information they need to make safe decisions in or near accidents. In this paper we further propose that these municipality-owned base stations form a Single Frequency Network (SFN). In order to ensure that transmissions are reliable, we derive tight bounds on the outage probability when the SFN is overlaid on an existing cellular network. Using our bounds, we propose a transmission power allocation algorithm. We show that our power allocation model can reduce the total instantaneous SFN transmission power up to 20 times compared to a static uniform power allocation solution, for the considered scenarios. The result is particularly important when base stations rely on an off-grid power source (i.e., batteries).

1:48 ***A Fast, Adaptive, and Energy-efficient Multi-path-multi-channel Data Collection Protocol for Wireless Sensor Networks***

Cheng Kiat Tan, Soung Yue Liew and Hock Guan Goh (Universiti Tunku Abdul Rahman, Malaysia); Ivan Andonovic (University of Strathclyde, United Kingdom)

Energy consumption, traffic adaptability, fast data collection, etc are the major issues in wireless sensor networks (WSNs). Most existing WSN protocols are able to handle one or two of the above issues with the other(s) being compromised. In order to reduce the energy consumption of wireless sensor nodes while having fast data collection under different traffic generating rates, this paper proposes a fast, adaptive, and energy-efficient multi-path-multi-channel (FAEM) data collection protocol. FAEM makes use of the Basketball Net Topology proposed in the literature, in which a multi-parent-multi-child connection table is pre-established at each node; each node is also pre-assigned a receiving channel which is different from those of the neighboring nodes so as to eliminate the transmission interference. During data transmission, time is divided into duty cycles, and each consists of two phases, namely distributed iterative scheduling phase and slot-based packet forwarding phase. The former is to match parents and children of the entire WSN in a distributed manner in order to determine whether a node should be in upload (to which parent), download (from which child), or sleep mode in a particular slot; while the latter is for nodes to take action according to the schedule. Simulation shows that our protocol is able to achieve lower energy consumption, data reliability and low latency even during a high traffic load.

2:06 ***Analysis of Millimeter Wave Cellular Networks with Simultaneous Wireless Information and Power Transfer***

Thanh Tu lam (CNRS, France); Marco Di Renzo (Paris-Saclay University / CNRS, France)

In this paper, we study the joint performance of information decoding and harvested power in simultaneous wireless information and power transfer (SWIPT) millimeter wave (mmWave) cellular networks. In particular, by modeling base stations (BSs) as points of Poisson Point Process (PPP) and applying Maximum Ratio Transmission and Maximum Ratio Combining (MRT/MRC) at BSs and mobile terminals (MTs), the joint complementary cumulative distribution function (JCCDF) of both information decoding and energy harvesting is evaluated. Our results show that mmWave cellular networks achieve higher performance than conventional microWave (μWave) networks in both harvested power and coverage probability. Moreover, there is a different trend between μWave and mmWave cellular networks in ultra-dense networks.

2:24 ***An energy-aware multipath congestion control protocol for mobile devices***

Linh Pham (Faculty of Information Technology, Vietnam); Phuong L. Vo (HCM International University - VNU, Vietnam); Tuan-Anh Le (Thu Dau Mot University, Vietnam)

In this paper, we propose an energy efficient multipath congestion control protocol, called emReno. emRemo can shift traffic to the lower energy cost path without sacrificing the throughput and still guaranteeing the fairness and load balancing. The extensively simulations show the features of emReno as a common multipath congestion control protocol as well as its energy efficient characteristic

2:42 ***Opportunistic Scheduling for Fixed-Gain Amplify-and-Forward-based Multiuser Multirelay SWIPT Cooperative Networks***

Nhu Tri Do (Hongik University, Korea); Daniel Benevides da Costa (Federal University of Ceara (UFC) & Area: Telecommunications, Brazil); Trung Q. Duong (Queen's University Belfast, United Kingdom); Vo Nguyen Quoc Bao (Posts and Telecommunications Institute of Technology, Vietnam); Beongku An (Hongik University, Korea)

In this paper, we analyze the downlink outage performance of opportunistic scheduling in dual-hop fixed-gain amplify-and-forward (FG-AF) cooperative networks consisting of one source, multiple radio-frequency (RF) energy harvesting relays, and multiple destinations. To this end, a relay-destination selection scheme named direct links plus opportunistic channel state information (CSI)-based selection (DOS) scheme is proposed. The performance analysis in terms of outage probability (OP) is carried out for the proposed DOS scheme. In particular, an exact closed-form expression for the OP is provided. The developed analysis is corroborated through Monte-Carlo simulation. Numerical results show that the DOS scheme achieves full diversity gain, i.e., K+M, where K and M are the numbers of relays and destinations, respectively.

Monday, January 9, 15:00 - 15:30

TOP

Coffee break

Monday, January 9, 15:30 - 17:00

TOP

CT:1 Computing Technologies

Room: Rose

3:30 ***Optimization Vietnam Coast Station System Using Genetic Algorithm***

Nguyen Thai Duong, Canh Son Nguyen, Tran Xuan Viet and Cao Duc Hanh (Vietnam Maritime University, Vietnam); Duc Trong Nguyen (Faculty of Information Technology, Maritime University, Vietnam)

The planning issue and the optimal plan of coast station network in Vietnam Maritime Communication System has been creating numerous challenges for the related managers as the quality of services, the corresponding with the national development strategy and international standards. The mathematical fundamentals of these issues have been addressed in several recent publications. In this paper, the authors focus on analysis and designing an optimal planning software using genetic algorithm

3:48 ***Interface Driven Service Composition: A Highlevel Colored PetriNet Based Approach***

Megha Gaur (National Institute of Technology, Durgapur, India); Amit Kr Mandal and Anirban Sarkar (National Institute of Technology, Durgapur (India), India); Narayan Debnath (Winona State University, USA)

Service composition refers to the process of developing the complex services from existing services. In order to add or remove functionalities of the composite services and to reduce the human intervention, the service composition process should be dynamic, scalable, and reusable. For the purpose, this paper proposes a Colored PetriNet based approach for service composition. In the proposed mechanism, firstly, a conceptual model of service interface has been devised. Based on the conceptual model a Colored PetriNet (CPN) based model, called Colored PetriNet for Service Composition (CPSC) has been proposed to represent the behavioral aspects of the conceptual constructs of service interfaces and different composition aspects of the constituent services. It also implements a service composition algorithm to execute the composition sequence of services. Moreover, the proposed CPSC along with the algorithm are illustrated with a suitable case study and simulated using CPN tool. The result shows that the proposed algorithm can successfully compos services based on the user requirements. Beside these, the state space report of the proposed CPSC validates the standard behavioral properties of the concerned system

4:06 ***QoS Lake: Challenges, Design and Technologies***

Faisal Ahmad (Software Developer, India); Anirban Sarkar (National Institute of Technology, Durgapur (India), India); Narayan Debnath (Winona State University, USA)

QoS evaluation based on their historical data not only helps in getting more accurate QoS, but also helps in making future QoS prediction, recommendation and knowledge discovery. [1] designed a generic QaaS (Quality as a service) model in the same line as PaaS and SaaS, where users can provide QoS attributes as inputs and the model returns services satisfying the user's QoS. It uses historical data to evaluate accurate QoS. Storing and evaluating QoS based on historical data and managing QoS for all services on the internet is challenging. This paper proposed a QoS lake in the same line of Data Lake for implementing QaaS model using big data technologies like Hadoop, Spark, and Yarn etc. The QoS Lake is a very large repository that stores all logs generated from services and its evaluated QoS data in its original context for all services on internet. The log data are processed to evaluate QoS either in batch or real time. QoS Lake is integrated with cutting-edge analytics, automation, orchestration and machine intelligence tools and languages which are used for future prediction, recommendation and knowledge discovery. QoS Lake has four loosely coupled layers namely; Ingestion layer, data layer, Analysis layer and Visualization layer. The challenges and advantages of the data lake are also discussed. The paper also presented the technologies available today to realize each layer and functionalities of the QoS Lake.

4:24 ***Generalized Extra-Functional Properties composition for Component Based System***

Prasenjit Banerjee (Ravenshaw University, Odisha, India); Anirban Sarkar (National Institute of Technology, Durgapur (India), India); Narayan Debnath (Winona State University, USA)

Inclusion of Extra-Functional Properties (EFPs) can enrich the quality of component based system design and development. However, such inclusion is a complex engineering task. For this purpose, we need to identify valid and formally specified extra-functional properties and their composition mechanism for component based model. This will facilitate the developer to identify the best design suits on the component based software development. Then we need to categorize the composition of EFPs accordingly as because the importance of EFPs will vary from one domain to another. In this paper, we have proposed a general guideline for inclusion of EFPs into a component model which facilitates the software developer to properly identify the extra-functional properties in different categories and make fit for reuse. A tool has been developed to implement our concept which will automatically measure different composition of EFPs in component based paradigm.

4:42 ***Jumbler: A Lock-Contention Aware Thread Scheduler for Multi-core Parallel Machines***

Uzair Bin Nisar, Muhammad Aleem and Muhammad Iqbal (Capital University of Science and Technology, Pakistan); Nguyen-Son Vo (Duy Tan University, Vietnam)

On a cache-coherent multi-core multi-processor parallel machine, the execution time of a multi-threaded application with high-lock contention is immensely sensitive to the distribution of application-threads across multiple processors. Improper mapping of threads results in loss of performance due to the frequency of lock transfers between sockets. With increased transfer of lock object among different processors, a large number of last-level cache misses occur. The increase in last-level cache misses negatively affects program execution. Operating system's thread-schedulers are unaware of lock contention and therefore the default execution results in loss of performance especially in the application employing high lock-contention. To mitigate the problem, we propose a novel-scheduling technique as an extension of an existing work called shuffling. Our proposed scheduler migrates and maps the threads of a multi-threaded application across sockets so that the lock-contention threads are mapped on the same socket. The threads mapped together (employing the same lock) yield low number of last-level cache misses. We

experiment with the proposed scheduler on a system having 2 sockets with 4 cores each and evaluate it using multi-threaded parallel benchmarks. The experiments show that our algorithm achieves reduction in execution time up to 986.7%. Moreover, our algorithm does not require any changes to the application source-code or the operating system kernel.

TOP

SP:2 Signal Processing

Room: Lotus

3:30 ***Develop an algorithm for image forensics using feature comparison and sharpness estimation***

Tu Huynh-Kha (Ho Chi Minh City University of Technology, VNUHCM & International University, VNUHCM, Vietnam); Thuong Le-Tien (Hochiminh city University of Technology, Vietnam); Synh Ha-Viet-Uyen (International University-VNUHCM, Vietnam); Son Huynh-Thanh (Dong Thap Province, Vietnam); Khoa Huynh-Van (Ho Chi Minh City University of Technology (VNUHCM), Vietnam)

The paper presents a new method to detect the forgery in Copy-Move images using feature comparison to find the similar parts and sharpness estimation to collect the suspicious edges. Besides, one-level DWT decomposition, with the role of multiresolution, is used to limit the computational complexity and morphological operation is applied for presenting counterfeit objects. Both feature comparison and sharpness are done in overlapping 16x16 blocks of LL and HH sub-bands. Searching similar blocks in approximation part by modified Zernike Moments and calculating the sharpness of edges in HH sub-band confirm the copy-move objects in image. Faked regions have features similar to any other image's region and sharpness at boundaries higher than at other edges in the image. The combination of LL and HH sub-band can improve the reliability of the detection. The suspicious regions are then colored by opening and closing of morphological analysis and shown by logical operator "AND" to the tested image. The fact that similar regions can be detected and defined to be copy-move or same texture is the novelty of the proposed method. Results are simulated in Matlab environment with high accuracy and also compared to some related methods.

3:45 ***On the use of Convolutional Neural Networks for Graphical Model-based Human Pose Estimation***

Huynh Vu (School of Engineering, RMIT University, Vietnam); Eva Cheng, Richardt Wilkinson and Margaret Lech (RMIT University, Australia)

The recent application of Convolutional Neural Networks (CNNs) to Human Pose Estimation (HPE) from static images have improved estimation accuracy compared to traditional HPE approaches. In particular, a recent novel HPE approach combines a traditional graphical model with CNNs to result in state-of-the-art HPE accuracy, improving the estimation accuracy compared to using either approach alone. However, the accuracy of the CNN used in the hybrid model has not yet been explored, and this paper evaluates the use of CNNs in the hybrid model through investigating different network configurations and fine-tuning the network using pre-trained weights obtained from a large labeled dataset. The proposed CNN configurations not only improve the accuracy of the existing network by up to 2% but also uses fewer parameters, resulting in a higher HPE accuracy and simpler network structure

4:00 ***Received Signal Strength Prediction using Gaussian Process***

Anh Nguyen, Khanh Hung Nguyen and Nguyen Van Khang (Hanoi University of Science and Technology, Vietnam)

Gaussian distribution is very common, widely used in statistical theory and its applications. Many process in nature is considered Gaussian. Gaussian Process (GP) is a statistical tools where observations are considered normally distributed random variables. The technique uses the previous observations and their covariance or similarity to analyse the data and predict future data. In this paper, the Gaussian random variable is the Received Signal Strength (RSS) between one stationary base station (BS) and one mobile station (MS). In the training phase, the positions of BS and MS together with the RSS between them are known. GP will uses these data to predict the RSS at any other location of the MS. Experiment is conducted to validate the algorithm.

4:15 ***Distance Spectrum Calculation Method for Double Binary Turbo Codes***

Jingli Deng (Beijing University of Posts and Telecommunications, P.R. China); Yuexing Peng (Beijing University of Posts & Telecoms, P.R. China); Hui Zhao (Beijing University of Posts and Telecommunications, P.R. China)

With the rapid development and deployment of M2M, Mesh, ad-hoc and other types of decentralized random wireless communication systems, there are more demands on powerful forward error correction codes (FEC) with short length recently. Due to its error correction (EC) capability, convolutional Turbo code (CTC) with short length has been applied widely. In this paper, the distance spectrum (DS), which can catch the EC performance efficiently, is studied for CTCs. Firstly the DS of tailbiting (TB) duo-binary recursive systematic convolutional codes (RSC) is calculated by the modified FAST algorithm, and then the DS calculation of CTC with dual TB technique under the concept of uniform interleaver is presented. Given the DS results, the bit error probability (BEP) performance of the CTC can be analyzed on the base of union bound and pairwise error probability (PEP) techniques. The analysis on the EC performance of CTC is verified by Monte Carlo simulations, and the results show the analysis greatly matches the simulation results.

4:30 ***An Efficient Image Watermarking Scheme Using the Laplacian Pyramid based on Projection***

Sy Nguyen (Ho Chi Minh University of Technology, Vietnam); Ha H Kha (Ho Chi Minh City University of Technology, Vietnam); Hoang Minh Nguyen (Banking University of HCM City & Saigon Institute of Information Communications Technology, Vietnam)

The image digital watermarking technology is widely used to protect intellectual property and to authenticate digital content in the network environment. The aim of the paper is to invoke the improved Laplacian Pyramid transform to develop a new image watermarking scheme. Specifically, the host image is decomposed and reconstructed using the improved Laplacian Pyramid transform. Then, the mid frequency subband data with the appropriate level and strength factor are chosen to embed the watermark. Finally, we conduct experiments to investigate the invisibility and robustness of the proposed algorithm. To measure the invisibility and the robustness of the algorithms, we use peak signal-to-noise ratio (PSNR) and normalized correlation (NC) as performance metrics. Experimental results demonstrate that invisibility and robustness are guaranteed. The proposed algorithm outperforms one based on curvelets for the lossy JPEG compression attack in terms of invisibility and robustness

4:45 ***Understanding the Impact of Planarized Proximity Graphs on Toxic Gas Boundary Area Detection***

Zhihong Sun (Guangdong University of Petrochemical Technology, P.R. China); Haihui Wang (Wuhan Institute of Technology, P.R. China); Yuanfang Chen and Lei Shu (Guangdong University of Petrochemical Technology, P.R. China); Mithun Mukherjee (Guangdong Provincial Key Lab of Petrochemical Equipment Fault Diagnosis, P.R. China)

Detecting the diffusion boundary of toxic gas is an important research issue in petrochemical plants. There have been many research efforts on this issue. However, detecting an accurate absolute boundary is still less likely to be achieved, because of the extreme environmental sensitivity and easy diffusion characteristic of the toxic gas. Therefore, it is more practical to detect a boundary area instead of an absolute boundary. In this paper, we analyze the impact of four planarized proximity graphs on the accuracy of detecting the boundary area, based on a boundary detection algorithm. By extensive experiments and analyses, we obtain three important observations to understand the different performance of four graphs on different detection scenarios (e.g., different numbers of sensor nodes and different radii of toxic gas leakage). Moreover, we learn the factors that influence the accuracy of boundary area detection. The learning results can be used to direct the strategy design of boundary area detection.

Monday, January 9, 19:00 - 21:00

Dinner

Provided by SigComTel 2017

Tuesday, January 10

Tuesday, January 10, 08:00 - 09:30

Keynote speaker #2: Distributed MIMO Cooperative Signal Transmission for 5G Details

Fumiyuki Adachi

Summary

After 35 years from its birth in 1979, mobile wireless communications networks have evolved into the 4th generation (4G). The mobile data traffic volume is growing explosively and therefore, significantly advanced spectrum- and energy-efficient wireless communication technology needs to be developed for the 5th generation (5G) mobile wireless communications networks. One promising approach is to adopt a distributed antenna small-cell network, in which a number of distributed antennas are deployed over a macro-cell area. Distributed antennas surrounding a user and user antennas form distributed MIMO channel. In this presentation, two types of distributed MIMO cooperative signal transmission technique are presented. One is space-time block coded (STBC) diversity, which aims to improve the macro-cell edge users' throughput. The other is multi-user joint transmit/receive filtering, which aims to improve the sum-throughput of users in a good channel condition. When using cooperative signal transmission, peak-to-average power ratio (PAPR) of the transmit signal is increased. Therefore, PAPR reduction will be still necessary for battery-operated user terminal transmit power amplifiers. Blind selected mapping (blind SLM) which can effectively suppress the PAPR and requires no side information sharing is presented.

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 interest is in the area of wireless signal processing (multi-access, equalization, antenna diversity, adaptive transmission, channel coding, etc.) and networking.

He is an IEICE Fellow and an IEEE 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, Telecom System Technology Award 2009, Prime Minister Invention Award 2010, British Royal Academy of Engineering Distinguished Visiting Fellowship 2011, KDDI Foundation Excellent Research Award 2012, VTS Conference Chair Award 2014, C&C Prize 2014, and Rintaro Shida Award 2016. He is listed in Highly Cited Researchers 2001 (http://hcr.stateofinnovation.thomsonreuters.com/page/archives).

Tuesday, January 10, 09:30 - 10:00

Coffee break

Tuesday, January 10, 10:00 - 11:00

Tutorial #2: Applications of Mobile Robots and Drones in Future Wireless Communication Systems

Des McLernon

Room: Lotus

Abstract

In parallel with the well documented comms revolution (e.g., internet, cellular phones, social media, etc.), another technological revolution is taking place with robotics. Robots (fixed, mobile, UAVs/drones) have recently been named as one of the world's 'eight great technologies'. In particular, by virtue of their mobility they can be used to assist in meeting the huge wireless communications demands outlined above. In this tutorial level talk I will show how signal processing allows mobile robots (either individually, as relays or as swarms) to enhance communications links and meet the aforementioned and other challenges. Specifically I will introduce:

how the new concept of intelligent trajectory planners allow mobile robots to find (in an energy efficient manner) the optimum position from which to wirelessly upload data; how we can use efficient energy harvesting to assist robotic communications; how robotic arrays can use communications and signal processing in 'search and rescue' scenarios; how to optimise the communications performance of drone-based small cells (e.g., emergency response for resilience in future cities through to temporary cellular services for major events). Tutorial Duration

60 minutes

Biography

Des McLernon received his BSc/MSc in electronic and electrical engineering from the Queen's University of Belfast, N. Ireland. He then worked in industry on radar systems research and development with Ferranti Ltd in Edinburgh, Scotland and later joined Imperial College, University of London, where he took his PhD in signal processing. After first lecturing at South Bank University, London, UK, he then moved to the School of Electronic and Electrical Engineering, at the University of Leeds, UK, where he is a Reader in Signal

Processing and Post Graduate Research Tutor. His research interests are broadly within the domain of signal processing for wireless communications systems (in which discipline he has published over 285 international journal and conference papers). He has supervised over 40 PhD students, given many invited talks in the UK and abroad and is associate editor of the UK IET journal "Signal Processing". Recent conference organisation ctte involvement includes: IEEE workshop on Signal Processing Advances in Wireless Communications (SPAWC 2010, Marrakech), European Signal Processing Conference (EUSIPCO) 2013, IET Conference on Intelligent Signal Processing (London, 2013/2015/2017) and IEEE Globecom 2014/2015/2016 (Workshop on Trusted Communications with Physical Layer Security) and IEEE WCNC 2018. Finally, his research activities have been funded from different sources and his current research projects include PHY layer security, M2M comms/caching in heterogeneous networks, energy harvesting for comms, robotic and drone-based communications, intrusion detection in SDNs, distributed sensing, stochastic geometry, multi-packet reception, through the wall radar and spectrum sensing for cognitive radio.

Tuesday, January 10, 10:00 - 11:30

TSN:2 Telecommunications Systems and Networks

Room: Rose

10:00 ***Outage Probability of Full-Duplex Cognitive Relay Networks with Partial Relay Selection***

Cheng Yin (Queen's University Belfast & Queen's University Belfast, United Kingdom); Xuan-Toan Doan, Nam-Phong Nguyen, Trang C. Mai and Long D. Nguyen (Queen's University Belfast, United Kingdom)

This paper investigates the outage performance of full duplex cognitive radio networks. We consider that a dual-hop system with multiple decode-and-forward (DF) relays.We assume that there is no direct link between secondary source terminal (S) and destination (D), and self-interference exists at the relays. All the links are independent identically distributed (IID) Rayleigh distributed. In order to analysis the outage performance, the exact closed-form expression of the outage probability is derived. Then we do simulations in different conditions to corroborate our theoretical analyses. Our results show that the system outperforms when the relay (R) is close to D and P is far away S.

10:18 ***Secrecy Outage Probability of Full-Duplex Networks with Cognitive Radio Environment and Partial Relay Selection***

Muhamad Ayub Azaman (Queen's University Belfast & Queen's University Belfast, United Kingdom); Nam-Phong Nguyen (Queen's University Belfast, United Kingdom); Dac-Binh Ha and Truong Vu (Duy Tan University, Vietnam)

This paper investigates the secrecy performance of full-duplex relay mode in underlay cognitive radio networks using decode-and-forward relay selection. The analytical results prove that full-duplex mode can guarantee security under critical conditions such as the bad residual self-interference and the presence of hi-tech eavesdropper. The secrecy outage probability is derived based on the statistical characteristics of channels in this considered system. The system is examined under five circumferences: 1) Different values of primary network's desired outage probability; 2) Different values of primary transmitter's transmit power; 3) Applying of multiple relays selection; 4) Systems undergo path-loss during the transmission process; 5) Systems undergo self-interference in relays. Simulation results are presented to verify the analysis.

10:36 ***Multi-way Massive MIMO Relay Networks with Maximum-Ratio Processing***

Chung Ho (Queen's University Belfast, United Kingdom); Hien Ngo (Linköping University, Sweden); Michail Matthaiou and Trung Q. Duong (Queen's University Belfast, United Kingdom)

This paper considers a multi-way massive multiple-input multiple-output (MIMO) relaying system. The bearing-information is exchanged among multiple users with the help of a multiple-antenna relay (the base station). The maximum-ratio (MR) processing is used at the relay under the assumption of perfect channel state information. The spectral efficiency and the asymptotic results for the signalto-interference-plus-noise ratio when the number of relay antennas increases large) are derived. By using a massive number of antennas the transmit power at both user side and/or relay can be made inversely proportional to the number of relay antennas without degradation in the system performance.

10:54 ***Secrecy Performance Analysis of Cooperative Multiuser Single Carrier Systems***

Yijun Yang (College of Communications Engineering, P.R. China); Jinlong Wang (PLA University of Science and Technology, P.R. China); Jin Chen (PLA University of Sci. and Tech., P.R. China); Yujuan Liu (Unit 95035 of PLA, P.R. China); Yuzhen Huang (School of Information and Communication, Beijing University of Posts and Telecommunications, P.R. China)

In this paper, we study the secrecy performance of cooperative single carrier system with the kth-best user selection scheme in Rayleigh fading channels. Assuming perfect decoding at the relay, we choose the legitimate user with the kth-best instantaneous signal-to-noise ratio (SNR) among Q users to receive the forwarded messages, which are intercepted at a passive eavesdropper simultaneously. To accurately assess the secrecy performance of the system, we derive exact closed-form expressions of secrecy outage probability and the probability of nonzero secrecy capacity to evaluate the impact of key parameters on the secrecy performance. Moreover, the asymptotic analysis is also performed to demonstrate that the secrecy diversity order is determined by both the number of channel taps and the index of the selected user. Finally, simulation results are provided to verify the correctness of the derived closed-form as well as asymptotic expressions.

11:12 ***Secured Energy Harvesting Networks with Multiple Power-Constrained Information Sources***

Nguyễn Cẩm, Nhung, Doan-Thi Phuong-Cham, Dung Tran and Dac-Binh Ha (Duy Tan University, Vietnam)

The transfer of energy via radio frequency (RF) is the new solution for prolonging the lifetime of wireless networks. This paper investigates the secrecy performance of RF energy harvesting system that consists of one power transfer station, multiple power-constrained information sources and one destination in the presence of one eavesdropper over Rayleigh fading channels. To do so, the exact closed-form expressions of existence probability of secrecy capacity and secrecy outage probability are derived by using statistical characteristics of signal-to-noise ratio (SNR). The numerical results show a quite agreement between numerical analysis and equivalent Monte-Carlo simulations.

Tuesday, January 10, 11:30 - 13:30

Lunch break

Tuesday, January 10, 13:30 - 15:00

ECS:1 Electronics & Control System

Room: Rose

1:30 ***Multi-Output Differential Power Processing System using Boost-Flyback Converter for Voltage Balancing***

Kyoungtak Kim and Jounghu Park (Soongsil University, Korea)

In this paper, a new boost-flyback converter topology for a Differential Power Processing(DPP) System in feed-forward type is proposed. Output of photovoltaic(PV) panels are connected in series, each of them is attached to DPP converter and then the output of the DPP converters are coupled in series. These output of the DPP converters need to balance the voltage each other to ensure the proper working of the PV generation when energy imbalance condition occurs such as partial shading. To balance the voltage under partial shading conditions, the secondary flyback rectifier of the main string boost-flyback converter is interfaced each of DPP converter. To validate the performance of the proposed method, computer simulation(PSIM) and 75watts' prototype hardware experiments are presented.

1:48 ***Fuzzy Adaptive Interactive Algorithm for Rig Balancing Optimization***

Viet-Dung Do (Ho Chi Minh City University of Transport, VietNam & DongAn Polytechnic, Vietnam); Xuan-Kien Dang (Ho Chi Minh City University of Transport, Vietnam); An-Tinh Le (BaRia-VungTau Province Vocational College, Vietnam)

Today, Vietnam has already been able to build rig, however monitoring control system is dependent on the oversea technology. On the other hand, lift systems is still used semi-automatic balancing method. Therefore, the application of automation and control algorithm for balancing the rig is a high priority problem. The article surveys fuzzy adaptive interactive controller (FAI) which is applied on balancing rig model to stabilize it as the fixed location. The system is simulated in Matlab under the influence of environmental factors such as operation cases and applied on experimental model. Comparing the proposed method has given the good result than the linear control methods other such as Fuzzy-PID.

2:06 ***Real-time Video Enhancement on FPGA by Context-based Fusion Technique***

Sang Nguyen and My Van The Nguyen (University of Information Technology, Vietnam); An Huynh (University of Information Technology & DH CNTT, Vietnam); Dao Tran (University of Information Technology, Vietnam)

This paper proposes a new method for video enhancement based on context-based fusion technique with respect to surveillance applications in real-time. In addition, a FPGA-based design for the proposed method is also presented. The developed technique here outperforms the original methods by without complex formulas and being time-effective, whereas the output videos still keep a high quality. The effectiveness of this method is also demonstrated through extensive experimental results along with quantitative measures. Besides, we also set up successfully a real system to assure that our hardware design is feasible and straightforward to apply into practice.

2:24 ***A 180-nm CMOS Bitmap-Index-Based Query Processor for Fast Data Analytics***

Xuan-Thuan Nguyen and Hong-Thu Nguyen (The University of Electro-Communications, Japan); Pham Cong-Kha (The University of Electro-Commununications (UEC), Japan)

Fast database analytics has become increasingly important nowadays due to the massive growth of global data created by social networking services, mobile devices, and Internet-of-Things. In this paper, a high-performance 180-nm query processor using bitmap index technology is presented. The parallel processing is fully applied in the processor so that thousands of records can be queried in every clock cycle. The post-simulation results prove that a 1.8-V 200-MHz processor can process as many as 5.7$\times$10^6 queries per 92.7$\times$10^6 records in every second.

2:42 ***Null Convention Logic (NCL) based Asynchronous Design - Fundamentals and Recent Advances***

Linh Duc Tran (RMIT University Vietnam, Vietnam); Glenn I. Matthews and Paul Beckett (RMIT University, Australia); Alex Stojcevski (RMIT University Vietnam, Vietnam)

As clock skew and power consumption have been become major challenges in deep submicron design of synchronous circuit, asynchronous design, especially Null Convention Logic (NCL) subset, is gaining more and more attention in the renewed interest. NCL methodology eliminates problems related to clock tree and also, can significantly reduce power consumption, noise and electromagnetic interference (EMI). In this paper, we briefly provide a historical overview of asynchronous design then presents a comprehensive introduction to the NCL design approach, from fundamentals to recent advances and implementations. In addition, automation design flows for NCL circuits are also discussed

TOP

TSN:3 Telecommunications Systems and Networks

Room: Lotus

1:30 ***Throughput Analysis of Energy Harvesting MIMO Relay Systems over Nakagami-m Fading Channels***

Ngoc Phuc Le and Nguyen-Son Vo (Duy Tan University, Vietnam); Tiep Minh Hoang (Queen's University Belfast, United Kingdom)

In this paper, we consider two-hop multi-input multi-output (MIMO) relay wireless systems with energy harvesting. In each hop, transmit antenna selection (TAS)/receive antenna selection (RAS), TAS/maximum ration combining (MRC), or maximum ratio transmission (MRT)/RAS is employed. Also, a relay harvests energy from the source via either a time switching-based relaying protocol (TSR) or a power splitting-based relaying protocol (PSR). We perform unified analysis of the resulting eighteen system configurations over Nakagami-m fading channels. Specifically, we derive exact and approximated closed-form expressions for ergodic capacity and throughput. Moreover, optimal energy-harvesting time (in TSR-based system) and optimal power-splitting ratio (in PSR-based system) to achieve maximum throughput at high signal-to-noise-ratio (SNR) are analyzed. Impacts of various MIMO processing schemes and energy harvesting mechanisms on the system performance are also examined and discussed. All theoretical analysis are corroborated by simulations.

1:45 ***Compact and Power-Efficient 5 GHz Full-Duplex Design Utilizing the 180\degree~Ring Hybrid Coupler***

Nathaniel Raymondi and Mike Seredich (University of Akron, USA); Tutku Karacolak (Washington State University Vancouver, USA); Nghi H Tran (University of Akron, USA); Duy H. N. Nguyen (San Diego State University, USA)

This paper presents a compact and power-efficient 5 Ghz in-band full-duplex design in ANSYS HFSS using the 180-degree ring hybrid coupler. The proposed design achieves an excellent isolation of 57dB by taking advantage of destructive interference between two radiating antennas attached to the coupler, leading to a large reduction in self-interference. The design is passive and hence overcomes additional power requirement for adaptive channel estimation. In addition, it has a very workable physical size for the desired frequency of operation. The proposed FD design is therefore compact and power-efficient, which can be used in mobile devices, such as cell phones or tablet/phablet devices for a more flexible and greater contention of scarce RF resources.

2:00 ***Joint Time Switching and Rate Allocation Optimization for Energy Efficiency in Wireless Multimedia Sensor Networks***

Thanh-Hieu Nguyen, Nguyen-Son Vo and Ba-Cuong Huynh (Duy Tan University, Vietnam); Hoang Minh Nguyen (Banking University of HCM City & Saigon Institute of Information Communications Technology, Vietnam); Thu De Huynh (Huazhong University of Science & Technology, Vietnam)

In wireless multimedia sensor networks (WMSNs), multimedia contents from remote areas are captured by camera sensors (CSs) and sent to data center via cluster heads (CHs) and base stations (BSs) for the purpose of monitoring. The problem in WMSNs is that enabling multimedia streaming, e.g., video streaming, demands high quality and consumes considerable bandwidth and energy resources, meanwhile, the CSs, CHs, and wireless channels are energy- and bandwidth-constrained and

diverse lossy. In this paper, we propose a joint time switching and rate allocation optimization scheme for WMSNs to minimize energy consumed by capturing, packetizing, and transmitting the video contents, while conserving bandwidth and guaranteeing high quality. In particular, firstly, a time switching optimization (SOP) problem is formulated and solved for optimal capture durations of each CS, so as to minimize the capture energy consumption. Secondly, to minimize energy consumed by packetizing and transmitting, we formulate a rate allocation optimization (ROP) problem and solve it for optimal rates allocated to each video for packetizing and transmitting under bandwidth resource and quality constraints. Simulation results show that our proposed SOP and ROP schemes can significantly enhance the performance of WMSNs in terms of minimum energy consumption, bandwidth efficiency, and high quality.

2:15 ***On the Efficient Use of Multi-line Rate Transponder for Shared Protection in WDM Network***

Dao Thanh Hai and Kha Manh Hoang (Hanoi University of Industry, Vietnam)

This paper introduces the conceptual operation of a simple multi-line rate (MLR) transponder having two bit-rate options and thereby proposes a novel protection scheme based on rate-adaptive operation. The MLR transponder is proposed to operate at lower rate to handle working capacity and in case of failure event, it could be temporarily tuned to higher rate to support protection capacity. We formulate the network design with shared mesh protection considering our new proposal as integer linear programming problem. Extensive simulation over numerous traffic matrices and common network topologies are performed to investigate efficiency of our protection proposal compared to traditional approach in terms of total transponder count, cost issues and energy consumption.

2:30 ***An Efficient Genetic Algorithm Approach for Solving Routing and Spectrum Assignment Problem***

Dao Thanh Hai and Kha Manh Hoang (Hanoi University of Industry, Vietnam)

In flex-grid optical network, routing and spectrum assignment (RSA) problem is a crucial task for planning and operating. Due to the non-deterministic polynomial time (NP-hard) complexity of problem, efficient computing techniques are always sought out with the aim to not only achieve good solutions but also in an efficient time span. In this context, this paper addresses the static version of RSA problem in a single objective scenario. We propose efficient meta-heuristic based on genetic algorithm (GA) to provide (near-) optimal solutions to the problem. The effectiveness of GA-based heuristic is bench-marked with exact approach based on integer linear programming (ILP) and other traditional heuristics for a set of scenarios. It is shown that the proposed GA heuristic exhibits better performance than typical heuristics and indeed could achieve optimal solutions in most cases while the running time is still highly manageable.

2:45 ***Walsh-Hadamard Precoded Circular Filterbank Multicarrier Communications***

Quang Duong and Ha Nguyen (University of Saskatchewan, Canada)

Circular filter bank multicarrier communication (C-FBMC) is an emerging multicarrier communication technique which combines the classical FBMC/OQAM with circular convolution. It has a block based structure and achieves orthogonality among subcarriers. This paper applies Walsh-Hadamard precoding scheme to C-FBMC to exploit the frequency diversity in a multipath channel. The theoretical approximation for the bit error rate (BER) of the resultant scheme, abbreviated WHT-C-FBMC, is derived. Its BER performance is also compared to the performance of precoded GFDM. Results show that the theoretical results match well with simulation results and WHT-C-FBMC is superior than WHT-GFDM.

Tuesday, January 10, 15:00 - 15:30

Coffee break TOP

Tuesday, January 10, 15:30 - 16:30

Invited talk: In-band Full-duplex Radios: Networking and Security Issues Details TOP

Diep N. Nguyen

Room: Lotus

In-band Full-duplex Radios: Networking and Security Issues

Diep N. Nguyen

University of Technology Sydney, Australia

Email: Diep.Nguyen@uts.edu.au

Abstract

The self interference suppression (SIS) capability allows a transmitting device to suppress its self-interference up to the noise floor, enabling two wireless radios to simultaneously transmit and receive on the same channel and even using the same antenna array. Radios with this in-band full-duplex (IBFD) capability have the potential to not only double the network throughput but also help solve various issues (e.g., Tx deafness, hidden/exposed nodes) at the MAC and network layers. Additionally, one can exploit the SIS capability in various applications like indoor localization, securing wireless transmissions. This talk gives an overview on recent developments of SIS and its implications on wireless networking and securities. Our latest findings on the network capacity, anti-jamming solutions, eavesdropper countermeasures for IBFD radios and their experimental prototypes are also discussed.

Tutorial Duration

60 minutes

Biography

http://web.uts.edu.au/staff-photos/Diep-Nguyen.jpgDiep N. Nguyen is a faculty member of the School of Computing and Communications, University of Technology Sydney (UTS). Before joining UTS, he was a DECRA Research Fellow at Macquarie University, a member of technical staff at Broadcom (California), ARCON Corporation (Boston), consulting the Federal Administration of Aviation on turning detection of UAVs and aircraft, US Air Force Research Lab on anti-jamming. He has received several awards from LG Electronics, University of California, San Diego, The University of Arizona, US National Science Foundation, and the Australian Research Council, including the best paper award finalist at the WiOpt conference (2014) and the discovery early career researcher award (DECRA, 2015). He received B.Sc., M.E., and Ph.D. degrees in Electronics, Electrical and Computer Engineering from PTIT, University of California, San Diego (UCSD) and The University of Arizona (UA), respectively. His recent research interests are in the areas of computer networking, wireless communications, and machine learning with emphasis on systems' performance and security/privacy.

Tuesday, January 10, 15:30 - 17:18

TSN:5 Telecommunications Systems and Networks

Room: Rose

3:30 ***The peculiar third-order differential characteristics of Midori64 block cipher(II)***

Yusuke Takahashi, Yasutaka Igarashi and Toshinobu Kaneko (Tokyo University of Science, Japan)

Midori64 proposed by Banik et al. in 2015 is an SPN-type block cipher with 128-bit secret key. The higherorder differential characteristics of the boolean polynomial of encryption function can be exploited for cryptanalysis. In this paper, we show a variety of the peculiar third-order differential characteristics of Midori64 block cipher, and theoretically analyze the characteristics.

3:48 ***Chaos-based Spread-Spectrum Using M-ary PSK and OFDM-MIMO***

Nguyen Xuan Quyen, Lam Nguyen-Tung and Do Huy Duy (Hanoi University of Science and Technology, Vietnam); Nguyen-Son Vo (Duy Tan University, Vietnam); Nam-Phong Nguyen (Queen's University Belfast, United Kingdom)

This paper proposes a chaos-based direct-sequence spread-spectrum (CDSSS) communication system using M-ary PSK modulation in combination with MIMO-OFDM technique. This combination aims at improving the performance as well as capacity of the conventional CDSSS systems over multipath fading channels. In the transmitter, the data is modulated by an M-PSK modulator whose output is fed to a MIMO encoder. Two resulting signals are spread by directly multiplying with chaos-NRZ sequences and then put into the corresponding OFDM modulators. The output signals are transmitted through a multipath fading channel using multiple transmitting and receiving antennas. In the receiver, beside the use of OFDM demodulation, chaotic despread-spectrum, and M-PSK demodulation, a V-BLAST algorithm with Minimum mean squared error (MMSE) equalization is applied to decode and recover the data. Schemes for the transmitter and receiver are described in detail and their BER performance over the multipath Rayleigh fading channel is evaluated by means of numerical simulations. The obtained results prove that the performance and capacity of the proposed system are significantly enhanced and can be adjusted by changing the values of M-ary level, spreading factor or the number of used antennas.

4:06 ***Design of An Improved Multi-carrier DCSK System for Digital Communications***

Nguyen Huu Long (HUST, Vietnam); Nguyen Xuan Quyen (Hanoi University of Science and Technology, Vietnam); Van Yem Vu (Hanoi University Of Science and Technology & School of Electronics and Telecommunications, Vietnam)

In this paper, we propose a differential chaos-shift keying (DCSK) system using multi-carrier modulation (MCM), namely improved multi-carrier DCSK (IMC-DSCK), which can be considered as an improve version of conventional (MC-DSCK) system. Instead of transmitting the chaotic spreading sequence on a predefined subcarrier as in the conventional MC-DCSK, in the proposed system, a DCSK-modulated signal is sent via this subcarrier. The remaining parallel bit streams are multiplied with the same repeated reference sequence and then sent by the corresponding subcarriers. In the receiver, the repeated reference is retrieved from the signal on the predefined subcarrier and used for the demodulation. Structure and operation of the IMC-DCSK system is designed and described. BER performance under AWGN and Rayleigh fading channels is evaluated by numerical simulations. The obtained results show that the spectral efficiency and BER performance of the IMC-DCSK system are enhanced in the comparison to those of the MC-DCSK system.

4:24 ***Power Splitting for MIMO Energy Harvesting in Multi-User Networks***

Tam Ho and Hoang D. Tuan (University of Technology, Sydney, Australia); Ali A Nasir (National University of Sciences and Technology (NUST), Pakistan); Trung Q. Duong (Queen's University Belfast, United Kingdom)

We consider a multicell multi-user multiple-inputmultiple- output (MU-MIMO) network and propose the efficient design of precoding matrices for the sum throughput maximization under throughput QoS constraints and energy harvesting (EH) constraints for energy-constrained devices in both downlink (DL) and uplink (UL) transmissions. We employ power splitting (PS) approach at the receiver to ensure practical EH and information decoding (ID). The considered practical problem is quite complex due to highly non-convex objective and constraints. Towards this end, we develop a new path-following algorithm for its solution, which just requires a convex quadratic program at each iteration and promises quick convergence.

4:42 ***A Continuous Compressive Estimation Method with MSE-Optimal Thresholding for OFDM Channels with Off-Grid Quantization Paths***

Yuexing Peng (Beijing University of Posts & Telecoms, P.R. China); Da Fu (Beijing University of Posts and Telecommunications, P.R. China); Peng Wang (Huawei Technologies Sweden AB, Sweden); Yonghui Li (University of Sydney, Australia)

In orthogonal frequency-division multiplexing (OFDM) systems, the broadband channel features sparse structure in delay domain. By fully exploiting the sparse structure of channels, transform domain (TD) channel estimation (CE) methods such as discrete Fourier transform (DFT) method and compressed sensing (CS)-based methods can greatly upgrade the performance of channel estimation. When the pathes of the channel are not located in the sampling grids, which is a normal case due to the randomly distributed path delay, power leakage effect happens. This "off-grid" problem will severely degrade TD methods. In this paper, the negative effect due to the off-grid problem is analyzed, and the improvement of the first-order Taylor approximation method to resist power leakage is also analyzed. Then an enhanced CS-based method is proposed, which combines first-order Taylor approximation and thresholding to minimize the mean squared error (MSE) of CE and the detection resolution of path delays. Monte Carlo simulations are presented to evaluate the performance of the proposed method, and the results show that it greatly enhances the CE performance in the low to medium signal-to-noise ratio (SNR) region.

5:00 ***On the Energy Efficiency of NOMA for Wireless Backhaul in Multi-Tier Heterogeneous CRAN***

Huu Q. Tran (Ho Chi Minh City University of Technology and Education, Vietnam); Truong Quang Phuc (HCMC University of Technology and Education, Vietnam); Ca V. Phan (Ho Chi Minh City University of Technology and Education, Vietnam); Quoc-Tuan Vien (Middlesex University, United Kingdom)

This paper addresses the problem of wireless back- haul in a multi-tier heterogeneous cellular network coordinated by a cloud-based central station (CCS), namely heterogeneous cloud radio access network (HCRAN). A non-orthogonal multiple access (NOMA) is adopted in the power domain for improved spectral efficiency and network throughput of the wireless down- link in the HCRAN. We first develop a power allocation for multiple cells of different tiers taking account of the practical power consumption of different cell types and wireless backhaul. By analysing the energy efficiency (EE) of the NOMA for the practical HCRAN downlink, we show that the power available at the cloud, the propagation environment and cell types have significant impacts on the EE performance. In particular, in a large network, the cells located at the cloud edge are shown to suffer from a very poor performance with a considerably degraded EE, which accordingly motivates us to propose an iteration algorithm for determining the maximal number of cells that can be supported in the HCRAN. The results reveal that a double number of cells can be covered in the urban environment compared to those in the shadowed urban environment and more than 1.5 times of the number of microcells can be deployed over the macrocells, while only a half number of cells can be supported when the distance between them increases threefold.

Tuesday, January 10, 16:30 - 17:18

TSN:4 Telecommunications Systems and Networks

Room: Lotus

4:30 ***A Study on Link Quality in Single Hop Sensor Networks with Brownian Motion***

Trong-Minh Hoang (Posts and Telecommunications Institute of Technology, Vietnam)

Wireless sensor networks play as a key important role in Internet of things era, they provide a lot of utilized applications deployed in quite different environments. Beside its clear benefits, a wireless sensor network has to face with several challenges which come from a practical environments such as interference, energy limitation, transmission constraints or mobility model. Especially, several sensor networks acted in underwater, micro-sensors or human being environments introduce new limitation of network performance due to unpredicted movement of nodes. To exploit this effect, this study considers a link quality issue as in throughput aspect of single hop Brownian wireless sensor networks through analysis and numerical verification methods. The relationship of link throughput with other real conditions such as movement specifications and packet size is delivered to reach optimal transmission performance.

4:46 ***A Method to Approximate the Transmission Rate of Phase Signal with Amplitude Uncertainty***

Truc Thanh Tran (Danang Department of Information and Communication, Vietnam); Duy H. N. Nguyen (San Diego State University, USA); Sinh Nguyen (Duy Tan University, Vietnam); Van-Dung Hoang (Quang Binh University & University of Ulsan, Vietnam)

This paper considers the case of transmitting and receiving a continuous phase signal whose amplitude is degraded by an unknown uniformly distributed real signal. Therefore, the receiver does not have the knowledge of the instantaneous amplitude. In such context, this study is aimed at calculating an approximately transmission rate of the continuous phase signal with a consideration of the amplitude uncertainty. Simulation results are also provided to validate the theoretical analysis. They show that the approximately theoretical expression is in agreement with the simulated version when the transmitter uses sufficiently large transmitting power. We also provide an example of cooperative spectrum sharing as a demonstration of application of this analysis in practice.

5:02 ***Towards An IoT Network Testbed Emulated over OpenStack Cloud Infrastructure***

Quan Le-Trung (University of Information Technology - VNUHCM, Vietnam)

Internet of things (IoTs) and the development of its network protocols, network architectures, and applications, are hot research topics recently. However, testing and building such a real-time IoT application takes a high cost due to the heterogeneity and a variation on the number of IoT devices, i.e., the scalability. The work in this paper, instead, reduces such the cost and focuses on the development of an IoT emulation testbed to deploy different IoTs applications, to evaluate and measure the performance of IoT network protocols, under flexible logical network architectures, e.g., Tree, with reasonable cost. This IoTs emulation testbed has been designed and deployed to run on the OpenStack cloud platform and high-speed network infrastructure in the Data Center of University of Information Technology-VNUHCM

Tuesday, January 10, 18:00 - 21:00

Banquet TOP