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# On Target Recognition and Classification by a Polarimetric Radar

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**Summary**

In this letter, an overview on target recognition and classification is given, then the contributions of Yang's lab. in Tsinghua University are summarized, including feature extraction, target recognition and classification. Finally some problems and conclusions will be given.

## 1. Background

For fully utilizing the information of EM waves, Sinclair, Kennaugh, et al., at Ohio State University successively began fundamental studies on polarization effects from the middle 1940s [1]. Following Sinclair's work, Kennaugh in the early 1950s presented the theory of the optimal polarization [2]. He demonstrated that there exist polarization states for which the radar receives maximum or minimum power. These optimal distinct polarization states are called the characteristic polarization states. By expanding on Kennaugh's work [2], Huynen, another pioneering radar polarimetrist, derived his own approach to radar target phenomenology which culminated in his famous dissertation: "Phenomenological theory of radar targets" [3] in 1970. Huynen presented a set of parameters, i.e., Huynen's parameters. With these parameters, we can describe a target. In addition, Huynen also used the sequent co-pol nulls on the Poincare sphere for describing a moving target. Some years later, Chaudhuri and Boerner [4] used the first order polarization correction to physical optics for validation analysis of Huynen's target-descriptor interpretations of the Kennaugh matrix elements. All these works were the contributions on target recognition by the pioneers.

In 1980s, a special imaging polarimetric radar was made, i.e., AirSAR. It is an airbrone polarimetric synthetic aperture radar (SAR) system. After that, many polarimetric SARs were developed, e.g., PISAR-1/2, E-SAR/F-SAR, SIR-C/X-SAR, ALSO-1/2, Radarsat-2, RerraSAR, TanDEM-X, GF-3, and so on, and we have obtained huge polarimetric SAR data during the past 30 years, which can be used for target classification.

In this letter, we will give an overview of target recognition and classification, then we will give a summary on the contributions of Yang's lab, including feature extraction, and target recognition and classification. In addition, we will give some important conclusions.

## 2. Overview of Target Recognition and Classification

Feature extraction is an important step for target recognition and classification. Besides the contributions of Kennaugh, Huynen, and Boerner, some other parameters are also important, such as polarization ratio, phase difference and so on. On the other hand, target geometrical structures are also used for target recognition. For example, the symmetry and the ratio of length to width are often used for ship classification.

An important approach to feature extraction is target decomposition. Since Huynen's original work, various decomposition techniques have been proposed, including the Krogager decomposition [5], the Cloude and Pottier decomposition [6], the Freeman-Durden decomposition [7], the Yamaguchi decomposition [8], the Touzi decomposition [9], the Cameron decomposition [10], the adaptive model based decomposition [11]. However, it is impossible to find a matrix to describe various volume scattering. So we still need to improve the volume scattering model in this approach. With target features and some possibility distributions, we can classify different kinds of targets/land covers. A lot of investigations have been made, e.g., the complex Wishart distribution based method [12], target decomposition based methods [6, 7, 13], Fuzzy theory based method [14], multi-frequency SAR data fusion based methods [15, 16] and quantitative comparison of classification capability of fully polarimetric versus dual and single-polarization SAR [17]. In addition, neural network based method was used for land cover classification by many researchers (e.g., [18]), and more recently, deep leaning based method was also used [19].

It should be pointed out that image filtering is the first step and it is useful for land cover classification. Lee made important contributions to SAR image filtering [20, 21] and target classification [12-14, 17].

## 3. The Contributions of Jian Yang's Lab

Yang et al., introduced the concept of the periodicity and quasi-periodicity of a scattering matrix and proved that many different targets may have the same scattering matrix [22]. It implies that the Huynen's parameters cannot be used for measuring a complex target. It is also means that it is impossible to recognize a target by using a scattering matrix only.

Inverse scattering technique is important for target recognition/classification. Yang' team employed the sparse Bayesian multitask learning to present the formulas for Bayesian inference as well as the algorithm flowchart. Experimental results demonstrated that the proposed polarimetric inverse scattering method can be used to effectively extract the characteristics of canonical scatterers [23].

Yang et al., also introduced the concept of stable matrix decomposition, and demonstrated the instability of Huynen's decomposition [24]. He hence proposed a modified Huynen's decomposition which can be used to extract the desired target scattering matrix from a measured Kennaugh matrix [25]. In addition, Yang's team also modified several decomposition methods [26-28]. Another approach to feature extraction is to introduce the concept of similarity parameter of two matrices and derived the measures of single bounce scattering and double bounce scattering [29]. This approach is independent of matrix decomposition, quite different from the traditional approaches. Yang et al., proposed a simple formula of the polarization entropy and the running time by the proposed formula is just one twentieth of that by the traditional approach [30].

Based on the similarity parameters, Yang's team proposed several methods for target classification, including the supervised and unsupervised classification [31, 32]. High classification accuracy was demonstrated because of the separability of different targets in the similarity parameters based feature space.

The OPCE is optimization of polarimetric contrast enhancement, which is to find the optimal polarizations of the transmitting antenna and the receiving antenna such that the power ratio of the desired target to undesired target/clutter [33]. Yang, et al., proposed the generalized OPCE (GOPCE) and then employed it for target detection [34, 35], and target classification [36] which has very high classification accuracy. Yang also proposed some other classification methods with his students, such as the expectation-maximization (EM) based method [37], the Markov random field based method [38], a modified H/alpha based method [39], the mixture model based method [40], the Riemannian Manifold based method [41] and so on. In addition, In addition, Yang's team proposed some approaches to dual-band or multi-band polarimetric SAR data fusion and obtained good target classification results [41-43].

## 4. Conclusion

In this letter, an overview on target recognition and classification was given. Then Yang's lab contributions to target recognition and classification were summarized. From our research results, we have the following conclusions

(1) It is impossible to recognize a target if one scattering matrix is used only. Using the polarimetric inversing scattering method, we can extract more detail geometrical information of a target.

(2) Target feature extraction is the key step for target recognition or classification. Now the useful features are not enough. It may be a possible method to use Electromagnetic Theory for extracting more features. Although target decomposition techniques have been developed by many researchers, it is still a problem to describe the volume scattering model. From the concept of the similarity parameter, we can also derive some important target features.

(3) For different targets/land covers, we should use different classification methods. In general, the classification accuracy can be increased if we fuse multi-band polarimetric SAR data.

(4) Deep leaning is a tool for target recognition and classification. However, it is not the best method for land cover classification. The main reason is that the land covers may have quite different geometrical shapes. In addition, if the possibility distributions of the land covers are complicated, it is different to get the statistical features.

(5) For some special large targets, e.g., airports, harbors, aircraft carriers, it is possible to recognize them by high-resolution polarimetric SAR images.

## 5. Acknowledgement

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# Research on Microwave Power Transfer and Microwave Chemistry at the Kyoto University

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Kyoto University

## 1. Introduction

Microwave technology is usually applied for wireless communication and remote sensing. It can also be used for heating applications, e.g., in microwave ovens and wireless power transfer (WPT). Microwave applications such as wireless communication and remote sensing can provide a more convenient life. Moreover, using microwave as a novel energy transfer method can solve energy problems for a sustainable society.

The Research Institute for Sustainable Humanosphere (RISH) at the Kyoto University aims to realize a sustainable Earth. One promising technology for a sustainable Earth is using microwave power. In the near future, a solar power satellite (SPS) with microwave power transfer (MPT) technology is planned for launch. A heating process using microwaves, namely, microwave chemistry, can reduce the total energy required for a chemical process to create new and additional valuable materials. Figure 1 depicts an image of a future sustainable Earth by RISH, Kyoto University. RISH defines “humanosphere” as the sphere that supports human activities, including the human living environment, the forest-sphere, the atmosphere and the space environment. We aim to investigate the present and future problems of the humanosphere and explore innovative technology that can contribute to the establishment of a sustainable society in harmony with the environment. In this article, the recent research activities on MPT and microwave chemistry at the Shinohara Laboratory of RISH, Kyoto University, are described.

Fig. 1 Image of a future sustainable humanosphere

## 2. Research Activities on Microwave Power Transfer and Microwave Chemistry

### 2.1 Microwave Power Transfer

MPT can be divided into three main technologies, microwave generation/amplification, microwave rectification, and antenna and beam formation. Important characteristics of MPT are high efficiency of the generator, amplifier, rectifier, and antenna, which includes technology for high accurate beam forming and target detecting. All MPT technologies are studied in view of the system at the Shinohara Laboratory.

We have developed various rectennas (rectifying antennas) as a receiver in the MPT system. A rectifier is a microwave circuit with a diode. The rectifier can theoretically achieve 100% conversion efficiency over the frequency range from microwave to DC. However, the RF–DC conversion efficiency has a peak with an optimum microwave input power and an optimum load because of the I–V characteristics of the diode. The RF–DC conversion efficiency also depends on the microwave frequency because of the diode characteristics.

Recently, we developed a new rectenna with constant efficiency and an extremely wide load range using a self-powered buck-boost converter at the 2.45 GHz band [1]. It can be applied as a DC power source for an MPT, ignoring impedance matching between the rectenna and the load.

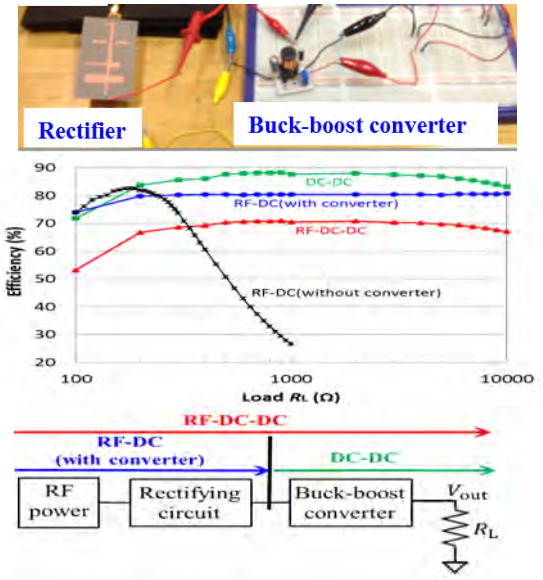


Fig. 2 Experimental result of RF–DC conversion efficiency of the developed rectifier using a self-powered buck-boost converter

We also developed a GaAs-based MMIC rectenna that operated at 24 GHz along with the NTT Corporation. Its dimensions were 1 mm × 3 mm with a maximum RF–DC conversion efficiency of 47.9% at

24 GHz [2]. We focused on the diode for the rectenna. We developed a GaN Schottky barrier diode along with the Tokushima University [3] and Sumitomo Electric Industries, Ltd [4]. We developed various rectennas not only for MPT but also for energy harvesting from broadcasting radio waves.

For a microwave generator/amplifier, we focused on both GaN amplifiers [5] and magnetrons as a high power and high efficiency microwave generator/amplifier. The magnetron for a microwave oven that operated at 2.45 GHz exhibited good characteristics such as high power, high efficiency, and low cost. Instability of frequency, lack of phase control, and high noise were some of its deficiencies. Our technology could realize a "phase controlled magnetron (PCM)" with a PLL feedback loop and injection locking [6] (Fig. 3). Moreover, a phased array could be developed using the PCMs. Currently, we are working on the development of a PCM at 5.8 GHz.

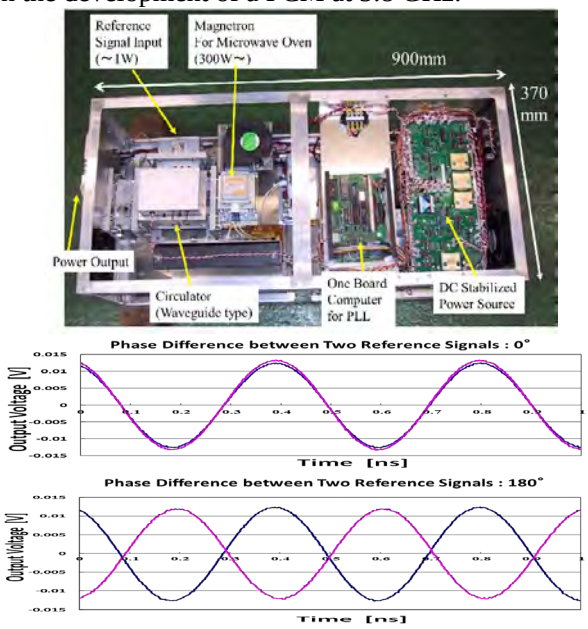


Fig. 3 Developed phase controlled magnetron and its waveform from two PCMs

Furthermore, we focused on the high efficiency beam forming technology with a phased array and target detection via a pilot signal. At RISH, a special phased array with 256 GaN MMIC amplifiers and beamforming network can be used as a research facility. With the phased array, we evaluated the position and angle correction (PAC) method, which was proposed for the phased array antenna of the panel-structured SPS by Mitsubishi Heavy Industries, Ltd. The PAC method estimated the positions of the antenna elements and calculated the correction values of the output phases from the pilot signal that is radiated from the receiving antenna to detect the receiving site. The simulation results confirmed that the PAC method can be applied to correct the beam shape, even if the pilot signal phase measurement contained errors [7].

In addition to this research, we performed some WPT experiments. In 2015, we conducted an experiment using a WPT-assisted sensor with a flying drone. Microwave power was transmitted from the flying drone to the sensors that received the microwave power. We assumed that the proposed WPT system can be applied to rescue victims using a batteryless vital sensor, for sensors at a volcano, and for the infrastructure inspection by placing the sensors inside concrete.

### 2.2 Microwave Chemistry

Microwave power can be applied not only for wireless power but also for heating, e.g., in microwave ovens. In comparison with conventional heating, microwave can heat materials rapidly, selectively, and internally. As a result of microwave heating, namely, microwave chemistry, some materials become better than materials that are created by conventional heating. Microwave chemistry is a new field of science that combines microwave engineering and chemistry. Technology of microwave chemistry and microwave power transfer is similar, e.g., high power microwave generator/amplifier and electromagnetic wave design with continuous waves.

Both professors of microwave engineering and chemistry belong to the RISH of Kyoto University. Good synergy can be brought forth for microwave chemistry. During FY2011–FY2016, Prof. Takashi Watanabe of the RISH along with the author of this study have been conducting a research project, namely, "Development of lignin-derived functional polymers from plants by catalytic reactions responsive to electromagnetic waves," at the Japan Science and Technology Agency and CREST Strategic Basic Research Programs [8]. In the project, new catalysts with an affinity to lignins in plant cell walls were synthesized and the absorption properties of electromagnetic waves were analyzed. The hyperfine molecular structures of entire lignified plant tissues were studied and highly efficient lignin-degrading reaction systems using the catalysts and a newly developed electromagnetic wave irradiator were developed, thereby producing linear type lignin and polymerizable monomers. The isolated molecules are purified and converted to functional aromatic polymers with a high level of physical strength, solvent tolerance, dispersibility, shock resistance, and ultraviolet absorption properties.

We also applied microwave heating technology to transform asbestos cement into a harmless waste. This was especially applicable after the Tohoku Earthquake in 2011 [9]. We developed a microwave rotary furnace with powers of 13.5 kW and 19 kW at 2.45 GHz using magnetrons to heat up the asbestos cement to 600–1050°C (Fig. 4). This was placed at Natori city, Miyagi, and experiments were conducted. We succeeded in effectively and rapidly transforming asbestos cement into harmless waste with microwave heating. A test apparatus was established with a 2 ton per day treatment capacity and was tested at an area affected by the 2011 Tohoku Earthquake. This work was supported by the Environmental Research and Technology Development Fund of the Ministry of the Environment of Japan during FY2012–FY2013.

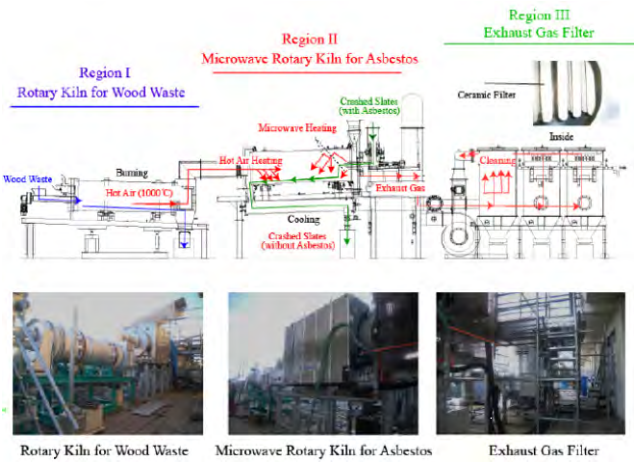


Fig. 4 Microwave rotary furnace installed at the area affected by the 2011 Tohoku earthquake (Natori City, Miyagi Prefecture, Japan).

### 2.3 Other Topics

Prof. Junji Miyakoshi and Dr. Shin Koyama belong to the Shinohara Laboratory and their research involves the evaluation of bioeffects by electromagnetic waves. They mainly perform in vitro studies on cells under electromagnetic waves to determine bioeffects.

Prof. Yohei Ishikawa also belongs to the Shinohara Laboratory and promotes a SPS and ocean inverse dam, which is a new concept in the new energy network consortium.

## 3. Collaborative Research Facility at RISH

There are various research facilities that promote microwave power transfer and microwave chemistry through collaborative research with universities. The facilities can be used by anyone who is interested in collaborative research of microwave applications, such as MPT and microwave chemistry, as well as other microwave applications, materials science, and chemistry. If you are interested in using the research facilities at RISH, please visit the website [10, 11].

### 3.1 AMETLAB, METLAB, and SPSLAB

Fig. 5 AMETLAB and plane-polar near field scanner

Advanced Microwave Energy Transmission Laboratory (AMETLAB) (Fig. 5) and Microwave Energy Transmission Laboratory (METLAB) are anechoic chambers (typically 1–40 GHz) with high power absorbers (>1 W/cm$^2$) used for MPT and other microwave applications. Their sizes are 18 m (L) × 17 m (W) × 7.3 m (H) and 16 m (L) × 7 m (W) × 7 m (H). SPS Laboratory (SPSLAB) has a shield room with a plane near-field scanner. In the AMETLAB, there is a large plane-polar near field scanner for the <10 m phased array antenna. In each facility, there are high power microwave amplifiers (<100 W) at 2.45 GHz and at 5.8 GHz, 5 kW–2.45 kW magnetron and parabolic antenna, phased array for MPT, rectenna array, network analyzer, spectrum analyzer, power meter, and other measurement systems.

### 3.2 ADAM

The Analysis and Development System for Advanced Materials (ADAM) was installed in FY2009 as a collaborative research facility to support microwave chemistry and advanced materials science research (Fig. 6). The ADAM comprised a microwave applicator, high power microwave generators/amplifiers of various frequencies, microwave measurement facilities, mass spectrometer, and two types of electron microscopes for inorganic and organic materials. All resources can be used for development and analysis of advanced materials.

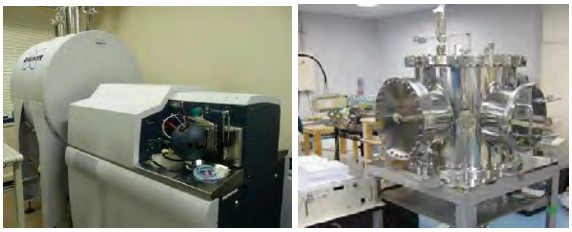

Fig. 6 Mass spectrometer and microwave applicator in ADAM

## 4. Other Activities Outside The Laboratory

Support from scientific societies as well as industry is very important to establish new science fields such as MPT and microwave chemistry.

### 4.1 Scientific Society Activities

A technical committee for Wireless Power Transfer (WPT) technology was established in 2014 by the IEICE Communication Society. The author was the first chair of the WPT technical committee from 2014 to 2015. The WPT technical committee covered not only MPT but also inductive/capacitive/resonance coupling WPT (kHz–MHz), electron devices, EMC, and power electronics. In the WPT technical committee, 6–7 workshops were held every year. There were more than 90 papers per year and more than 800 attendees each year. We established the Asian Wireless Power Transfer Workshop (AWPT) in 2015. In 2015, the first AWPT was held in Taipei, Taiwan. In 2016, the second was held in Chengdu, China. The AWPT was a very successful workshop that promoted WPT technology in Asian regions.

A technical committee of wireless power transfer was also established by the IEEE MTT Society, which is TC-26 of “Wireless Energy Transfer and Conversion” [12]. The author was the vice chair of the TC-26 from 2015 to 2016. The TC-26 conducted an IEEE Wireless Power Transfer Conference (WPTc) that was established by the author in 2011, in Kyoto. Currently, within the WPTc, over 150 papers were submitted and less than 90 papers were accepted. The IEEE MTTS

chose me as one of the distinguished lecturers to promote WPT technology from 2016 to 2018. In 2016, I gave 24 DMLs throughout the world.

In 2015, The Space Solar Power Systems Society was established in Japan. A Solar Power Satellite is one hopeful application of MPT for the future. The author is one of the founders and directors of the SSPS Society.

Microwave chemistry was supported by Japan Society of Electromagnetic Wave Energy Applications (JEMEA). JEMEA was established based on the Institute of Electromagnetic Wave Application, Japan (IEAJ) and the Microwave Technology Forum in 2006. JEMEA was recognized as a NPO (incorporated nonprofit organization) from Tokyo Metropolitan Government in 2007. In JEMEA, chemistry scientists and microwave engineers from various universities and industries collaborated to promote the electromagnetic wave energy applications. The author is one of the vice presidents of JEMEA in 2016.

### 4.2 Activities toward Industries

Industry supports science and technology, especially new fields of science, such as MPT and microwave chemistry. Therefore, expansion of these industries is very important.

In 2013, I established two consortiums to promote MPT and WPT technology. They were called Wireless Power Transfer Consortium for Practical Applications (WiPoT) with 29 companie [13] and Wireless Power Management Consortium (WPMc) with 35 companies [14]. We are predominantly promoting MPT applications in WiPoT and resonance coupling WPTs in WPMc. In 2016, the WiPoT contracted a Letter of Intent with the Broadband Wireless Forum, who is the main promoter of WPT technology in Japan. WiPoT and BWF collaborated to promote WPT technology. Concerning industrial WPT applications, an impact study of conventional wireless communication systems and human safety issues most important. Therefore, industrial WPT applications were discussed with the International Telecommunication Union (ITU). The discussion was initiated in 2013. The author is one of the representatives from Japan. ITU has published new report of beam (microwave) WPT in 2016 [15]. This is a first step toward WPT industries.

Prof. Yuji Wada of Tokyo Institute of Technology established No.188 committee of ‘excitation and reaction field by electromagnetic waves’ [16] in Japan Society for the Promotion Science (JSPS) in 2014 with us to promote the microwave chemistry with industries.

## 5. Conclusion

As participating members in the research activities at the Shinohara Laboratory of RISH, Kyoto University, fourteen students (B4, M1, M2, Ph.D in 2016) work hard with the same dream [17, 18]. Our common dream is a futuristic society with wireless power that includes a new material creation process using microwaves, a ubiquitous information society, IoT (Internet of Things) with batteryless sensors, unconscious and convenient wireless charging of mobile phones, and $CO_2$-free stable power from space using SPSs. “I have a dream.”

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# Radio Propagation Research for 5G and IoT

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Takuichi Hirano, Azril Haniz
School of Environment and Society, Tokyo Institute of Technology

## 1. Introduction

Nowadays, various applications of radios have been essential part of our lives, such as wireless communications. Recently, research and development of the next generation wireless communication system such as the 5G system have become one of the hot topics due to the demand for extremely high data throughput in mobile wireless systems. Meanwhile, it is also expected that every physical device in our life will have the capability of wireless communication, and will connect to networks for providing more precise and flexible services. However, to justify the real performance and the feasibility of the system, we believe that it is necessary to understand the actual radio channel characteristics in such scenarios.

We have investigated the radio propagation mechanism over a wide frequency range in various environments. For that purpose, we have also developed many types of channel sounders. In this article, we introduce the developed channel sounders and the results of several radio measurement campaigns conducted for that purpose. Finally, we also introduce the localization techniques that utilize the radio waves.

## 2. Channel Sounding Research For The Next Generation Wireless System

### 11 GHz band channel sounding

In the 5G system, the frequency bands from 6 GHz to 100 GHz, which are much higher than the frequency bands of the cellular network, are expected to be utilized for the mobile wireless communication. However, the radio propagation channel properties in these higher frequency bands have not been sufficiently investigated. Therefore, we have developed a 24-by-24 Multiple-Input and Multiple-Output (MIMO) channel sounder [1] as shown in Fig. 1 to investigate channel properties in 11 GHz bands. The channel sounder is an instrument to measure the transfer function of radio propagation channels by transmitting and receiving a predefined wideband measurement signal. Comprehensive measurements in indoor and outdoor environments have been conducted in 2012. From the measurement data, delay and angular properties of the propagation channel were estimated from combining the array data processing [2] as shown in Fig. 2.

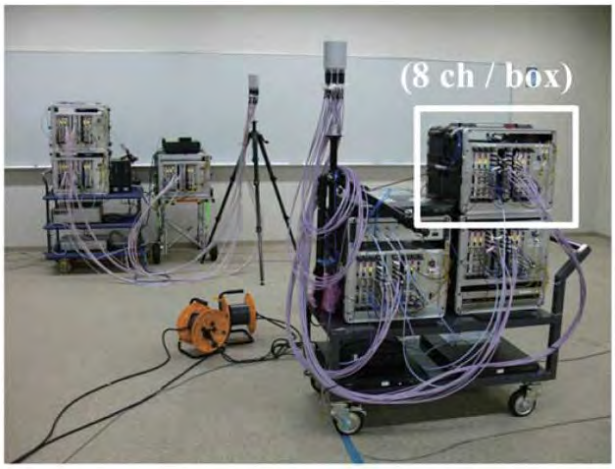



Fig. 1 11 GHz band channel sounder [1]

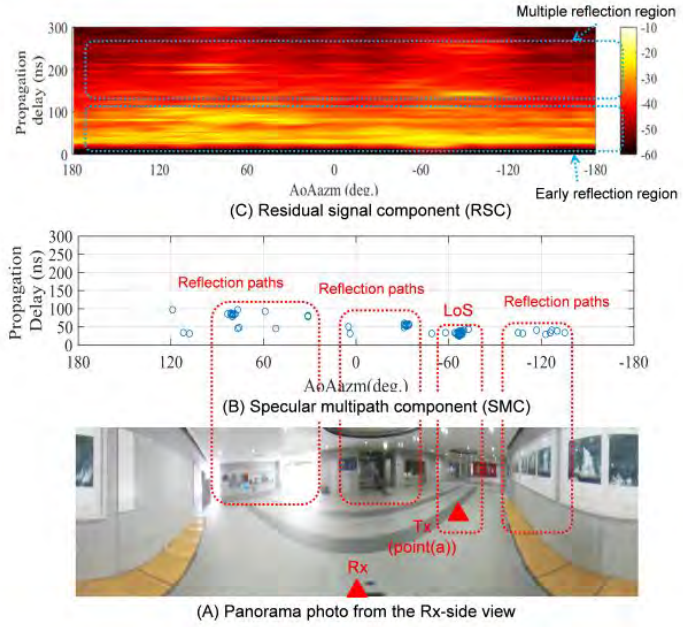



Fig. 2 11 GHz band channel measurement and delay and the angular characteristics of channel

### 60 GHz band channel sounding

We have also developed the channel sounder for 60 GHz band, which is one of the candidate frequencies for the 5G commercial service, in collaboration with Niigata University. For the development, we used the baseband units of the 11 GHz band channel sounder and combined them with commercial RF modules as shown in Fig. 3. Fig. 4 shows that the overview of the outdoor channel measurement by using the channel sounder [3]. The results showed that although the direct waves were significant, reflections and irregular

scatterings were not negligible in this frequency band. The measurement results are also expected to be utilized for the international standard channel models for the 5G system.

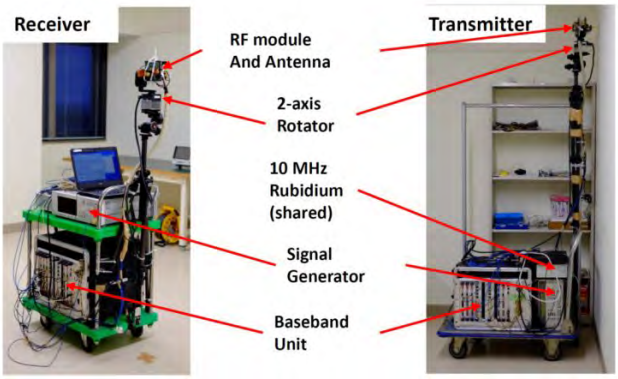



Fig. 3 60 GHz band channel sounder

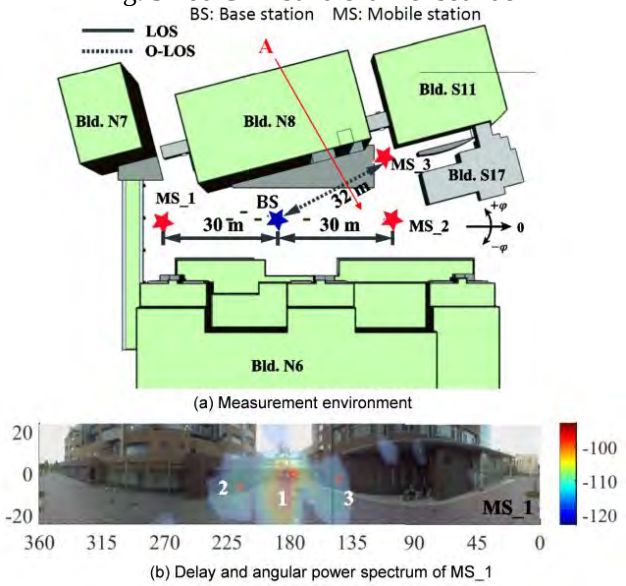
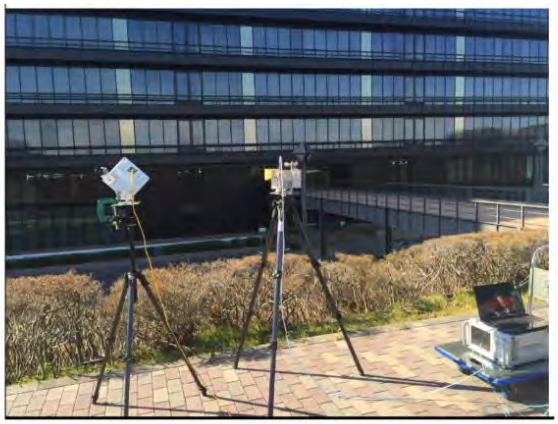



Fig. 4 60 GHz band channel measurement in an outdoor environment

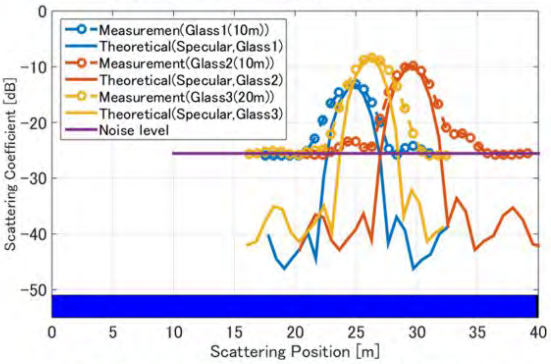
**Investigations of radio propagation mechanisms**

The target frequencies of the 5G system are very wide, and it is expected that several frequency bands will be used simultaneously for the communication to achieve both high data throughput and reliable network connectivity. Therefore, the clarification of the channel frequency characteristics becomes a more important issue. For the purpose, we are developing a more versatile channel sounder by utilizing the vector network analyzer (VNA). We are also promoting collaborative research and measurement with universities in Europe.

The clarification of scattering mechanism in higher frequency bands is also an important issue because irregular scatterings from physical objects such as floor, wall, and furniture occur more frequently, as the radio wavelength reduces to the order of the roughness of the scattering surface. We conducted measurements in 25 GHz band for investigating the scattering characteristics from surfaces with various shapes and different materials [4] as shown in Fig. 5. We are also investigating the radio propagation simulation method that takes into account scattering effects.



(a) Photo of the measurement




(b) Scattering Pattern Measurement

Fig. 5 Scattering characteristics measurement in 25 GHz band

## 3. Channel Sounding By Using Software Defined Radio Technology

### Channel Sounder Development on Software Defined Radio platform

Generally, the development cost of dedicated channel sounders is considerably high, and the equipment tends to become large-sized. This has limited the environments that we can conduct the measurements. We are also concerned that it may become an obstruction to radio propagation research as a result. To solve this issue, we have developed a versatile channel sounder on the commercial software defined radio (SDR) platform. Fig. 6 shows the overview of the developed channel sounders. Many platforms with a variety of specifications are offered in the Ettus/NI USRP series of products. We have developed the USRP N210-based channel sounder and conducted MIMO channel soundings by using the virtual array method [5]. We have also developed the Nuand bladeRF-based channel sounder to reduce the equipment size. Although the measurement bandwidth is limited due to the inferior sampling rate of analog digital converter (ADC) / digital analog converter (DAC) converter on those devices, we have proposed the multitone-overlapping frequency stepping method to increase the bandwidth [6]. Achieved measurement bandwidth is thought to be wide enough for evaluating the current system which operates in the UHF band.

| | |
|---|---|
| Center Frequency | 2.4 GHz |
| Bandwidth | 12.5 MHz |
| Transmission Signal | Multi-Tone (128 tones) |
| Transmit Power | 15 dBm |

(a) USRP N210 based channel sounder

| | |
|---|---|
| Center Frequency | 2.4 GHz |
| Bandwidth | 43.35 MHz† |
| Transmission Signal | Multi-Tone (128 tones)† |
| Transmit Power | 15 dBm |

†multitone-overlapping frequency stepping is applied

(b) BladeRF based channel sounder

Fig. 6 Channel sounders utilizing commercial SDR platforms

**Channel Measurements in Various Environments**

We have conducted channel measurements using the developed channel sounders in various environments and situations. Fig. 7 shows the channel measurement for the Body Area Network (BAN) application [7]. Because the radio propagation channel is significantly affected by the human body and its motion, we simultaneously captured the human body motion by using Kinect. We compared the measured channel with the simulated channel that takes into account the human body motion. Fig. 8 shows the channel measurement in an agricultural environment for future smart farming applications. We assumed the scenario that many sensor nodes are distributed in the field for gathering the growth information of crops. We investigated the influence of the growth degree of surrounding vegetation on the propagation channel. Fig. 9 shows the channel measurement using an unmanned aerial vehicle (UAV). Due to the congestion of the cellular network in urban area nowadays, 3-dimensional service areas are being constructed to accommodate users in high-rise buildings efficiently. We utilized a UAV to investigate the propagation loss characteristics in various radio propagation situations.

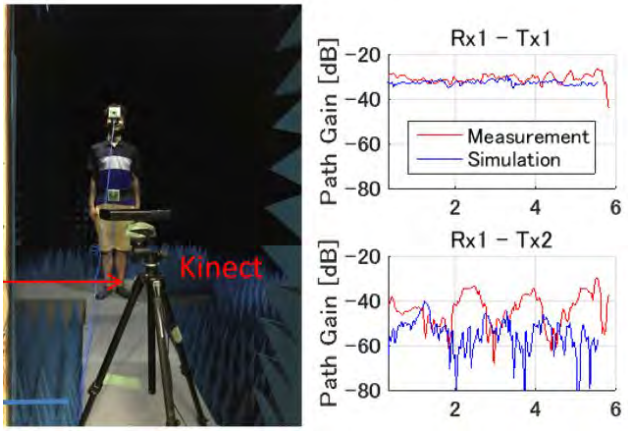



Fig. 7 Body Area Network Channel Measurement


Fig. 8 Channel Measurement in agricultural environment [6]

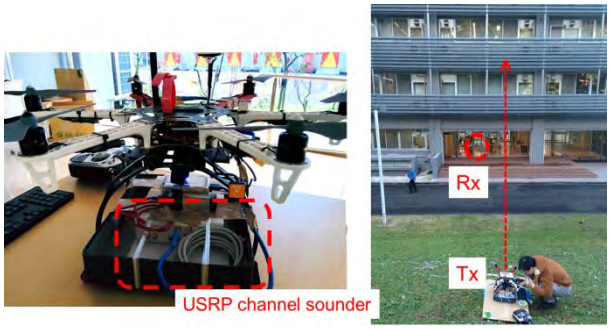



Fig. 9 Channel measurement by using UAV

**4. Localization Techniques By Utilizing Radio**

In our laboratory, we are also pursuing research on the application of radio waves and propagation channel characteristics for the localization of radios. One topic of research is on the localization of unknown radios in outdoor urban environments in collaboration with Koden Electronics. This is crucial because unknown radios may cause interference to other licensed radio systems and disrupt their services. Conventional localization techniques relying on the direct line-of-sight path face several challenges in the non-line-of-sight (NLoS) environment with obstruction of direct path, and also the lack of knowledge regarding the target's signal parameters when dealing with unknown radios.

To solve this issue, we have proposed several novel techniques which effectively utilize propagation channel characteristics as location fingerprints. One of the main features of the proposed algorithm is the interpolation of the propagation channel over several domains [8]. We have also employed the particle filter for dynamic tracking of a moving unknown radio, which can significantly reduce computation time without sacrificing localization accuracy. Localization performance of the proposed algorithms is evaluated through electromagnetic propagation simulations using commercial software, and results have shown high localization accuracy over a wide range of signal parameters. On-going research includes the theoretical analysis and modelling of localization error.

The increasing demand for location-based services in the recently years has also motivated research for accurate indoor localization systems. We are currently developing an indoor localization system utilizing low-

cost Raspberry Pi devices and the Bluetooth Low Energy (BLE) technology shown in Fig. 11. We are conducting collaborative research with National Taiwan University of Science and Technology.

Fig. 10 3D model of area surrounding Shinjuku Station, Tokyo in Wireless Insite software

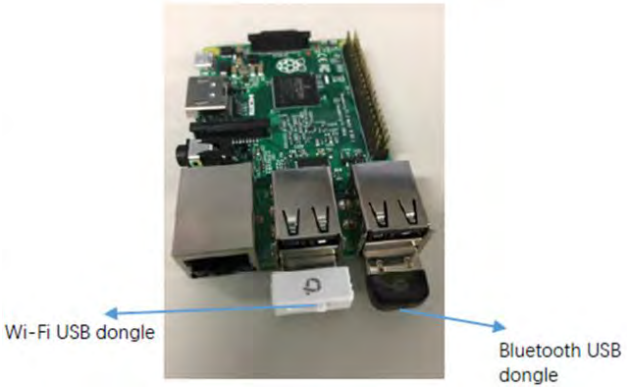



Fig. 11 Raspberry Pi2 device with Wi-Fi and Bluetooth dongles

## 5. Conclusion

In this article, we introduced our activities on radio propagation research. Although the radio propagation research has an accumulation of knowledge for its long history, it still has vast frontiers for academic and practical research topic. We would like to promote our research toward the realization of next generation IoT. Lastly, we would like to appreciate the support from collaborative research partners and all people concerned with our group.

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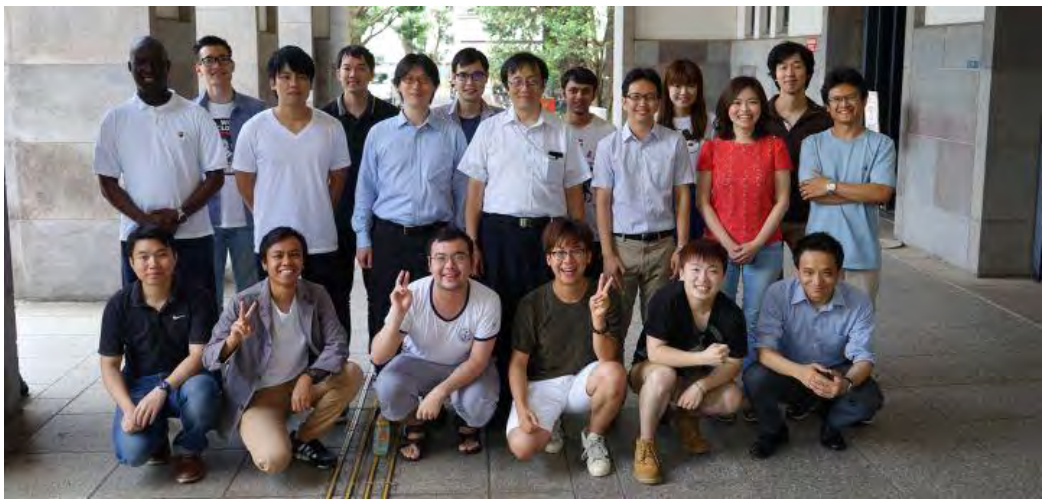

Our laboratory members (in July, 2016).

# From Bulgaria to Japan – Studying Abroad

Dimitar R. Kolev
National Institute of Information and Communications Technology

I have arrived in Japan from Bulgaria in 2010 to pursue my doctor degree and currently I work as a researcher in a Research center in Tokyo.

Let me introduce my home country Bulgaria first. Bulgaria is situated in the east part of Balkan Peninsula and it is a relatively small country (the area is around three times smaller than that of Japan). The neighbor countries are Turkey, Serbia, Republic of Macedonia, Greece and Romania.

Bulgaria is traditionally a Christian country since 865 AD and main is the Orthodox Church. During the Ottoman rule Islam has also been established and it is the second wide religion in the country.

Easter is one of the religion related holidays. During Easter we have a game called “egg-fight” with boiled and painted eggs. Each of two people holds his egg using the sharp or the blunt part of the egg. One egg is hold stable below, and the other hits it. If one egg is not broken on both sides after the fight it is a winner. The broken one is eaten by the owner. We also eat a special sweet egg bread with yogurt.

Fig. 1 Visiting the Architectural And Ethnographic Complex Etar in Bulgaria

Another big holiday is Christmas, which is a family holiday and it is celebrated differently than Japan and Catholic countries. For the true believers there is a 40-day fasting before Christmas and Easter during which people do not eat meat and fish. Although many people do not do the fasting, the traditional Christmas Eve menu is without meat, fish and eggs. The number of dishes that are present on the table is also specified (7, 9, etc.). Also, a home-made bread is prepared with a coin in it. On the Eve the eldest person would distribute the bread to each family member. The person who finds the coin is believed to bring the most money in the family in the next year. The typical drink for the night is wine. On the next day (25$^{th}$ of December) it is allowed to eat meat and since old days there is a tradition for the people who grow pigs to invite their family together and kill and eat a pig in the evening.

The birthday parties in Japan are different since the party is organized by other people for the birthday person. In Bulgaria the party organization and inviting the guests is done by the person who has a birthday. Also, it is believed to be bad to have birthday party before the birthday date.

Since I received my Masters degree from the Technical University of Sofia, I have worked for around two years in a company related to optical fiber networks. Since I had a deep interest in free-space optical systems, I decided to pursue a doctor degree in Waseda University in Japan on this topic.

Fig. 2 With the Best man just before the wedding

I have unforgettable experience since my first day in Japan. The planned arrival airport was Tokyo/Narita, but due to the strong wind we almost crashed on the lane. I was already seeing the asphalt and was glad that the over two-hour shaking is over, when the pilot suddenly rose the plane up again and we flew towards Osaka with the hope to make another try for Tokyo/Narita later when the wind is weaker. We were allowed to get off in Osaka if we were willing to. Due to the constant shaking we were not feeling well. It was Friday so I and some other people from Bulgaria decided to get off in Osaka and spend the weekend there. When we got off, however, we received free “shinkansen” tickets to Tokyo on the same day and after all we left for Tokyo. We were exhausted from the long day and were about to arrive in Tokyo late in the

evening so we called a Bulgarian friend who came to meet us.

Our hotel was in Ueno and after check in we went with our friend for a late dinner. We had fried mackerel and fried potatoes with some beer. Since that night I had no experience with Japanese food apart from sushi so I was relieved that there is food similar to the Bulgarian one.

Before coming to Japan I was studying the Japanese culture and traditions and I had no culture shock upon arrival. I was staying in an international dorm where I managed to find many friends including people from my university. Communication was mainly in English and nobody from ne freshmen felt lonely. I have chosen various university subjects to practice Japanese language so the study was quite interesting every day. I participated in different activities as English language volunteer, university nomikai, karaoke, climbing mount Fuji, etc. Also, each year my lab would have a summer seminar out of Tokyo, where we not only study, but also play soccer and basketball and in the evenings we would have BBQ and suika-wari game. I have very special and warm memories from our summer seminars especially from Karuizawa.

I have studied Japanese language in Bulgaria prior to coming to Japan to prepare for my daily life, but in the beginning it was very hard to use it. Among my international friends everybody was speaking only English so I was often the only person to use some Japanese language, for example, when we ask for the way to a station or a place to visit.

Generally I am very picky when I eat meat and fish and until I find dishes I can eat my main menu was fast food and snacks. I like Italian food, but the Italian restaurants in Japan are a little bit expensive so I could not afford to visit every day.


Fig. 3 Graduation ceremony in Waseda University

Compared to Bulgaria, the rules in Japan are very strictly adhered to with no exceptions. For example, when I arrived in Japan, I had to prepare a lot of documents in the first few days regarding my scholarship, bank account, residence card, etc. When I finished I went to sign up for standard Japanese classes. However, I have missed an orientation two days before and for this reason I was not allowed to sign up for regular classes. Although I explained I just arrived and there were a lot of important things to do for my stay in Japan prior to coming to school, there was no exception for me. While I felt the rules are too strict, I realized that this is very important for a country with huge population like Japan (over 120 million people with density of over 300 people per square km, compared to 7 million people in Bulgaria with density of about 60 people per square km) and in many cases the order and the speed of different services has amazed me alas the big number of customers.

Fig. 4 Climbing mount Fuji

The education systems of Bulgaria and Japan are also quite different. In Japan the school year starts in the beginning of April and in Bulgaria it starts in September. Both schools and universities in Bulgaria start the autumn term in September like the Japanese one with similar vacation around the end of December. Then the Spring term is until May (June for upper classes). Particularly big difference is the school day. In Bulgaria we have two shifts per day – morning (7:30 to around 13:00) and afternoon (13:30 to 6:30) one. Each class comes only for half a day and often the shifts change for each school term. That allows the students to have a lot of free time compared to the Japanese ones. When you come back from school, there is plenty of time to finish your homework and play with friends. There are no clubs and circles in the schools, but everybody can freely enter the school grounds and play soccer, basketball, etc., including students and parents.

The primary school in Bulgaria is 4 years, then mid school is another 4 years totaling in 8 years for general education. However, to enter high school there is an exam after the 7$^{th}$ grade. While the high school is also 3 years like Japan, the mid school and high school are often not separated and there are or two years in the high schools as preparatory or final 8$^{th}$ grade of the basic education prior to the high school which are also thought in the high school itself.

The university system is 4 years for bachelor degree, 1.5 years for master degree and 3 years for doctor degree in my university. If the student decides to study

a different major for his master compared to his bachelor normally, there is one additional preparatory year prior to the master courses and the total would be 2.5 years for master degree. In the bachelor degree there are lectures, seminars and laboratory experiment classes. There are no separated labs as in the Japanese system. Also, in my Bulgarian university at the end of each term each student has to collect signs from all the teachers for the term. If one cannot collect all the signatures, he is not allowed to attend the exams and has to repeat the school year.

Fig. 5 Participating an ITU conference

The doctor course is similar to the Japanese one but every year there is an internal presentation showing the progress. Also, there are teaching classes where the doctor student has to teach bachelor and master students lab exercises.

The job hunting is also completely different from Japan and there is no fixed long job hunting process so one can find and start work right away. Also, it is normal for first and second year bachelor students to start full time job during their studies and work and study in parallel. Thus the student can basically sustain his life and education (students loans are not popular) and upon graduation 2-3 years of work experience and additional skills allow better job opportunities. Normally, there is no overtime work and once the day is finished nobody would have any phone calls or emails related to work (although not officially forbidden by law as in some West Europe countries).

Apart from the interesting things in Japan there are also bad sides. Number one for me is the high price of the fruits. In Bulgaria normally fruits are sold in kilos. For example, in summer we would buy 1-2 kg cherries or strawberries and eat it as dessert for lunch. In japan the price is very high so it is hard to eat that much fruits every day.

Second thing is the health care system. I like the fact that I can use any clinic by just showing my health insurance card, but during holidays and the evening almost all clinics are closed and in big hospitals it is considered an emergency with very high taxes. In Bulgaria we have a personal GP doctor so each time somebody gets sick he first contacts his GP. If it is necessary to go to a specialist, the GP will prepare some documents and send the patient there. Also, emergency cases are free and big hospitals have 24 hour staff to accept and treat patients.

My wife gave birth to my child in Japan and I was surprised to hear that we need to make a reservation in the hospital for the scheduled birth day. Calling to different hospitals I was rejected several times since all the beds for this day were already full months in advance.

Immediately after receiving my PhD I was very lucky to start working in a research center in Japan and my work is in the same field as my interests and doctor course studies. I am participating in a project where instead of radio-wave communication between satellite and ground we develop equipment and conduct experiments for satellite-to-ground laser communication. When the laser beam propagates through the atmosphere, there are different atmospheric effects that will influence the signal. For example, the blinking of the stars in the night is due to the same atmospheric effects that influence the starlight. There is a wide field for research regarding these atmospheric effects and their influence on the propagating beam light and my laboratory is engaged in measurements, modelling, standardization activities, etc. Being part of my current team and participating in our research projects I feel how significantly I level-up my knowledge and experience. Thus I and my family enjoy our life in Japan.

**Dimitar Kolev**

After receiving his master's degree from the Technical University of Sofia in 2008, he has worked in a private company for about two years. Then he came to Waseda University in Japan as a research student and received his doctor degree in 2014. Currently he is working as a researcher in the National Institute of Information and Communications Technology in Tokyo in the field of space laser communications.

# Report on the 30th Optical Communication Systems Symposium
## "Following the traces of optical communication and looking ahead"


Takayuki Kobayashi† and Yoshinori Yamamoto‡
†NTT, ‡Sumitomo Electric Industries, Ltd.

### 1. Introduction

The 30th Optical Communication Systems (OCS) Symposium was held on Dec. 20–21, 2016 at the Toray Human Resources Development Center in Mishima City, Shizuoka, Japan. The symposium was sponsored by the IEICE Technical Committee on OCS, and organized in cooperation with the IEEE Photonics Society Japan Chapter, the Photonic Internet Forum (PIF), and the IEICE Technical Committees on Photonic Network (PN) and Extremely Advanced Optical Transmission Technologies (EXAT). To celebrate the 30th anniversary, we entitled this year's symposium "Following the traces of optical communication and looking ahead," which was intended for optical communication engineers to review the accomplishments of this field over 30 years and discuss future directions to meet expectations from a wide variety of services and applications. A special logo representing "30" in a QAM constellation map was also designed for the symposium. The number of this year's participants was 210, and 27 exhibitors participated in the symposium.

### 2. Technical Sessions

The Day 1 (Dec. 20) started with the opening session. First, Dr. Akira Hirano, the IEICE OCS committee chair, gave a welcome address with an overview of recent activities and future plans of the OCS technical committee. The opening session was then followed by a keynote speech by Dr. Kazuo Hagimoto (NEL), in honor of his reception of the Medal with Purple Ribbon, which was entitled "Optical transmission: challenges from analog to digital – with deepest gratitude to OCS community –" (Fig. 1). He described the milestones of optical communication technologies over the last 30 years, namely optical amplifier repeater systems, WDM transmission and digital coherent technologies, together with a number of historical photos and episodes in the old days. His remarks on the fundamental role of optical communication as a technological driving force of the ICT infrastructure, justified by his own career, were convincing and left a profound impression among the audience.

The rest of the technical sessions on Day 1 consisted of a poster session and a workshop. In the poster session, there were 25 posters presented by young researchers and three award winners. The workshop on Day 1 featured the historical development of optical fiber and device technologies, which included the following three invited talks (Fig. 2): evolution of transmission fibers and their perspectives by Dr. Shoichiro Matsuo (Fujikura), progress of planer lightwave circuits and future prospects by Dr. Senichi Suzuki (NEL), and past, present, and future of high-speed semiconductor lasers with technological trends toward 100 Gbit/s and beyond by Dr. Kazuhisa Uomi (Oclaro). The workshop served as a valuable opportunity for us to gain insights from the lecturers' own experiences accumulated through the research and development in the early days and how they have overcome challenges toward commercialization.

Fig. 1 Keynote speech by Dr. K. Hagimoto.

Fig. 2 Presenters of Workshop 1: from left, Dr. S. Matsuo, Dr. S. Suzuki, and Dr. K. Uomi.

The morning session of Day 2 (Dec. 21) started with three invited lectures with the aim of learning latest technologies in the vicinity of optical communication fields (Fig. 3). The first lecture was "Recent technological trends in terahertz communication and future perspective" given by Prof. Tadao Nagatsuma (Osaka University), which was organized by IEEE Photonics Society Japan Chapter. He overviewed the recent rapid progress in terahertz devices and applications, and presented future challenges for realizing 100 Gbit/s wireless transmission. The second invited lecturer was Dr. Changho Chong (Santec), who gave a talk entitled "Application of optical

communication technology to OCT." His talk covered from the principle of optical coherence tomography (OCT) to the latest progress of fast tunable laser sources as a key enabling device of OCT and their extensive applications in the medical field. The third invited lecture was given by Dr. Naoshi Serizawa (Yazaki Corporation) entitled "In-vehicle gigabit optical communication technologies." He overviewed in-vehicle network technologies with a special focus on its profound impact on automatic driving, and presented recent activities on the standardization of in-vehicle optical communication.

The rest of the morning session was devoted to a special invited talk by Prof. Kazuro Kikuchi (National Institution for Academic Degrees and Quality Enhancement of Higher Education) on "Coherent optical fiber communication: physical and information-theoretical performance limit" (Fig. 4). Starting from the fundamentals of coherent transmission, he gave a unique approach to understand coherent transmission from a viewpoint of quantum mechanics and information theory, providing deeper insights into fulfilling potential of digital coherent technologies.

Fig. 3 Invited lecturers: from left, Prof. T. Nagatsuma, Dr. C. Chong, and Dr. N. Serizawa.

Fig. 4 Special invited talk by Prof. K. Kikuchi.

Fig. 5 Presenters of Workshop 2: from left, Dr. H. Onaka, Dr. J. Kani, Dr. T. Tsuritani, and Dr. S. Namiki.

In the afternoon of the Day 2, we organized another workshop featuring the cutting-edge optical communication technologies. It consisted of the following four invited talks (Fig. 5): LSI chips for digital coherent transmission by Dr. Hiroshi Onaka (Fujitsu), optical access networks by Dr. Jun-ichi Kani (NTT), space division multiplexing by Dr. Takehiro Tsuritani (KDDI Research), and Dr. Shu Namiki (AIST) on dynamic optical path networks. The workshop covered exciting challenges ongoing over a wide spectrum of optical communication and delivered strong promising messages for sustainable growth of this field.

### 3. Rump Session

In the evening of Day 1, we organized a rump session with a topic of "Let's discuss the role of academic societies in the future," hosted by Prof. Akihiro Maruta (Osaka University). In order to initiate the discussion, Prof. Hiroyuki Uenohara (Tokyo Institute of Technology) and Dr. Masahito Tomizawa (NTT) first gave a short presentation on how situations surrounding academic societies have changed from an academic and industrial point of view, respectively. The attendees then had a round-table discussion about the benefits we have gained from academic societies and future expectation in the global era, such as more active collaboration with social networking services.

### 4. Award Ceremony

During the technical sessions, the OCS award ceremony took place on Day 1 (Fig. 6). The OCS Technical Committee presented the following awards to this year's winners:

- OCS Best Paper Award: "Adaptive modulation with multi-redundancy Trellis coded modulation," by Dr. Tatsuya Nakamura, Dr. Emmanuel Le Taillandier de Gabory, Dr. Hidemi Noguchi, Dr. Jun'ichi Abe, and Dr. Kiyoshi Fukuchi (NEC)
- OCS Young Researchers Award: Mr. Shuai Yuan (Osaka University) for "Turbo equalization for super-Nyquist WDM systems based on duobinary shaping"
- OCS Young Researchers Award: Dr. Masanori Nakamura (NTT) for "A construction method and basic characteristic evaluation of optical 8-dimensional modulation using square-QAM"

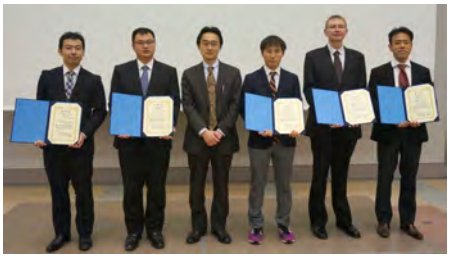

Fig. 6 OCS award-winners: from left, Dr. M. Nakamura, Mr. S. Yuan, Dr. A. Hirano (presenter), Dr. T. Nakamura, Dr. E. L. T. de Gabory, and Dr. J. Abe.

### 5. Conclusion

We hope that the symposium was a meaningful experience for the participants not only to look back over a journey of 30 years but also to look ahead the next 30 years of this field. Finally, the OCS technical committee would like to express gratitude to all the speakers, participants, and exhibitors, for making the 30$^{th}$ anniversary symposium successful.

# Report on the 12th International Conference on Space, Aeronautical and Navigational Electronics 2016 (ICSANE 2016)

Hirokazu Kobayashi†, Takahide Mizuno‡, Toshifumi Moriyama‡

Osaka Institute of Technology†
Japan Aerospace Exploration Agency‡
Nagasaki University‡

## 1. Introduction

The 12th International Conference on Space, Aeronautical and Navigational Electronics (ICSANE 2016) was held at National Taipei University of Technology (NTUT), Taipei on November 24th-25th, 2016. This conference was sponsored and organized by the Technical Group on Space, Aeronautical and Navigational Electronics (SANE) of the Institute of Electronics, Information and Communication Engineers (IEICE), NTUT and IEEE Taipei Chapter of Geoscience and Remote Sensing Society (GRSS). In addition, ICSANE2016 was jointly organized with the IEEE Geoscience and Remote Sensing Society Joint Chapters Meeting.

## 2. Purpose of Conference

The first ICSANE (former name is workshop on Space, Aeronautical and Navigational Electronics (WSANE)) was held in Daejeon, Korea, 2005. After that, ICSANE takes place every year in Asia-Pacific region. ICSANE aims at providing an opportunity for system engineers and researchers to discuss new and viable technical topics of electronics system in spacecraft, aircraft, ships and ground facilities. The detail covered topics are the following:

(1) Satellite and space-station systems
(2) Remote sensing and scientific observation technology
(3) Radar systems and applications
(4) Navigational and communication systems

## 3. Organizing Committee

The Steering committee of ICSANE2016 was strongly leaded by Co-Chairs and supported by Co-Chairs of Organizing Committee. The other organization is technical program committee. These main committee members are listed as the followings.

- Honorary Chair:
  Leeh-Ter Yao (President of NTUT, Taiwan)
- Steering Committee, Co-Chairs:
  Hirokazu Kobayashi (OIT, Japan)
  Yang-Lang Chang (NTUT, Taiwan)
- Organizing Committee, Co-Chairs:
  Toshifumi Moriyama (Nagasaki Univ., Japan)
  Chihyuan Chu (G-AVE Tech., Taiwan)
- Technical Program Committee, Chair:
  Kazuo Ouchi (IHI, Japan)

## 4. Program and Activities

At the opening ceremony of ICSANE2016, President Leeh-Ter Yao of NTUT delivered his warmly welcome address and the introduction of NTUT. Next, Prof. Hirokazu Kobayashi, who is a chair of SANE, IEICE, expressed his thanks and talked about SANE and ICSANE history. Prof. Yang-Lang Chang presented the introduction of ICSANE2016. The photo of ICSANE 2016 committee members with President Yao is shown in Fig. 1.


Fig. 1 ICSANE2016 committee members with President Yao

ICSANE 2016 had two keynote talks. First is ALOS2 Polarimetric Radar Observation over South-East Asia presented by Prof. Yoshio Yamaguchi, Niigata University, Japan, and second is Recent Advances in High-Performance Computing for Remote Sensing presented by Prof. Bormin Huang, Space Science and Engineering Center, University of Wisconsin-Madison, USA. Fig. 2 and 3 are keynote speakers.

The technical program of ICSANE2016 consisted of oral and poster sessions. The poster session was originally prepared for young researchers. The 45 papers in regular sessions and the 5 papers in poster session were presented. The papers covered the variety technologies which are satellite, aircraft navigation, radar signal processing, synthetic aperture radar (SAR), polarimetric and interferometric SAR technologies, etc.

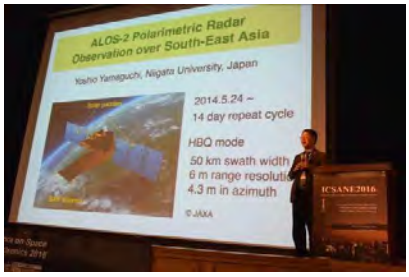


Fig. 2 Keynote speaker: Prof. Yoshio Yamaguchi


Fig. 3 Keynote speaker: Prof. Bormin Huang

Total number of participants reached around 130 in the two days from seven countries: Japan, Taiwan, Malaysia, USA, France, Thailand, Hong-Kong China. In the second day afternoon, a technical tour to Taoyuan International Airport Air Traffic Control Tower, Air Navigation and Weather Services (ANWS) was conducted. Fig. 4 is the photo of the technical tour participants.

Fig. 4 Participants of the technical tour

## 5. Award Ceremony

In the night of second day, an award banquet was held at Grand Halls, PALAIS de CHINE Hotel. We celebrated the winners of young scientist award and encouragement award. On behalf of TPC chair, Prof. Kazuo Ouchi, Prof. Hiroyoshi Yamada presented a testimonial to each award recipient. The winners are as follows:

Winners of Young Scientist Award:

- Mr. Takanori Ishikuro (Niigata Univ., Japan)
  Title: Experimental study on detection of automobile in flooded urban area using quad-pol SAR data
- Mr. Masafumi Setsu (The University of Electro-Communications, Japan)
  Title: Multi-path Exploitation Method Using Doppler Based Signal Recognition for UWB Through-the-wall Radar
- Mr. Takehiro Hoshino (Mitsubishi Electric, Japan)
  Title: An Experimental Study of Compressive Sensing for Synthetic Aperture Radar

Winner of Encouragement Award:

- Ms. Lee Sui Ping (Multimedia University, Malaysia)
  Title: An InSAR Phase Estimation Method for Surface Deformation Studies

Fig. 5 and 6 show the winners of Award. In addition, Prof. Hirokazu Kobayashi and Prof. Toshifumi Moriyama received letters of thanks from IEEE Taipei chapter of GRSS. The SANE committee offered the letters of appreciation to Dr. Leeh-Ter Yao, Prof. Yang-Lang Chang, Dr. Chihyuan Chu, etc. for outstanding contributions to ICSANE2016.


Fig. 5 Young scientist award-winners: from left, Prof. H. Yamada (presenter), Mr. T. Ishikuro, Mr. M. Setsu, Mr. T. Hoshino, Prof. H. Kobayashi and Prof. Moriyama


Fig. 6 Encouragement award-winner: from left, Prof. H. Yamada (presenter) and Ms. L. S. Ping

## 6. Conclusions

ICSANE2016 was successfully held in Taiwan. We hope that all the participants in this conference enjoyed the presentation and discussions on the future trends and the latest advances of research and development on Space, Aeronautical and Navigational Electronics.

Finally, the SANE technical committee would like to thank all the speakers and participants. You can see the meeting scenes (by pictures and videos) from the website [1].

## 7. Acknowledge

Prof. Yang-Lang Chang, Dr. Chihyuan Chu and the students of NTUT are highly appreciated for their efforts and passion to arrange ICSANE2016.

## 8. References

[1] http://www.ieice.org/~sane_ac/ICSANE2016/index.html

# Report on 2016 Asian Wireless Power Transfer Workshop (AWPT2016)

Qiang Chen, General Co-Chair of AWPT2016
Tohoku University

The 2016 Asian Wireless Power Transfer Workshop (AWPT2016) was successfully held at the University of Electronic Science and Technology of China (UESTC), Chengdu, from Dec. 16 to 18, 2016. This event was co-organized by the University of Electronic Science and Technology of China, the Technical Committee on Wireless Power Transfer (WPT) of Communications Society, IEICE, and the IEEE Chengdu Section.

This workshop, as an annual workshop, was planned by the WPT Technical Committee of IEICE to provide a platform for researchers to share the latest research and development progresses related to the wireless power transfer technology, and to promote exchanges and cooperation among the researchers who are interested and active in this technical field. It started in 2015 at Tamkang University, Taiwan. It was the second workshop this time and will take place once a year around the Asian countries in the future.

Prof. Zhizhang (David) Chen, of UESTC and Dalhousie University, Canada, and Prof. Qiang Chen of Tohoku University served as the General Co-Chairs of the workshop. Prof. Huapeng Zhao of UESTC, and Prof. Kenjiro Nishikawa of Kagoshima University served as the Co-Chairs of Technical Program Committee. The workshop was successfully organized owing to the great effort by many professors and students of UESTC, SiChuan University, and other local universities in Chengdu, as well as the Secretaries, Secretary Assistants, and many Members of the WPT Technical Committee.

The 3-day program of AWPT2016 consists of 44 technical presentations including 4 special presentations. These technical presentations covered a very wide research area related to the wireless power transfer technology, from the devices, circuits design, to the systems and application development. The technical session included the topics of

- Wireless Power Transfer based on Resonance Coupling
- Rectifier Design Technologies
- Design of Rectennas
- System-Level Design and EMC/EMI

4 special presentations were as follows.

- Development and Application of Wireless Power Transfer Technology, Yue Sun (Chongqing University)
- A Single Diode Microwave Rectifier Using an Inductor for Harmonic Suppression, Pengde Wu, Lei Zhang, Yingsheng Zhao and Changjun Liu (Sichuan University)
- Rectenna Technology for WPT and Energy Harvesting, Naoki Shinohara (Kyoto University)
- Recent Advances in Wireless Communication - From Component to System, Yu-Yao Chen,Wei-Ting Tsai, Chong-Yi Liou, and Shau-Gang Mao (Graduate Institute of Communication Engineering, National Taiwan University)

The student's paper award was selected by the TPC. The award was established by the WPT Technical Committee to encourage students to do challenging researches and to enhance their presentation skill at academic conferences. 10 prize winners and their papers were as follows.

- Bo Yang (Kyoto University): Study on a 5.8GHz Power-Variable Phase-Controlled Magnetron for wireless power transfer
- Takurou Nishimura (The University of Tokyo): Velocity Estimation and Control of DC Motor Driven by Wireless Power Transfer
- An Yan (Sichuan University): A Miniaturized C Band Large Power Rectenna
- Takuma Takeuchi (The University of Tokyo): Power Management on Wireless In-Wheel Motor with Dynamic Wireless Power Transfer
- Danyang Cui (The University of Tokyo): Optimization of Cross Coupling Cancellation for Multiple-Receiver Wireless Power Transfer System at Changing-State
- Kaipeng Xing (Shanghai Jiao Tong University): Design of A Wide Voltage Range Regulation Wireless Power Transfer System
- Koichi Furusato (The University of Tokyo): Improvement of 85 kHz self-resonant open end coil for capacitor-less wireless power transfer system
- Yang Nan (Shanghai Institute of Space Power-Sources): Constant-Current Output LCC Wireless power transfer Circuit
- Katsuhiro Hata (The University of Tokyo): Efficiency Maximization of Wireless Power Transfer Systems with Two Modes of Half Active Rectifier Based on Primary Current Measurement
- Dongdong Xu (University of Electronic Science and Technology of China): A novel design method for compact rectenna

There were more than 100 participants attending the workshop, much more than expected, showing the high attention on WPT technologies from both the universities and industry in the world. Technical level and quality of the presented papers was high. All the presentations were on schedule directed by session chairs and there was not a withdraw paper in the 3-day program.

The workshop was partly supported by the funding of activation plan from the Commutations Society, IEICE.

The WPT technical Committee is now planning the next workshop, AWPT2017. Please visit the website of the WPT Technical Committee for information of the activities including the workshop and other WPT related conference information. The website address is http://www.ieice.org/~wpt/


Fig. 1 The conference room of the AWPT2016

Fig. 2 Participants of AWPT2016


Fig. 3 Part of Organizing Committee Members


Fig. 4 Technical tour to Chengdu Research Base of Giant Panda Breeding

# Joint Conference on Satellite Communications (JC-SAT 2016) Report


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## 1. Introduction

The Joint Conference on Satellite Communications 2016 (JC-SAT 2016) was held on 13th and 14th of October 2016 at the Incheon National University, Songdo, Incheon, in Korea. The conference has been held annually with jointly organized by Technical Committee on Satellite Communications of IEICE (IEICE SAT) and Korea Society of Space Technology (KOSST) since 2000. It aims at information exchange and enhancing mutual understanding between satellite communication researchers and engineers both in Japan and Korea.

## 2. Program

Opening speeches were delivered by the organizing committee chairs, Dr. Seongbong Choi, the president of KOSST (Fig. 1), and Dr. Takatoshi Sugiyama, the chair of IEICE SAT. The number of presented papers was 29 including a special invited talk, and 75 participants attended. The conference topics were as follows:

- Fixed Satellite communications, mobile satellite communications, inter satellite communications, deep space communications
- Satellite broadcasting
- Network control and management
- Satellite bus technologies
- Satellite navigation system and its applications
- Integrated satellite and terrestrial network architectures
- Satellite sensor network
- Satellite imagery processing and applications
- Ground station and onboard equipment technologies
- UAS/UAV

## 3. Best Paper Awards

The best paper awards of JC-SAT were granted to the distinguished papers selected each from Japan and Korea. One was “A study on 64 APSK Coded Modulation” by Yuki Koizumi (Fig.2), Yoichi Suzuki, Masaaki Kojima, Kyoichi Saito and Shoji Tanaka, and the other was “Development of X-band Circular Waveguide Cavity Tunable Filter for Geostationary Satellite Applications” by Sun-Ik Lee, Joong Pyo Kim, Won Gyu Lim, Sang Goo Kim, Yong Lee, Duck Ki Baek, and Jin Baek Jang. A set of certificate was handed to each representative of the authors in the JC-SAT award ceremony.

## 4. Conclusion

A closing session was held in the end of day-2 with presentations of Dr. Sungtek Kahng, and Dr. Toshinori Suzuki, who is the vice chair of IEICE SAT. They remarked the great success of the conference and noted a plan for the next conference in Japan in 2017.

Fig. 1 Opening speech from Dr. Seongbong Choi, the president of KOSST


Fig. 2 The JC-SAT Award winner and the presenter

Fig. 3 JC-SAT 2016 participants

# Report on the 2016 NS English Session Awards and Award Ceremony

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Yoshikatsu OKAZAKI[††], NTT Corp.
Kazuya TSUKAMOTO[†††], Kyushu Institute of Technology
Hideki MAEDA[†††], NTT Corp.
Shohei KAMAMURA[††††], NTT Corp.
[†]Chair, [††]Vice Chair, [†††]Secretary, [††††]Assistant Secretary

## 1. Introduction

In the 2016 IEICE General Conference that was held on 15-18 March 2016, the IEICE Technical Committee on Network Systems (NS) provided the complete English Symposium Session entitled "Advanced Networking Technologies for Innovative Information Networks." In this session, 44 papers were presented at a single track during whole of 4-days conference period [1], and the total number of participants was 136.

The NS committee selected recipients of NS English Session Awards among the 44 papers. The recipients won the awards at an award ceremony and presented the progress of their awarded paper as encouragement talk at an NS technical meeting in October 2016.

## 2. Award Ceremony

The award ceremony was held in the NS technical meeting at Himeji city, Hyogo Prefecture on 20 October 2016, and 20 participants attended the ceremony. Three distinguished papers won the NS English session awards, and recipients including substitute recipients received an award certificate and a plaque from NS technical committee chair (Fig. 1).

(For the past recipients, please see our English home page. URL: http://www.ieice.org/cs/ns/eng/index.html)

## 3. English Session Awards 2016

The abstracts of the three papers that won the 2016 NS English session awards are as follows.

**Mohammad Nur Hasan and Khoirul Anwar: "Estimating Source Correlation Online in Massive Multiway Multirelay Networks" [2]**

Number of connected devices has been tremendously increasing since the introduction of the internet of things (IoT). In the next few years, massive number of devices such as smart phones, tablets, computers, sensors and other machine-type devices will be connected to the networks. New communication strategies that can handle this massive connection are highly required for this situation. One potential solution for this challenge is the random-multiway multirelay (MWMR) networks which consist of multiple users (devices) and multiple relays. The random-MWMR network employs coded random access to serve the connected users such that the information exchange among massive number of users can be performed efficiently.

Fig. 1 English session award recipient (Mr. Hasan) with chair (Dr. Tode).

In the random-MWMR networks, all users perform information exchange among themselves within two phases: multiple access (MA) and broadcast (BC) phases. In MA phase, the users transmit their messages to the relays, while in the BC phase the relays broadcast the messages to all users. Because the messages received by each relay are coming from the same users, the messages are correlated with each other. Source correlation exploitation has been shown to help improving the performance of the random-MWMR networks significantly. However, when the number of users is large, high accuracy of source correlation estimation is required. In this paper, we propose an online source correlation estimation technique performed during joint decoding process, namely *online estimation*, for the random-MWMR networks. We compare our technique with the ideal estimation, where the ideal estimation assumes that the relays have knowledge of error probability of messages to perfectly calculate the correlation before the decoding. We confirm via computer simulations that the proposed online source correlation estimation is accurate for the random-MWMR networks serving massive number of users with low computational complexity.

**Song Liu, Shigemi Ishida, Kohei Mimura, Shigeaki Tagashira, Akira Fukuda: "Initial Evaluation of Acoustic Vehicle Count System utilizing Dynamic Time Warping" [3]**

Traffic counting is one of the fundamental tasks in

intelligent transportation system (ITS). At present, the most widely used counters are loop detectors. However, installation and maintenance of these counters are expensive and frustrating. Non-intrusive counters like video camera based counters can solve this kind of problem, but they have other issues. For example, most of the non-intrusive counters can't work under bad weather or poor visibility. Among all the traffic counters, systems based on micro-phone array have been underestimated. Acoustic vehicle counting system has many advantages, it's cost-effective, highly portable and has the ability to deal with all kinds of weather conditions. Until now, the main problem of such system is performance.

Ordinarily, vehicle counting systems utilizing micro-phone array won't count cars directly from the received audio signal but will transform it into sound maps through a process called digital sound mapping. In digital sound mapping the system extract key data reflecting the road traffic conditions using a correlation based algorithm, it can map trajectories of sound sources on the road onto the sound map as lines and curves. The counting is performed by finding certain pattern on sound maps which represent car movement on the road.

Our proposed system adopts a dynamic time warping (DTW) based pattern matching algorithm. DTW is an algorithm for measuring similarity between two temporal sequences which may vary in speed or length, it could be used to match cars with different speed or with accelerations and decelerations through sound map. Cars in different directions are detected by using different templates accordingly. Experiments have been conducted on two-lane roads and evaluation is presented. Results show this system is capable to provide real-time traffic count information while maintaining high performance.

**Hitoshi Nakao, Kazuya Tsukamoto, Masato Tsuru, and Yuji Oie: "A Database-Assisted Collision Aware Data Channel Selection for V2V Communication: Practical Evaluation" [4]**

Recent years, vehicle-to-vehicle (V2V) communication is expected to have the potential to improve efficiency of traffic flow and ratio of accident. Therefore, Federal Communication Commission (FCC) allocated 75 MHz band for intelligent transportation systems (ITS). According to one recent study, more than 80 MHz of spectrum is necessary to keep stable communication for safety application. Moreover since various vehicular applications will be developed in future, they might suffer from spectrum scarcity and overcrowding. This motivates recent efforts to find spectral resources elsewhere.

One solution for accommodating this drastic spectrum demand is the cognitive radio technology where unlicensed users temporarily utilize licensed but spatially and/or temporally unused spectrum (called white space). Recently, to opportunistically access the unused spectrum reliably, several central authorized geolocation databases are developed and examined in many countries. Therefore, in previous study, we discussed how the database should be used even under high mobility environment, and then proposed a database-driven data channel selection scheme for V2V communication. And we showed that the proposed scheme can reduce channel switching and channel collision under the condition in which nearby vehicles move different speed and send data of different size. However, if both sender and receiver vehicles move at a same speed, the scheme is not good performance.

Therefore, in this paper, (1) we propose a database-assisted collision aware data channel selection scheme to reduce channel switching and channel collision under the condition in which vehicles move at same speed and send same size data, and (2) we evaluate the effectiveness of the scheme to set different speed to the sender and responder vehicles. Through simulation experiments, our proposed scheme can avoid the channel collisions and channel switching effectively and thus achieve "continuous utilization".

## 4. Future Plans

In the 2017 IEICE General Conference at Meijo University, the English Session entitled "Advanced Technologies in Communication, Networking, and its Innovative Application for Future Information Network Society" will be held on 22-25 March. Many interesting studies on "network" and "service" including "wireless" and "optical" will be presented. Please attend the IEICE General Conference and enjoy the NS English session during four days.

## 5. Acknowledgements

We would like to give special thanks to Prof. Yoshiaki Tanaka due to his great contributions.

## 6. References

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[2] Mohammad Nur Hasan and Khoirul Anwar: "Estimating Source Correlation Online in Massive Multiway Multirelay Networks," *IEICE General Conference*, BS-3-39, March 2016.

[3] Song Liu, Shigemi Ishida, Kohei Mimura, Shigeaki Tagashira, Akira Fukuda: "Initial Evaluation of Acoustic Vehicle Count System utilizing Dynamic Time Warping," *IEICE General Conference*, BS-3-44, March 2016.

[4] Hitoshi Nakao, Kazuya Tsukamoto, Masato Tsuru, and Yuji Oie: "A Database-Assisted Collision Aware Data Channel Selection for V2V Communication: Practical Evaluation," *IEICE General Conference*, BS-3-42, March 2016.

# Report on the Workshop on Internet Architecture and Applications 2016 (IA2016) at Taipei, Taiwan

Hiroyuki Ohsaki
Vice Chair, TCIA (Technical Committee of Internet Architecture), IEICE

## 1. Introduction

Since 2009, the Technical Committee on Internet Architecture (TCIA) has been organizing international workshops on Internet architecture and applications. The purpose of the workshops is to promote Internet-related research activities within Asian area and also to provide a forum for researchers and practitioners from the academic, industrial, public and governmental sectors to share their latest innovations, as well as internationalization of IEICE. This year, TCIA successfully organized the workshop at Taipei, Taiwan, on November 3 and 4, 2016, with dedicated support from National Taiwan University of Science and Technology (NTUST), Taipei, Taiwan. This article is a brief report on activities of the workshop.

## 2. Objectives

The Internet has revolutionized and changed the way we communicate, socialize, entertain, access information and conduct business. It has evolved into a pervasive ecosystem of connected computers, mobile devices, sensors, home appliances, and a variety of other gadgets. This evolution has led to a deep intertwining of the physical, social and digital worlds, raising new research agendas and challenging our understanding of the requirements for a vastly interconnected world.

Considering the fact that the theme is intensively studied in the world, Technical Committee on Internet Architecture of IEICE Communication Society (TCIA) decided to organize international Workshop. The purpose of this workshop is promoting research activities in Internet and its applications within Asian area, and provides a forum for researchers and practitioners from the academic, industrial, public and governmental sectors to share their latest innovations. Papers from students on this area are particularly welcomed.

## 3. Workshop Highlights

The first day of the workshop began with welcome talks from IA2016 TCP Co-Chairs, Kenichi Yoshida (University of Tsukuba, Japan; TCIA Chair) and Jiann-Liang Chen (NTUST, Taiwan), followed by an invited talk:

> Yao-Chung Chang (NTTU, Taiwan), *LoRaWAN: new IoT access networks, opportunities and challenges*


The workshop continued with two Network Architecture sessions including five oral presentations. The next event of the workshop was 90-minutes Poster session, in which ten poster speakers and workshop attendees actively exchanged their ideas such as recent research achievements and future directions. The last event of the first day was the banquet where all the participants enjoyed Taiwan cuisine and also tightened ties of their social network.

The second day of the workshop started with the other invited talk:

> Ren-Hung Hwang (National Chung Cheng University, Taiwan), *SDN-enabled Cloud Data Center*

The workshop was followed by four technical sessions --- SDN (Software-Defined Networking), Security I, Security II, and Applications --- containing 12 oral presentations. The second day of the workshop was closed with Student Presentation Awards and a closing talk by Kenichi Yoshida (University of Tsukuba, Japan; TCIA Chair).

As one of TCIA organizers, I am very pleased with high participation ratio of student researchers from different Asian countries. IA2016 workshop successfully provided a forum not only for senior researchers but also for young researchers.

## 4. Conclusion

We believe that all participants were satisfied with the quality of two-day workshop composed of two invited talks, 22 oral and 10 poster presentations, active discussions throughout the workshop, and social events. TCIA greatly appreciates all the speakers and participants for their high-quality presentations and constructive and encouraging discussions. TCIA would like to thank warm hospitality by NTUST. Next workshop is expected to be held in Thailand. Please visit http://www.ieice.org/~ia/eng/ for latest information.

# Report on the 2016 International Symposium on Antennas and Propagation (ISAP2016)

Kunio Sakakibara
Nagoya Institute of Technology

## 1. Introduction

The 2016 International Symposium on Antennas and Propagation (ISAP2016) was held at the Okinawa Convention Center in Ginowan, Okinawa, Japan, from October 24 to 28, 2016. This symposium, 21st ISAP, was organized and sponsored by the IEICE Communications Society (IEICE-CS) and in cooperation with the Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers (IEEE/AP-S), the International Union of Radio Science (URSI), Institution of Engineering and Technology (IET), European Association on Antennas and Propagation (EurAAP), Institute of Antenna Engineers of Taiwan (IAET), Korean Institute of Electromagnetic Engineering and Science (KIEES), Antenna Society of Chinese Institute of Electronics (AS-CIE), Chinese Microwave Association (CMA), Radio Electronics Association of Vietnam (REV), and Electrical Engineering/Electronics, Computer, Communications and Information Technology Association of Thailand (ECTI). The conference features 3 plenary talks, 6 invited talks, 6 technical workshops, 65 technical sessions including 26 organized sessions and two poster sessions. It was attended by 865 researchers and engineers including 47 accompany persons and 143 exhibitors from 33 countries and regions. This number is the largest in the ISAP history.

## 2. Conference History

The ISAP is intended to provide an international forum for the exchange of information on the progress of research and development in antennas, propagation and electromagnetic wave theory. The first ISAP was held at Sendai, Japan in 1971 and it had been held nine times in Japan until 2004. From 2005, ISAP expanded the conference venues to Asia and Pacific areas and became annual conferences. The host cities from 2005 to 2015 were Seoul, Singapore, Niigata, Taipei, Bangkok, Macao, Jeju, Nagoya, Nanjin, Kaohsiung, and Hobart, respectively. This symposium is now recognized as one of major conferences in this technical field.

## 3. Topics of the ISAP2016

Opening Ceremony and Plenary Talks

The symposium started with opening address by the general chair, Prof. Toru Uno, and was followed by brief complimentary addresses from the representatives of technical co-sponsors, EurAAP, IEEE/AP-S, KIEES, AS-CIE, IAET, ECTI and CMA.

Three plenary talks were organized in this symposium. In the first plenary talk, Prof. Wei Hong from Southeast University in China talked about “Millimeter Wave Communications for 5G.” In this talk, the current research status of China 5G was briefly introduced, including the candidate frequency bands, goal and key technologies etc. Then, the research advances in millimeter wave indoor and outdoor communications for 5G were presented.

In the second plenary talk, Mr. Tomohiro Saito from NHK Science & Technology Research Laboratories in Japan talked about “Wireless Transmission Technology for Ultra-high-definition Television.” In this talk, he reviewed individual technologies of camera, television, audio, recording and wireless communication for 8K super high vision, UHDTV under the background of digital broadcasting HDTV becoming popular in Japan.

Fig. 1 Okinawa Convention Center

Fig. 2 Opening address from Prof. Toru Uno

In the third plenary talk, Mr. Jongsik Lee from KT Telecom in Korea talked about "5G Trial in 2018 PyeongChang Winter Olympics –Technical challenges & preparations." In this talk, he shared KT's view and vision on 5G, and also introduced what KT had done so far, and what KT was currently working on for launching 5G networks in collaboration with our partners, mainly focusing on our 5G pre-commercial specifications and corresponding service plan.

Invited Talks

Six speakers were invited for the first presentations in the sessions with each related topic.

(i) Prof. Seong-Ook Park, KAIST
"Analysis of low loss magneto-dielectric antenna for the mobile communication"

(ii) Prof. Qun Wu, Harbin Institute of Technology
"Functional metamaterial devices for manipulation of waves in microwave region based on transformation optics"

(iii) Prof. Hao Xin, The University of Arizona
"3D printing technology for RF and THz antennas"

(iv) Prof. Monai Krairiksh, King Mongkut's Institute of Technology Ladkrabang
"Phased array of switched beam elements and application"

(v) Dr. Seiji Kawamura, National Institute of Information and Communications Technology
"Water vapor estimation using the propagation delay of digital terrestrial broadcasting waves"

(vi) Associate Prof. Jian Yang / Assistant Prof. Andres Alayon Glazunov, Chalmers University of Technology
"Design and characterization of cost-Effective planar antennas with steerable beams: gap waveguides, SMT and random LOS"

Technical Sessions

528 papers were presented in ISAP2016 from 30 countries and regions. In this symposium, the following topics were highlighted:

- Broadband, Multi-Frequency and Small Antennas
- Characteristic Mode Analysis for Small Antennas
- Antennas for Mobile Communications
- Advanced Base Station Antennas

Fig. 3 Technical Session

- MIMO Antennas and Decoupling Technologies
- 3D-Printed Lens and Antennas

Fig. 4 Buffet Party

- Reconfigurable and Tunable Antennas
- Metamaterial-Inspired Antennas
- Frequency Selective Surfaces and Meta-surfaces
- Reflector, Reflectarray and Array Antennas
- Millimeter-wave and THz Antenna Technologies
- Antennas and Propagation for 5G Systems
- DOA Estimation
- Adaptive and Phased Arrays
- Radar and Remote Sensing and Applications
- Propagation Models
- Indoor and Outdoor, Tunnel Propagation
- Antenna Measurements
- Electromagnetic Wave Theory
- Advances in Computational Electromagnetics
- Wearable Devices and Human Body Interactions
- Wireless Power Transfer
- Filters and EMC

In addition to the above topics, three special sessions were organized.

- EurAAP Session: Recent Advances in European Antennas and Propagation Research I, II
- Recent Advances in Antennas and Propagation in ASEAN countries I, II
- Next 50 years Antennas and Propagation Technologies in Japan (50-year anniversary of AP committee of IEICE)

**4. Technical Workshop**

Following technical workshops about recent hot topics were organized with free of charge for the attendees.

1. Prof. Ikmo Park (Ajou University): Design of Antenna with Crossed Dipoles
2. Prof. Fan Yang (Tsinghua University): Reflectarray Antennas: Theory, Designs, and Applications
3. Prof. Nozomu Ishii (Niigata University): Fundamentals of Practical Antenna Measurement to Get More Accurate Data for Input Impedance and Pattern
4. Prof. Raj Mittra (Pennsylvania State University/ University of Central Florida): A New Look at Transformation Optics (TO) Approach for Designing Electromagnetic Devices such as Flat Lenses, and Cloaks
5. Prof. John L. Volakis (The Ohio State University): Ultra Wideband Phased Arrays and Transceivers

6. Mr. Lars J. Foged (Microwave Vision Group): Multi-Probe Antenna Measurement Systems with Applications to Telecom, Space and Defense

**5. Exhibition**

32 exhibitors and 9 technical seminars joined and demonstrated their works and products such as electromagnetic simulators, measurement instruments, antennas and microwave components and equipment in the exhibition area.

**6. Award**

The ISAP2016 established two awards namely the Best Paper Award from all papers and the Student Paper Award from student poster presentations.

Following five papers received the Best Paper Award.

a. 1A4-2, Surface Wave Manipulation based on Transformation Optics: from Design to Manufacturing, Luigi La Spada and Yang Hao, Queen Mary University of London, United Kingdom.
b. 1D3-5, Path Loss Characteristics between Different Floors from 0.8 to 37 GHz in Indoor Office Environments, Motoharu Sasaki(1), Minoru Inomata(1), Wataru Yamada(1), Naoki Kita(1), Takeshi Onizawa(1), Masashi Nakatsugawa(1), Koshiro Kitao(2) and Tetsuro Imai(2), (1)NTT Corporation, Japan, (2)NTT DOCOMO, Inc., Japan.
c. 3D3-5, Reflectarray with Arbitrarily Shaped Elements for Linear-to-Circular Polarization, Shogo Matsumoto, Hiroki Yamada, Hiroyuki Deguchi and Mikio Tsuji, Doshisha University, Japan.


Fig. 5 ISAP2016 General Chair Prof. Toru Uno passed the ISAP Flag to next ISAP2017 General Chair Prof. Monai Krairish.

d. POS1-10, E-band 3-D Metal Printed Wideband Planar Horn Array Antenna, Abbas Vosoogh(1), Per-Simon Kildal(1), Vessen Vassilev(1), Ashraf Uz Zaman(1) and Stefan Carlsson(2), (1)Chalmers University of Technology, Sweden, (2)Gapwaves, Sweden.
e. POS1-36, An Isolation Technique for Closely Stacked MIMO Antennas, Seonho Lim, Woo Cheol Choi, Young Joong Yoon and Chisang You, Yonsei University, Korea.

Following eight papers were awarded the Student Paper Award.

a. Wan Chin Wu, Metal-Frame Inverted-F Antenna for the LTE Metal-Casing Smartphone, National Sun Yat-sen University, Taiwan.
b. Taihei Fujino, Design and Fabrication of a Dual-polarized Corporate-feed Waveguide 32x32-slot Array Antenna with an Orthmode Transducer for 40 GHz Band, Tokyo Institute of Technology, Japan.
c. Abbas Vosoogh, E-band 3-D Metal Printed Wideband Planar Horn Array Antenna, Chalmers University of Technology, Sweden.
d. Riho Suzuki, Probe-Positioning Error Estimation for Planar Near-Field Phaseless Measurements, Yokohama National University, Japan.
e. Xin Xu, An E-band Slotted Waveguide Monopulse Array Antenna with Corporate-feed Using Diffusion Bonding of Laminated Plates, Tokyo Institute of Technology, Japan.
f. Masanori Gocho, Verification of Simple Calibration Method for Multi-baseline SAR Tomography, Niigata University, Japan.
g. Joonsuk Kim, Simulation of Passive Time-Reversal Surveillance System for Detection of Target Invasion Inside Forested Environment, Yonsei University, Korea.
h. Shigeaki Okumura, Technique of Tracking Multiple Pedestrians Using Monostatic Ultra-wideband Doppler Radar with Adaptive Doppler Spectrum Estimation, Kyoto University, Japan.

**7. ISAP-ISC Meeting**

An ISAP International Steering Committee (ISAP-ISC) meeting was held during the symposium. The ISAP-ISC is organized by the researchers of mainly contributed countries and regions in Asia and Pacific areas to ISAP. The operation of the symposium was discussed and future ISAP venue has been decided in the meeting. In this meeting, the representative from Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Singapore, Taiwan, and Thailand attended. ISAP-ISC has decided that the venue of ISAP2019 will be Xian, China in this meeting. Thus, the venues up to 2019 has been decided as Phuket Thailand in 2017 and Busan Korea in 2018.

**8. Conclusion**

The ISAP2016 steering committee thanks to all attendees and related people for the contribution organizing the ISAP2016. All the papers of past ISAP can be referred in the web page “ISAP archives” [1] with free of charge during the trial service. The papers of ISAP2016 will appear in ISAP archives in May, 2017. In addition, the papers of ISAP2016 have been included in IEEE Xplore. The symposium web page of ISAP2017 has been available [2].

**9. References**

[1] http://ap-s.ei.tuat.ac.jp/isapx/
[2] http://www.isap2017.org/

# Report on the 5th IEEE International Conference on Renewable Energy Research and Applications (ICRERA2016)

Kazuhiro Kajiwara
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## 1. Introduction

The 5th IEEE International Conference on Renewable Energy Research and Applications (ICRERA2016) was held in Birmingham, UK from November 20 to November 23, 2016. ICRERA is the annual world-class technical forum presenting the latest research topics in the renewable energy technologies and their applications.

## 2. Overview

The conference program included 5 keynote addresses, 33 technical sessions, 8 special sessions, and 4 tutorials on state of art and emerging topics. In this conference, 3 papers were selected for best paper award.

The main sponsors of ICRERA2016 were the International Journal of Renewable Energy (IJRER) and IEEE Power Electronics Society (IEEE PELS). IEEE PELS joined as one of the main sponsors of ICRERA from this year. The conference was also technically co-sponsored by IEEE Industry Applications Society (IEEE IAS), IEEE Industrial Electronics Society (IEEE IES), the Institute of Electronics, Information and Communication Engineers (IEICE) and the Institute of Electrical Engineers of Japan (IEEJ). It was also supported by Aston University, UK, Nagasaki University, Japan and Gazi University, Turkey.

## 3. Opening Ceremony and Keynote Speeches

The conference was commenced by welcome address by General Chair, Prof. Nagi Fahmi, General co-chairs, Prof. Ilhami Colak and Prof. Fujio Kurokawa. After the opening ceremony, two high-profile keynote speakers, Prof. Dan M. Ionel and Prof. Rik De Doncker gave keynote speeches about the latest renewable energy plan and the intelligent sub-stations for dc distribution systems. Furthermore, three keynote speakers, Prof. Adel Nasiri, Dr. Yousuke Nozaki and Prof. Rosario Miceli gave keynote speeches in the morning of Nov. 22. They addressed DC UPS and load leveling, photovoltaic power systems deployment, and fault tolerant inverter operation, respectively.

## 4. Technical Program

The Technical Program Committee selected papers for presentation by careful peer review process. Finally 250 papers were presented during the conference. Among them, 160 oral presentations were organized in 33 technical sessions. 90 papers were presented in the poster session. Poster presentations were organized in the afternoon of Nov. 21 through Nov. 23. Each session was mostly well-attended and they discussed advances and developments in renewable energy research and applications.

Fig. 1 Opening Ceremony

Fig. 2 Keynote Speakers Prof. Rik De Doncker and Prof. Dan M. Ionel (3rd and 4th from the left)

## 5. Conclusions

ICRERA has been the forum for researchers and engineers in renewable energy since 2012. In 2016, IEEE PELS joined main sponsors of this conference. Total 250 papers were presented at ICRERA2016 including exhibitors from more than 40 countries and regions. ICRERA2016 successfully provided an excellent venue and facilitated the research collaboration in renewable energy technologies.

IEEE ICRERA2017 will be held in San Diego, CA, USA on November 12-15, 2017.

# Report on the 7th International Conference on ICT Convergence (ICTC 2016)



Oh-Soon Shin[1], Sang-Jo Yoo[2], and Sunghyun Choi[3]
[1]Soongsil University, Korea, [2]Inha University, Korea
[3]Seoul National University, Korea

## 1. Introduction

The 7th International Conference on Information and Communication Technology Convergence (ICTC 2016) was held in Ramada Plaza Hotel, Jeju Island, Korea from October 19th to 21st, 2016 [1]. ICTC is a leading, flagship international conference hosted by the Ministry of Science, ICT and Future Planning (MSIP) of Korea government, organized by the Korean Institute of Communications and Information Sciences (KICS) and technically co-sponsored by IEICE-CS and IEEE Communications Society. ICTC 2016 features an extremely rich program with the main theme of "Toward Smarter Hyper-connected World." The conference addresses numerous challenges of ICT convergence over various industrial sectors, including wireless and mobile communication systems and infrastructure, future networks, services and applications, smart devices and consumer appliances, cloud computing, green communication, healthcare and bio-informatics, and Internet of Things (IoT).

## 2. Conference Program

The conference program includes plenary sessions, invited industrial sessions, technical paper sessions, and special sessions.

In each of two plenary sessions (Fig. 1), we had 2 keynote speeches. In the Plenary Session I, Dr. Sanghoon Lee (President of ETRI) delivered a keynote speech on "New ICT Waves and the 4th Industrial Revolution," which was followed by another keynote speech on "The Future of the Connected World" by Mr. Patrick Johansson (President & CEO of Ericsson-LG). The Plenary Session 1 was ended with the opening address by Prof. Yongsoo Cho (President of KICS), a welcome address, and a congratulatory address. Plenary Session II featured topics on future automotive technologies. Dr. Yuji Inoue (Chairman of Toyota Info Technology Center) delivered a keynote speech on "Vehicle Networking as a New Social Infrastructure," and Dr. Ryuji Kohno (Professor of Yokohama National University) delivered a keynote speech on "Global Demands and Standard ion Enhanced Dependability in Wireless Networks for Automotive Industries-Highly Reliable and Secure Wireless IoT/M2M for Cars and Factory Automation."


Fig. 1 Plenary Session

Each of two industrial sessions (Fig. 2) consists of 3 invited talks from industries. The theme of Industrial Session I was future network and 5G mobile. Dr. Kang-Won Lee (Senior Vice President of SK Telecom), Dr. Byung K. Yi (Executive Vice President & CTO) of InterDitgital), and Mr. James Kimery (Director of Marketing of National Instruments) gave excellent talks on the theme. In Industrial Session II, Dr. Chong-Mok Park (Director of Naver Corporation), Mr. Changwoo Jung (Korea Lab. Director of IBM), Mr. Willy Cho (Country Executive of GE Digital Korea) gave interesting talks on Artificial intelligence and IoT.

Regarding technical paper sessions (Fig. 3), 622 papers were submitted to the conference from 29 countries. After thorough review process, the technical program committee (TPC) accepted 307 papers, which were organized into 30 oral sessions and 2 poster sessions. The overall acceptance ratio was about 46%. The topics of technical paper sessions covered wireless and mobile communications, information and communication theory, future internet, smart media and



Fig. 2 Industrial Session


Fig. 4 Conference Banquet

Fig. 3 Technical Session

Fig. 5 Best Paper Award

broadcasting, green communication technologies, smart grid, u-healthcare and bio-infomatics, IoT, Machine-to-Machine (M2M), and encryption and security. In addition, 6 special sessions were organized with 18 invited talks from academia and industries.

### 3. Social Events

At the first night, the welcome reception was held at the Convention Lobby of hotel. The participants enjoyed the beverage and cookies talking together.

The conference banquet (Fig. 4) was held at the second night. The banquet began with a welcome address and introduction of OC members by Dr. Seung Ku Hwang (Organizing Committee Chair). Prof. Sangjo Yoo (TPC Chair) then made a TPC report, including paper statistics and Best Paper Award selection procedure. Best Paper Awards were presented to the authors of five excellent papers (Fig. 5). In recognition to the continued contribution to ICTC, Service Awards were also presented to Prof. Ross Murch (Hong Kong University of Science & Technology) and Prof. Mazen Omar O. Hasna (Qatar University). All participants enjoyed the banquet with nice Korean food and an exciting performance.

### 4. Conclusion

Since 2010, ICTC has been the unique global premier event for researchers, industry professionals, and academics interested in the latest developments in the emerging industrial convergence centered on the ICT technologies. On behalf of OC and TPC, we would like to thank all the participants and sponsors who made ICTC 2016 a big success. It is our great pleasure to announce that the next event, ICTC 2017, will be held again in Jeju Island, Korea, during October 18-20, 2017 [2]. ICTC 2017 invites the submission of original research works in all areas of infrastructure, services, technologies, and application of ICT convergence.

### References

[1] http://2016.ictc2017.org/
[2] http://ictc2017.org/

# Report on 2016 Workshop on Networks Optimization and Dimensioning (2016 IEICE WNOD)

Sławomir Hanczewski
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## 1. Introduction

The goal of the Workshop on Networks Optimization and Dimensioning, held on 20-21 October 2016 at Poznań University of Technology in Poznań, was to further a discussion on telecommunications and computer networks. The workshop was organised jointly by the European Section of the IEICE (Institute of Electronics, Information and Communication Engineers) and with the involvement of the Poznań Research Circle of the The Polish Association of Telecommunication Engineers and the Chair of Telecommunications Networks at Poznań University of Technolgy. In addition, the Workshop was technically sponsored by the Communications Society of IEICE (IEICE-CS).

Fig. 1 Prof. Mariusz Głąbowski opening remarks.

The goal of the workshop was twofold. First, the Workshop was aimed to gather interest in the budding minds as the event was targeted at young scientists (ScD students, young research workers), while young scientists were given an opportunity to present their, sometimes quite significant, scientific achievements. Beside the presentations of the results of their research work, the participants were able to share their experience gained during their work in different projects. The other goal was to promote the activity of IEICE to youg researchers in Poland.

The workshop was officially opened by Dr. hab. inż. Mariusz Głąbowski, associate professor, chairman of the European Section of IEICE. Prof. Głąbowski briefly presented the history of IEICE and the current activities and planes for the future of the Section. Prof. Głąbowski also invited the participants of the Workshop to attend the IEICE Information and Communication Technology Forum (http://www.ictf2017.ieice-europe.org/) scheduled to be held in Poznań again in July 2017. Prof. Głąbowski pointed out at the possibility of publishing research and scientific articles in the periodicals and journals published by IEICE. During the Workshop, the attending members of IEICE were able to provide answers to frequent questions related to the activity and operation of IEICE and its European Section.

## 2. Workshop Program

The program of the Workshop was divided into two sections. The first day of the conference was devoted to the presentations. The scope of the presentations was wide and included network optimization, evaluation of the effectiveness of data transfer over wired and wireless networks, network algorithms and issues related to energy efficiency of network devices, among others. This part of the Workshop included 13 presentations. It is worthwhile to add that the results of the studies presented in the workshop will be published in a special issue of the journal IMAGE PROCESSING & COMMUNICATIONS (ISSN: 1425-140X).


Fig. 2 Tytus Sielach (A proposal of a new structure for NetFPGA cards)

The second day of the Workshop continued with a presentation of the projects that are currently being executed in the research units represented by the participants of the Workshop. The ensued discussion clearly showed and highlighted that that type of a meeting like the one attended was necessary to provide a platform for an exchange of information on various competences and capacities within the context of future research needs and possible cooperation in research projects. It was also on this day that, thanks to the courtesy of the Research Section of Poznań University of Technology, the most important information concerning the current and planned projects to be announced by NCN (National Science Centre) and NCBiR (National Centre for Research and Development) to foster future intercollegiate cooperation (both at home and abroad) were presented. This presentation was prepared and given by Ms. Agnieszka Barcik and Ms. Anna Koralewska.

A particular link between the both parts of the Workshop were three technical presentations given by the invited guests, Mr. Ronald Mai (Spirent) and Ms. Ewa Tajkiewicz (Systemics-PAB). The presentations were designed to show and discuss the current issues in testing network systems security as well as efficient and safe network architecture. The subject matter of these presentations proved to be extremely interesting for the participants, many of them being students.


Fig. 3 Ronald Mai, Spirent

The closing session was presided over by Dr. hab. inż. Piotr Zwierzykowski, vice-president of the European Section of IEICE, who invited all the participants to attend the workshop at the AGH University of Science and Technology in Kraków due to be held next year.

### 3. Future Event

This year's edition of the IEICE Information and Communication Technology Forum will be held in Poznań (Poland) on July 4-6. The conference will be hosted by the Chair of Telecommunications and Computer Networks at Poznań University of Technology. The ICTF Forum was already hosted in Poznań in May 2014. Poznań is the capital of the Wielkopolska Province – one of the regions in Poland. It is also a major industrial and academic centre. The themes addressed by the conference will include the following areas of inquiry:

- Information Processing,
- Communications,
- Engineering,
- Electronics.

Fig. 4 Poznań University of Technology (Lecture-Conference Center)

We believe that the conference will be an excellent platform for sharing ideas and discussions for both experienced and young research workers from Europe and Japan.

The conference web page is available at: http://ictf2017.ieice-europe.org/ New information on the conference will be released and updated on a regular basis as soon as it is available (we have officially opened Call for Papers). All papers to be presented at the conference will be added to the I-Scover (IEICE Knowledge Discovery) data base.

Feel invited to join us during this event.

# IEICE-CS Related Conferences Calendar

| Date | Conference Name | Location | Note |
|---|---|---|---|
| 4 Dec. – 6 Dec. 2017 | 2017 IEEE International Conference on Antenna Measurements & Applications (**2017 IEEE CAMA**) | Tsukuba, Japan | Submission deadline: 1 Aug. 2017 |
| 26 Nov. – 30 Nov. 2017 | 13th Int. Conference on Network and Service Management (**CNSM2017**) | Tokyo, Japan | Submission deadline: 12 Jun. 2017 |
| 14 Sep. – 15 Sep. 2017 | Special European Conference on Optical Communications 2017 Symposium (**Special ECOC 2017 Symposium**) | Copenhagen, Denmark | Invited Only |
| 21 Aug. – 25 Aug. 2017 | The 24th Congress of the International Commission for Optics (**ICO-24**) | Tokyo, Japan | Submission deadline: 3 May 2017 |
| 24 Jul. – 28 Jul. 2017 | Photonic Networks and Devices /APC 2017 | New Orleans, USA | Submission deadline: 4 Apr. 2017 |
| 4 Jul. – 7 Jul. 2017 | International Conference on Ubiquitous and Future Networks 2017 (**ICUFN2017**) | Milan, Italy | Submission deadline: Closed |
| 7 Jun. – 9 Jun. 2017 | International Symposium on Extremely Advanced Transmission Technology (**EXAT2017**) | Nara, Japan | Submission deadline: 31 Mar. 2017 |
| 4 Jun. 2017 | Technology Trials and Proof-of-Concept Activities for 5G and Beyond (**TPoC5G**) | Sydney, Australia | Submission deadline: Closed |
| 21 May 2017 | The 10th International Workshop on Evolutional Technologies & Ecosystems for 5G and Beyond (**WDN-5G ICC2017**) | Paris, France | To be held **soon** |
| 22 Mar. – 24 Mar. 2017 | The 13th International Symposium on Autonomous Decentralized Systems (**ISADS2017**) | Bangkok, Thailand | To be held **soon** |
| 19 Mar. – 22 Mar. 2017 | The third International Workshop on Smart Spectrum (**IWSS2017**) | San Francisco, USA | To be held **soon** |
| 8 Mar. – 10 Mar. 2017 | 2017 IEEE International Conference on Computational Electromagnetics (**ICCEM2017**) | Kumamoto, Japan | To be held **soon** |
| 6 Feb. – 8 Feb. 2017 | The 11th International Symposium on Medical Information and Communication Technology 2017 (**ISMICT2017**) | Lisbon, Portugal | Done |
| 20 Nov. – 23 Nov. 2016 | 5th International Conference on Renewable Energy Research and Applications (**ICRERA2016**) | Birmingham, UK | **Reported** on this issue |
| 24 Oct. – 28 Oct. 2016 | International Symposium on Antennas and Propagation (**ISAP2016**) | Okinawa, Japan | **Reported** on this issue |
| 20 Oct. – 21 Oct. 2016 | 2016 IEICE - Workshop on Networks Optimization and Dimensioning (**2016 IEICE WNOD**) | Poznan, Poland | **Reported** on this issue |
| 19 Oct. – 21 Oct. 2016 | International Conference on Information and Communication Technology Convergence 2016 (**ICTC2016**) | Jeju Island, Korea | **Reported** on this issue |

Please confirm with the following IEICE-CS web site for the latest information.
http://www.ieice.org/cs/conf/calendar.html

# Special Section Calendar of IEICE Transactions on Communications

| Issue | Special Section | Note |
|---|---|---|
| Apr. 2018 | Optical Access System for Social Life | Submission due**:** 15 May 2017 **See page 38** |
| Mar. 2018 | Network Resource Control and Management for IoT Services and Applications | Submission due**:** 27 March 2017 **See page 37** |
| Feb. 2018 | Recent Progress in Antennas and Propagation in Conjunction with Main Topics of ISAP2016 | To be issued |
| Jan. 2018 | Internet Technologies to Accelerate Smart Society | To be issued |
| Nov. 2017 | Network Virtualization, Network Softwarization and Fusion Platform of Computing and Networking | To be issued |
| Oct. 2017 | Opto-electronics and Communications for Future Optical Network | To be issued |
| Aug. 2017 | Radio Access Technologies for 5G Mobile Communications System | To be issued |
| Jul. 2017 | Smart Radio and Its Applicationsin Conjunction with Main Topics of SmartCom | To be issued |
| Jun. 2017 | Visible Light Communications in Conjunction with Topics of ICEVLC 2015 | To be issued |
| May 2017 | No special section in this issue | |
| Apr. 2017 | No special section in this issue | |
| Mar. 2017 | No special section in this issue | |
| Feb. 2017 | Antenna and Propagation Technologies Contributing to Realization of Next Generation Wireless Systems | Vol. E100-B, No. 2 |
| Jan. 2017 | Challenged Networking Technologies and Its Service Quality | Vol. E100-B, No. 1 |
| Dec. 2016 | Information Centric Networking: Paradigms, Technologies, and Applications | Vol. E99-B, No. 12 |

Please confirm with the following IEICE web site for the latest CALL FOR PAPERS
http://www.ieice.org/event/ronbun-e.php?society=cs

Call for Papers

# — Special Section on Network Resource Control and Management for IoT Services and Applications —

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Network Resource Control and Management for IoT Services and Applications" in March 2018.

With the spread of Internet of Things (IoT) services and applications, the amount of traffic transmitted in several kinds of networks increases significantly and the traffic pattern also becomes more diversified than ever. For accommodating and processing such traffic, which is different from the existing traffic, it is indispensable to utilize an appropriate network resource control and management in several kinds of environments such as wireless access networks, wireless core networks, substrate networks, and cloud. Moreover, with the increase of battery-powered IoT devices, new control and management technologies that satisfy widespread requirements are expected in order to reduce the power consumption of the IoT devices and to decrease not only the processing load on the IoT devices but also the traffic load significantly. In addition, such new technologies must satisfy the requirements such that a huge number of IoT devices should be operated at low cost and with high efficiency, a huge amount of data should be processed at high speed and with high efficiency, and IoT services and applications should be developed in a safe and secure manner. Theoretical performance analysis, simulation/emulation experiments, and experimental evaluations are also important to deploy the technologies suitable for various IoT services and applications.

In order to further promote the above-mentioned researches for IoT services and applications, we thus call for publications (scheduled to appear in the March 2018 issue) to promote discussion and development of network resource control and management technologies including SDN, NFV, mobile edge computing (MEC), M2M/D2D, DTN, ICN/CCN, wireless network technologies, optical network technologies, LAA, cloud network, and so on. This special section solicits not only the standard regular papers but also position papers describing innovative ideas.

## 1. Scope

The scope of this special section includes, but is not limited to, the following topics:

- Software-defined networking (SDN)
- Network function virtualization (NFV)
- Network virtualization
- Mobile edge computing (MEC)
- Information/content centric networking (ICN/CCN)
- Machine-to-Machine (M2M)
- Device-to-Device (D2D)
- Delay/disruption/disaster tolerant networks (DTN)
- License Assisted Access (LAA)
- Network resource control
- Network resource management
- Fog computing
- Data center networking
- Optical network architecture
- Overlay networking
- Mobile networks
- Wireless sensor networks
- Environment monitoring networks
- Security / Privacy
- Inter-cloud networking
- RFID networking
- Device management
- Data offloading
- Performance analysis

## 2. Submission Instructions

The standard number of pages is 8 for a PAPER and 4 for a POSITION PAPER. Manuscripts should be prepared according to the guideline in the "Information for Authors." The latest version is available at the web site, http://www.ieice.org/eng/shiori/mokuji_cs.html. The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by **27th March 2017** (JST). Authors should choose the "Network Resource Control and Management for IoT Services and Applications" as a "Journal/Section" on the online screen. Do not choose [Regular EB].

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## 3. Special Section Editorial Committee

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*At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception.
We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit the web-page, http://www.ieice.org/eng/member/OM-appli.html.

Call for Papers

# ------- Special Section on Optical Access System for Social Life -------

The IEICE Transactions on Communications announces that it will publish a special section entitled "Special Section on Optical Access System for Social Life" in the **April 2018** issue.

Since the FTTH (Fiber To The Home) service kicked into gear in Japan in 2001, optical access systems have kept on advancing as economical technologies which enable broadband services to be enjoyed easily in customer's homes, and FTTH has been taking root as an essential social infrastructure. Additionally, owing to standardization activities and overseas developments, the optical access technologies have been widely spread as international technologies which are employed not only in Japan.

On the other hand, a rapid development of mobile services is driving the drastic increase of the data traffic of mobile network, and evolution of optical access technologies is expected toward applications to mobile backhaul and mobile fronthaul of the 5G mobile network, the services of which are expected to start from 2020. Furthermore, new technologies supporting social infrastructure, such as M2M and IoT, have been discussed actively, and expectations for optical access technologies supporting these applications are increasing. To meet such expectations, it is increasingly important to establish optical access technologies which will be essential in future social life.

Because of such reasons, a special section is being planned (scheduled to appear in the April 2018 issue) to further promote research and development of technologies on optical access system for social life

## 1. Scope

This special section aims at timely dissemination of research in these areas. Possible topics related to optical access system include, but are not limited to:

- Access network architecture
- PON technologies (QoS, DBA, Protection, Long-reach transmission, Low latency, Circuit emulation)
- Operation systems
- Video distribution in access network
- Optical-wireless convergence
- Optical access network for mobile network
- Network resilience
- Edge computing in access network
- Digital signal processing for optical access network
- Virtualization for optical access network
- Modulation formats
- Power saving
- Optical transceivers for access network
- Optical/Electronics devices for access network
- Applications across PON
- Impact of standardization

## 2. Submission Instructions

The standard number of pages is 8. The page charges are considerably higher for extra pages. Manuscripts should be prepared according to the guideline in the "Information for Authors." The latest version is available at the web site, http://www.ieice.org/eng/shiori/mokuji_cs.html. The term for revising the manuscript after acknowledgement of conditional acceptance for this special section could be shorter than that for regular issues (60 days) because of the tight review schedule.

This special section will accept papers only by electronic submission. Submit a manuscript and electronic source files (LaTeX/Word files, figures, authors' photos and biographies) via the IEICE Web site https://review.ieice.org/regist/regist_baseinfo_e.aspx by May 15th, 2017 (JST). Authors should choose the Optical Access System for Social Life as a "Journal/Section" on the online screen. Do not choose [Regular EB].

**Contact point:**
**Tomohiro Taniguchi, NTT**
**Hiroaki Mukai, Mitsubishi Electric Corporation**
**Tel: +81-46-859-2247, Fax: +81-46-859-5514, E-mail: eb-cs2018@mail.ieice.org**

## 3. Special Section Editorial Committee



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* At least one of the authors must be an IEICE member when the manuscript is submitted for review. Invited papers are an exception. We recommend that authors unaffiliated with IEICE apply for membership. For membership applications, please visit http://www.ieice.org/eng/member/OM-appli.html

## *Welcome to the IEICE Overseas Membership Page* URL:http://www.ieice.org/

**Membership for Overseas Candidates:** Overseas Members may opt to join **one IEICE Society of their choice** and may request to **receive the IEICE Transactions of online version** of that Society. Furthermore, Overseas Members may request to receive the IEICE Journal(written in Japanese) and Transactions (published in paper) at an additional cost. Similar services are available to **Overseas Student Members.** Voting privileges in the IEICE election do not apply to Overseas Members. Note that the Overseas Membership applies only to candidates who reside outside of Japan and who have citizenship in countries other than Japan.

**OMDP (Overseas Membership Development Program):** OMDP is provided for candidates **from countries/areas in Asia(except Republic of Korea and Taiwan), Africa, Central America, and South America.** This program is designed so that IEICE can contribute to and support the progress of science and technology throughout the world. Scientists and engineers in these countries/areas are encouraged to apply to the program.

### ● IEICE Societies and Publications

| Society | Transactions | Editorial Subject Indexes |
|---|---|---|
| A (Fundamentals of Electronics, Communications and Computer Sciences) | EA (English) A (Japanese) | Engineering Acoustics, Noise and Vibration, Speech and Hearing, Ultrasonics, Digital Signal Processing, Analog Signal Processing, Systems and Control, Nonlinear Problems, Circuit Theory, VLSI Design Technology and CAD, Numerical Analysis and Optimization, Algorithms and Data Structures, Graphs and Networks, Reliability, Maintainability and Safety Analysis, Cryptography and Information Security, Information Theory, Coding Theory, Communication Theory and Signals, Spread Spectrum Technologies and Applications, Mobile Information Network and Personal Communications, Intelligent Transport System, Image, Vision, Computer Graphics, Language, Thought, Knowledge and Intelligence, Human Communications, Neural Networks and Bioengineering, Multimedia Environment Technology, Communication Environment and Ethics, Concurrent Systems, Measurement Technology, General Fundamentals and Boundaries |
| B (Communications) | EB (English) B (Japanese) | Fundamental Theories for Communications, Devices/Circuits for Communications, Transmission Systems and Transmission Equipment for Communications, Optical Fiber for Communications, Fiber-Optic Transmission for Communications, Switching for Communications, Switching for Mobile Communications, Network, Network Management/Operation, Internet, Wireless Communication Technologies, Terrestrial Radio Communications, Satellite Communications, Optical Wireless Communications, Antennas and Propagation, Electromagnetic Compatibility (EMC), Sensing, Navigation, Guidance and Control Systems, Energy in Electronics Communications, Terminals for Communications, Multimedia Systems for Communications, Broadcast Systems, Integrated Systems for Communications, Space Utilization Systems for Communications |
| C (Electronics) | EC (English) C (Japanese) | Electromagnetic Theory, Lasers, Quantum Electronics, Optoelectronics, Microwaves, Millimeter-Waves, Ultrasonic Electronics, Electronic Circuits, Electronic Materials, Organic Molecular Electronics, Electronic Components, Electromechanical Devices and Components, Semiconductor Materials and Devices, Integrated Electronics, Electron Tubes, Vacuum and Beam Technology, Electronic Displays, Superconducting Electronics, Storage Technology, Electronic Instrumentation and Control |
| D (Information and Systems) | ED (English) D (Japanese) | Computation and Computational Models, Automata and Formal Language Theory, Algorithm Theory, Complexity Theory, Computer Components, VLSI Systems, Computer Systems, Fundamentals of Software and Theory of Programs, System Programs, Software Engineering, Database, Contents Technology and Web Information Systems, Data Mining, Networks, Dependable Computing, Application Information Security, Distributed Cooperation and Agents, Artificial Intelligence and Cognitive Science, Human-computer Interaction, Office Information Systems, e-Business Modeling, Educational Technology, Rehabilitation Engineering and Assistive Technology, Pattern Recognition, Speech and Hearing, Image Processing and Video Processing, Image Recognition, Computer Vision, Computer Graphics, Multimedia Pattern Processing, Natural Language Processing, Biocybernetics, Neurocomputing, Biological Engineering, Music Information Processing, Kansei Information Processing, Affective Information Processing |
| **Journal of IEICE (written in Japanese only)** | | |

### ● Membership Charges (http://www.ieice.org/eng/member/OM-appli.html#c)

Basic Membership Charge is as follows. It will change the term when you join IEICE. Please refer to the above website.

**Basic Membership Charge (UNIT : Japanese YEN)**

| | | Online Version | | Paper Version (optional) |
|---|---|---|---|---|
| Service coverage for overseas members | Admission charge | Registration of the first society (includes its online version transactions) | Registration of additional societies (includes its online version transactions) | Journal (written in Japanese) |
| Member (overseas) | 1,400 | 7,000 | 3,500 / 1society | 6,000 |
| Member (overseas) with OMDP* | 1,000 | 5,000 | 3,000 / 1society | 6,000 |
| Student member (overseas) | – | 2,000 | 2,000 / 1society | 6,000 |
| Student member (overseas) with OMDP* | – | 1,000 | 1,500 / 1society | 6,000 |

**NOTE**

**1. You need to choose one Society, and you can subscribe Transactions online of your registered society.**
*Example: If you want to subscribe to Transaction of EA, please check **Society Registration** as "A", and your membership fee amounts to 7,000 yen / 5,000 yen.*

**2. If you want to register other Societies and Transaction of web version, please check "Additional Society registration".**
*Example: If you want to subscribe to Transaction of EA and EB, please check **Society Registration** as "A", **Additional Society registration (optional)** as "B". Your membership fee amounts to 7,000+3,500 yen / 5,000+3,000 yen.*

**3. If you want to subscribe to one Transaction of paper version, please check "Additional Transaction subscription (published in paper)".**
*Example: If you want to subscribe to Transaction of EC in paper version additionally, please check **Society Registration** as "A", and **Additional Transaction subscription (in paper version)** as "C" or as "EC". Your membership fee amounts to 7,000+4,000 yen / 5,000+4,500 yen.*

**4. If you want to change membership from Member (In Japan) to Overseas Member, you don't need to pay an Entrance charge.**

### ● Optional Rapid Mailing Service

Surface mail charge is included in the membership charge. Optional rapid mailing service is available by air mail or surface air lifted (SAL) mail. The additional charge per year periodical depends on the mailing address, as shown in the right table.

| Areas | Air mail | SAL mail |
|---|---|---|
| Asia; Guam; Midway islands | 5,600 yen | 3,200 yen |
| Oceania; Near & Middle East; North & Central America; Europe | 7,800 yen | 4,400 yen |
| Africa; South America | 11,000 yen | 5,600 yen |

**Please contact the IEICE Membership Section:** E-mail:member@ieice.org FAX: +81 3 3433 6659 ***Please fill out the application form printed on the next page.***

# IEICE Overseas Membership Application Form

**URL** http://www.ieice.org/eng/member/OM-appli.html **E-mail** member@ieice.org **FAX** +81-3-3433-6659

◆ **Please type or print in English. The deadline for submitting application form is the 1st day of every month.**

## Personal Information

***Full name:*** _____ ***Nationality:*** _____ ☐Male ☐Female
First name Middle name Last name

☐Prof. ☐Dr. ☐Mr. ☐Ms. ***Place of birth:*** _____ ***Date of birth:*** _____
Day Month Year

## Mailing Address ☐Home ☐Office

Name of Company/School/College Department/Section

Street City State/Province

Postal code Country

TEL FAX E-mail

## Academic Background The highest academic degree: ☐Ph.D. ☐Masters ☐Bachelors ☐Others: _____

University/college/school of the highest academic degree Month & year of graduation

**(For Student Member)** Academic degree which will be conferred on you Month & year when the degree will be conferred on you

## Application Information

***Membership:*** I want to apply for the following membership (check one item!)

☐Member (Overseas) ☐Student Member (Overseas)

◆If you want to apply for OMDP, please check; ☐OMDP (Overseas Membership Development Program)

***Society registration (Membership fee includes one Society of Transaction of Online version.):***

☐A: Engineering Sciences ☐B: Communications ☐C: Electronics ☐D: Information and Systems

**Additional Society (optional):** ☐A: Engineering Sciences ☐B: Communications ☐C: Electronics ☐D: Information and Systems

**Additional Transactions of paper version (optional):**

☐EA: Fundamentals ☐EB: Communications ☐EC: Electronics ☐ED: Information and Systems

☐A: Fundamentals (Japanese) ☐B: Communications (Japanese) ☐C: Electronics (Japanese) ☐D: Information and Systems (Japanese)

**Journal subscription (optional):** ☐(Japanese)

## Remittance Remittance is available only in *Japanese yen* by a *credit card*.

Admission charge……¥_____ Journal subscription (optional)……..¥ _____

Annual charge……¥_____ Mailing option: ☐Air mail……..……¥ _____

Additional Society (optional) …… ¥_____ ☐SAL mail……¥ _____

Additional Transactions (optional)……..…¥_____ **Total……..……¥** _____

Credit Card: ☐UC ☐Master Card ☐VISA ☐JCB ☐American Express

Card number: | | | | | | | | | | | | | | | | |

Expiry date: _____/_____ Credit Card Holder: _____ Signature: _____
Year Month

## Endorsement *Endorsements by one IEICE Member application is required. If it is difficult to find endorsers, please contact the IEICE Membership Activities Section by sending this sheet, and we will help you.*

I recommend this applicant for IEICE membership.

Endorser's name Membership number Endorser's signature Date

# IEICE-CS Overseas Membership with Special Annual Fees for Sister Society Members

To foster the cooperation between the Sister Society and the IEICE Communications Society (IEICE-CS), the Sister Society agreement enables members of each institution to become members of both societies by granting special annual fees.

A 10% - 20% discount* of the annual fees will be granted to the sister society members to become the IEICE-CS overseas members. The discounted fees will be applied for the individual members when the new membership is starting or the current membership is renewing.

* The discount does not apply to the optional items and services i.e. “Additional Society”, “Additional Transactions of paper version” and “Rapid Mailing Service”.

*------ Please send the following Sister Society membership information, together with membership application form in the next page. ------*

**Sister Society membership information**

***To apply discount rates for this IEICE-CS Sister Society member’s application, please indicate your Sister Society Membership number below, and attach a copy of your Sister Society Membership certificate or card to this form.***

Sister Society: ☐IEEE ComSoc ☐KICS ☐VDE-ITG

Membership number (Member):_____

Copy of Membership certificate or Membership card:

(Attached here)

# IEICE Overseas Membership Application Form for IEICE-CS Sister Society Members

**URL** http://www.ieice.org/eng/member/OM-appli.html **E-mail** member@ieice.org **FAX** +81-3-3433-6659

◆ **Please type or print in English. The deadline for submitting application form is the 1st day of every month.**

## Personal Information

☐Male ☐Female

***Full name:*** _____ ***Nationality:*** _____

First name Middle name Last name

☐Prof. ☐Dr. ☐Mr. ☐Ms. ***Place of birth:*** _____ ***Date of birth:*** _____

Day Month Year

## Mailing Address ☐Home ☐Office

Name of Company/School/College Department/Section

Street City State/Province

Postal code Country

TEL FAX E-mail

## Academic Background The highest academic degree: ☐Ph.D. ☐Masters ☐Bachelors ☐Others: _____

University/college/school of the highest academic degree Month & year of graduation

## Application Information

***Membership:*** I want to apply for the following membership*:

☐Member ☐Member (including Japanese Journal subscription)

☐Student Member ☐Student Member (including Japanese Journal subscription)

**Membership applies only to applicant who reside outside of Japan and who have non-Japanese citizenship.*

◆If you want to apply for OMDP (Overseas Membership Development Program), please check; ☐OMDP

***Society registration (Membership fee** includes one Society of Transaction of Online version.):***

☑B: Communications

***Discount rate is applied to this IEICE-CS Sister Society Member's application.*

---------- *Discount rate is not applied for the following optional items.* ----------

**Additional Society (optional):** ☐A: Engineering Sciences ☐C: Electronics ☐D: Information and Systems

## Remittance Remittance is available only in *Japanese yen* by a *credit card*.

Admission charge……..¥_____ Journal subscription (optional)……..¥_____

Annual charge…….. ¥_____ Mailing option: ☐Air mail……..……¥_____

Additional Society (optional) …… ¥_____ ☐SAL mail……¥_____

**Total……..……¥** _____

Credit Card: ☐UC ☐Master Card ☐VISA ☐JCB ☐American Express

Card number: | | | | | | | | | | | | | | | | |

Expiry date: ____/____ Credit Card Holder: _____ Signature: _____

Year Month

## Endorsement *The following endorsement for this Sister Society member's application will be given by an IEICE-CS director (any related action of endorsement by applicant is not necessary if a copy of your Sister Society Membership certificate or card is indicated).*

I recommend this applicant for IEICE membership.

(Director of Planning and Member Activities, IEICE-CS)

Endorser's name Membership number Endorser's signature Date

# From Editor's Desk

## ● Season's greetings

The IEICE General Conference 2017 will be held at Meijo University, Nagoya, March 22nd – 25th, 2017. On the first day of the conference, Communications Society is going to hold Welcome Party from 17:15 to 19:15 at a cafeteria in the campus. The objective of the party is to provide young engineers especially students with a good opportunity to meet and talk friendly with experienced researchers and engineers in various organizations. Anyone can join the party for free. Please come and join the Welcome Party in the evening at the first day!

For the information on the IEICE General Conference 2017, please check out the latest information on the IEICE web site at: http://www.toyoag.co.jp/ieice/E_G_top/e_g_top.html

IEICE-CS GLOBAL NEWSLETTER Editorial Staff

**Editorial Staff of this issue**

No special order is observed.

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Meiji University
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**Manabu KAI**
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**Takashi DATEKI**
Fujitsu Laboratories, Ltd.
Network Systems Laboratory
*Director, International Publication, IEICE Communications Society*

# 2017 IEEE CAMA

## 4 - 6 December, 2017

## AIST, Tsukuba, Ibaraki, Japan

## 2017 IEEE Conference on Antenna Measurements & Applications

## http://www.2017ieeecama.org

**The venue is AIST (National Inst. of Advanced Industrial Science and Tech.)**
**The AIST (https://www.aist.go.jp/index_en.html) is located in Tsukuba, one hour from Narita airport by direct shuttle bus service and one hour to Tokyo by Tsukuba Express railway.**

Picture provided by Ibaraki Prefectural Tourism & Local Products Association

## Organizing Committee:

*General Chairs*

Satoru Kurokawa (AIST, Japan)

Nozomu Ishii (Niigata Univ., Japan)

*TPC Chairs*

Claire Migliaccio (Univ. Nice Sophia Antipolis, CNRS, France)

Takayuki Sasamori (Akita Prefectural Univ., Japan)

*International Advisory Committee Chairs*

Christian Pichot (Univ. Nice Sophia Antipolis, CNRS, France)

Hiroyuki Arai (Yokohama National Univ., Japan)

## Important Dates:

Submission Deadline for Regular Session: **1 August, 2017**

Submission Deadline for Special Session: **15 August, 2017**

Notification of Acceptance: **22 September, 2017**

## Suggested Technical Topics:

- Antenna Measurements in Non-anechoic Environments,
- Frequency versus Time-Domain in Antenna Measurements
- Multi-antenna System Measurements (Spatial Diversity)
- New Measurement Methods and Systems
- RF Material Characterization and Radomes
- Novel Near-Field to Far-Field Transformations
- Inverse & Imaging Techniques
- Super Resolution Algorithms and Processing
- Antenna Calibration, Uncertainty Analysis
- Applications:Telecommunications, Biomedical, Satellites, Industrial, Civil Engineering, Geophysics, Homeland Security

## Location of Tsukuba City:


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APS

Technically Co-sponsored by

AIST

IEICE Communications Society

ICO-24
JAPAN TOKYO 2016

# The 24th Congress of the International Commission for Optics

TOKYO, JAPAN

**Date: 21 (Mon.) - 25 (Fri.) August, 2017**

**Venue : Keio Plaza Hotel, Tokyo**

ICO-24 **The Congress of the International Commission for Optics (ICO) is the most important scientific and technical meeting on optics and photonics around the world.**

## Scope

1. Optical Design, Optical Materials, and Photo Lithography
2. Vision, Color, Display and Lighting
3. Optical Metrology
4. Optical Imaging and Optical Information Processing
5. Advanced Microscopy and Spectroscopy
6. Biomedical Optics/Photonics
7. Nonlinear Optics
8. Ultrafast Phenomena and Ultrafast Optics
9. High Power Lasers and Applications
10. X-ray and High-energy Optics
11. Microwave/Millimeterwave/THz Photonics
12. Near Field Optics, Plasmonics, and Metamaterials
13. Photonic Crystal, Nano Structures and Functions
14. Optoelectronics and Photonic Devices
15. Optical MEMS and Micro-optics
16. Quantum Optics and Atom Optics
17. Fiber Optics
18. Optical Communications and Photonic Network

**Paper Deadline : 3 March, 2017**

## Conference Chairs

- General Chair : Y. Arakawa (Univ. of Tokyo)
- Program Committee Chair : S. Kawata (Osaka Univ.)
- Steering Committee Chair : T. Baba (Yokohama National Univ.)
- Fundraising Committee Chair : T. Yatagai (Utsunomiya Univ.)

## Sponsors

International Commission for Optics
Science Council of Japan

### Co-sponsors

The Japan Society of Applied Physics (JSAP)
Optical Society of Japan (OSJ)

### Technical co-sponsors

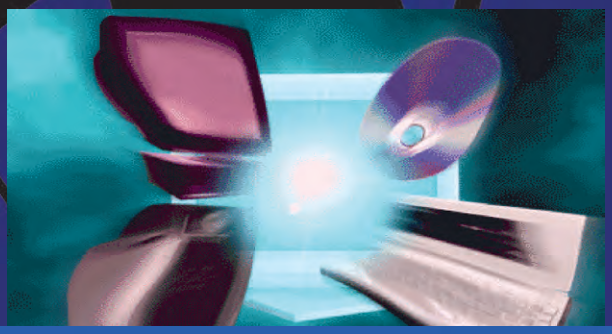
Chinese Optical Society (COS), Chinese Society for Optical Engineering (CSOE) European Optical Society (EOS), The Institute of Electronics, Information and Communication Engineers (IEICE) (Communication Society, Electronics Society), The International Society for Optical Engineering (SPIE), The Laser Society of Japan (LSJ), The Optical Society (OSA), Optical Society of Korea (OSK), The Physical Society of Japan (JPS), Taiwan Photonics Society (TPS)

**http://ico24.org/**

Secretariat-ICO24 : ico-24@or.knt.co.jp

*To Probe Further and Keep Up-to-date with Communication Technologies*

# IEICE Communications Society



## IEICE General Conference 2017

### 22-25 March 2017
### Meijo University, Nagoya, Aichi

Every spring, the five Societies, together with the Human Communications Group, jointly hold a General Conference to provide a forum where members can present their study results and exchange views. Besides the presentation of papers, there are special IEICE events, conferment ceremonies of Fellows and Young Investigators Awards, and social parties. The Communications Society holds English-language sessions as well. Please check out the latest information on the IEICE web site at:

http://www.toyoag.co.jp/ieice/E_G_top/e_g_top.html

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(*) Depending on material, IEICE membership account, password attached to proceedings DVD, etc. may be required to view PDF contents.


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IEICE Communications Society: cs-secretariat@ieice.org