

External Awards

Achievement Award

Winner: Shuto Yamamoto, NTT Network Innovation Laboratories

Date: February 19, 2016

Organization: The Institute of Electronics, Information and Communication Engineers (IEICE)

For the research and development of ultra-high-capacity multilayer-integrated transport system.

Interaction 2016 Best Paper Award

Winner: Naomi Yamashita, NTT Communication Science Laboratories; Hideaki Kuzuoka, University of Tsukuba; Keiji Hirata, Future University Hakodate; Takashi Kudo, Osaka University; Eiji Aramaki, Kyoto University; and Kazuki Hattori, University of Tsukuba

Date: March 2, 2016

Organization: The Information Processing Society of Japan (IPJS) Interaction 2016 executive committee

For “Mimamo-Mate: A Web Application for Family Caregivers to Track Their Caregiving Activities.”

Published as: N. Yamashita, H. Kuzuoka, K. Hirata, T. Kudo, E. Aramaki, and K. Hattori, “Mimamo-Mate: A Web Application for Family Caregivers to Track Their Caregiving Activities,” Proc. of IPJS Interaction 2016, Tokyo, Japan, Mar. 2016.

2015 Temperature Award for the Best Puzzle

Winner: Hsin-Ni Ho, NTT Communication Science Laboratories

Date: March 11, 2016

Organization: Editorial board of Temperature

For “Red... How does it feel?”

Young Researcher’s Award

Winner: Farhan Mahmood, NTT Network Technology Laboratories

Date: March 17, 2016

Organization: IEICE

For “Design of DC-AMN with Considering Longitudinal Conversion Loss.”

Published as: F. Mahmood, K. Okamoto, H. Tatemichi, K. Takaya, and N. Kuwabara, “Design of DC-AMN with Considering Longitudinal Conversion Loss,” Proc. of the 2015 IEICE Society Conference, B-4-34, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher’s Award

Winner: Minoru Inomata, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For “Prediction Method for Propagation Loss Characteristics in NLOS Street Microcell Environment.”

Published as: M. Inomata, N. Ohmaki, W. Yamada, M. Sasaki, T. Sugiyama, M. Mizoguchi, K. Kitao, and T. Imai, “Prediction Method for Propagation Loss Characteristics in NLOS Street Microcell Environment,” Proc. of the 2015 IEICE General Conference, B-1-28, Kusatsu, Shiga, Japan, Mar. 2015 (in Japanese).

Young Researcher’s Award

Winner: Minoru Inomata, NTT Access Network Service Systems

Laboratories

Date: March 17, 2016

Organization: IEICE

For “Outdoor to Indoor Path Loss Characteristics for 8 to 37 GHz Band.”

Published as: M. Inomata, W. Yamada, M. Sasaki, and T. Onizawa, “Outdoor to Indoor Path Loss Characteristics for 8 to 37 GHz Band,” Proc. of the 2015 IEICE Society Conference, BS-1-8, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher’s Award

Winner: Naotaka Shibata, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For “Performance Evaluation of Mobile Fronthaul Transmission Employing Ethernet-based TDM-PON.”

Published as: N. Shibata, T. Tashiro, S. Kuwano, J. Terada, and A. Otaka, “Performance Evaluation of Mobile Fronthaul Transmission Employing Ethernet-based TDM-PON,” Proc. of the 2015 IEICE General Conference, B-8-15, Kusatsu, Shiga, Japan, Mar. 2015 (in Japanese).

Young Researcher’s Award

Winner: Hiroshi Takahashi, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For “Splice Loss Measurement Using End-reflection Assisted Brillouin Analysis.”

Published as: H. Takahashi, K. Toge, F. Ito, and C. Kito, “Splice Loss Measurement Using End-reflection Assisted Brillouin Analysis,” IEICE Tech. Rep., Vol. 113, No. 265, OFT2013-22-37, pp. 39-42, Oct. 2013 (in Japanese).

Young Researcher’s Award

Winner: Hiroshi Takahashi, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For “Brillouin-based PON Monitoring Using Frequency-swept Pump Pulse.”

Published as: H. Takahashi, C. Kito, K. Toge, and T. Manabe, “Brillouin-based PON Monitoring Using Frequency-swept Pump Pulse,” Proc. of the 2015 IEICE Society Conference, B-13-17, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher’s Award

Winner: Takayoshi Mori, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For “Compensation of Inter-channel Signal Quality Difference in Mode-division-multiplexed Transmission.”

Published as: T. Mori, T. Sakamoto, M. Wada, T. Yamamoto, F.

Yamamoto, and K. Nakajima, "Compensation of Inter-channel Signal Quality Difference in Mode-division-multiplexed Transmission," IEICE Tech. Rep., Vol. 115, No. 201, OCS2015-33, pp. 13–18, Aug. 2015 (in Japanese).

Young Researcher's Award

Winner: Takayoshi Mori, NTT Access Network Service Systems Laboratories

Date: March 17, 2016

Organization: IEICE

For "Experimental Evaluation of Inter-modal Fiber Nonlinearity in MDM Transmission."

Published as: T. Mori, T. Sakamoto, M. Wada, A. Urushibara, T. Yamamoto, and F. Yamamoto, "Experimental Evaluation of Inter-modal Fiber Nonlinearity in MDM Transmission," Proc. of the 2015 IEICE Society Conference, B-13-28, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher's Award

Winner: Yui Yoshida, NTT Network Innovation Laboratories

Date: March 17, 2016

Organization: IEICE

For "An Efficiency Evaluation of Dispersed Storage Systems Based on Irregular Flat XOR Codes."

Published as: Y. Yoshida, T. Nakachi, D. Shirai, and T. Fujii, "An Efficiency Evaluation of Dispersed Storage Systems Based on Irregular Flat XOR Codes," Proc. of the 2015 IEICE Society Conference, A-20-6, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher's Award

Winner: Hideya So, NTT Network Innovation Laboratories

Date: March 17, 2016

Organization: IEICE

For "Suppression Design of Undesired Reflections from Frequency-selective Surfaces for Multiband Antenna Employing FSSs" and "A Proposal on Undesired Radiation Suppression Technique Using Adaptive Control of Transmission Plate for Distributed Array Antenna Systems in Mobile Environment."

Published as: H. So, A. Ando, T. Sugiyama, and K. Cho, "Suppression Design of Undesired Reflections from Frequency-selective Surfaces for Multiband Antenna Employing FSSs," Proc. of the 2015 IEICE General Conference, B-1-149, Kusatsu, Shiga, Japan, Mar. 2015 (in Japanese); H. So, K. Suzuki, D. Goto, Y. Suzuki, and F. Yamashita, "A Proposal on Undesired Radiation Suppression Technique Using Adaptive Control of Transmission Plate for Distributed Array Antenna Systems in Mobile Environment," Proc. of the 2015

IEICE Society Conference, B-3-18, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher's Award

Winner: Yasuhiro Mochida, NTT Network Innovation Laboratories

Date: March 17, 2016

Organization: IEICE

For "A Proposal of UI Construction Using WebSocket for REMOCOP."

Published as: Y. Mochida, D. Shirai, and T. Fujii, "A Proposal of UI Construction Using WebSocket for REMOCOP," Proc. of the 2015 IEICE Society Conference, B-11-13, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Young Researcher's Award

Winner: Mitsuteru Yoshida, NTT Network Innovation Laboratories

Date: March 17, 2016

Organization: IEICE

For "Blind Chromatic Dispersion Estimation Using Spectral Symmetry of Real-valued Signals."

Published as: M. Yoshida, K. Yonenaga, and A. Hirano, "Blind Chromatic Dispersion Estimation Using Spectral Symmetry of Real-valued Signals," Proc. of the 2015 IEICE Society Conference, B-10-23, Sendai, Miyagi, Japan, Sept. 2015 (in Japanese).

Maejima Hisoka Award

Winner: Kazuhide Nakajima, NTT Access Network Service Systems Laboratories; Shigeru Tomita, NTT Advanced Technology Corporation; and Izumi Sankawa, NTT Electronics Corporation

Date: March 18, 2016

Organization: Tsushinbunka Association

For the research and development of hole-assisted optical fibers.

SUEMATSU-Yasuharu Award

Winner: Yoshihide Tonomura, NTT Service Evolution Laboratories

Date: June 2, 2016 (presentation ceremony)

Organization: IEICE

For the research and development of high-efficiency forward error correction (FEC) codes and the contribution to ISO/IEC MPEG/MMT standardization.

Published as: Y. Tonomura, D. Shirai, T. Nakachi, T. Fujii, and H. Kiya, "Layered Low-density Generator Matrix Codes for Super High Definition Scalable Video Coding System," IEICE Trans. Fundamentals, Vol. E92-A, No. 3, pp. 798–807, 2009.

Papers Published in Technical Journals and Conference Proceedings

Performance Evaluation of SSB Transmission of DFTs-OFDM Using Multi-level BPSK through Nonlinear HPA

M. Umehira, S. Nihei, H. Fusayasu, T. Miyajima, S. Takeda, J. Mashino, and T. Sugiyama

Proc. of VTC2015-Spring (the 2015 IEEE 81st Vehicular Technology Conference), Glasgow, UK, May 2015.

This paper describes performance evaluation results of single side band (SSB) transmission of discrete Fourier transform spreading orthogonal frequency division multiplexing (DFTs-OFDM) using multi-level binary phase shift keying (BPSK) through a nonlinear HPA (high power amplifier). SSB-DFTs-OFDM is generated by eliminating the USB (upper side band) or LSB (lower side band) in the frequency domain after DFT spreading of multi-level BPSK signals. Thus, a Hilbert transformer is not necessary to generate SSB signals. The simulation results show that SSB-DFTs-OFDM achieves almost the same peak-to-average power ratio (PAPR) and adjacent channel power leakage (ACLP) as conventional DFTs-OFDM and lower PAPR and ACLP than OFDM.

Study on Multiple Stream Transmission by Using Multiple Polarizations

M. Arai, T. Seki, and N. Shinohara

Proc. of the 45th European Microwave Conference, pp. 1359–1362, Paris, France, September 2015.

In this paper, we propose a new method for achieving multiple stream transmission by using multiple polarizations. Using polarization switching sequences corresponding to streams enables interferences to be canceled and multiple streams to be made because the polarizations are symmetrical regardless of antenna spacing. Therefore, the method is effective when antenna spacing is small. Numerical analysis revealed that the channel capacity per unit area achieved with our method increases in proportion to the number of streams.

Cavity-less On-chip Optomechanics Using Excitonic Transitions in Semiconductor Heterostructures

H. Okamoto, T. Watanabe, R. Ohta, K. Onomitsu, H. Gotoh, T. Sogawa, and H. Yamaguchi

Nature Communication, Vol. 6, Article no. 8478, October 2015.

The hybridization of semiconductor optoelectronic devices and nanomechanical resonators provides a new class of optomechanical systems in which mechanical motion can be coupled to light without any optical cavities. Such cavity-less optomechanical systems interconnect photons, phonons, and electrons (holes) in a highly integrable platform, opening up the development of functional integrated nanomechanical devices. Here we report on a semiconductor modulation-doped heterostructure-cantilever hybrid system, which realizes efficient cavity-less optomechanical transduction through excitons. The opto-piezoelectric back-action from the bound electron-hole pairs enables us to probe excitonic transition simply with a sub-nanowatt power of light, realizing high-sensitivity optomechanical spectroscopy. Detuning the photon energy from the exciton resonance results in self-feedback cooling and amplification of the thermomechanical motion. This cavity-less on-chip coupling enables highly tunable and addressable control of nanomechanical resona-

tors, allowing high-speed programmable manipulation of nanomechanical devices and sensor arrays.

Selective-layer-free Blood Ionogram Using a 0D Nanotransistor Biosensor

R. Sivakumarasamy, K. Nishiguchi, A. Fujiwara, and N. Clément

Proc. of the 28th International Microprocesses and Nanotechnology Conference (MNC 2015), 11D-2-4, Toyama, Japan, November 2015.

We show that a 0D nanotransistor in liquid has unique properties that enable ion selectivity without the need for ion-selective layers. We performed a blood ionogram for various ions with a 1.5 mm × 1.5 mm silicon chip.

Electron Emission Using Multilayered-graphene/SiO₂/Si Heterodevice Driven by Low-voltage Supply in Low Vacuum

D. Yoshizumi, K. Nishiguchi, Y. Sekine, K. Furukawa, A. Fujiwara, and M. Nagase

Proc. of MNC 2015, 13P-11-104L, Toyama, Japan, November 2015.

In this study, taking advantage of this low electron scattering rate, we demonstrate a new application: a multilayered-graphene/SiO₂/Si heterodevice for electron emission. Since electrons gain energy during their tunneling event through the heterostructure, electrons are emitted from the device with a low-voltage supply in low vacuum.

Scalable and Locality-aware Distributed Topic-based Pub/Sub Messaging for IoT

Y. Teranishi, R. Banno, and T. Akiyama

Proc. of IEEE GLOBECOM 2015, San Diego, CA, USA, December 2015.

Topic-based pub/sub (TBPS) messaging plays an important role in building event-driven Internet of Things (IoT) applications. In IoT applications, scalability and locality-awareness are important properties that help to achieve low-latency message delivery and efficient usage of network resources. However, none of the existing distributed TBPS methods can simultaneously achieve a sufficient level of both properties. This paper proposes a new TBPS overlay method called ‘Skip Graph-based TBPS with Locality-Awareness’ (STLA), which extends existing Skip Graph-based TBPS messaging by adding locality-awareness. STLA determines the order of the keys on a Skip Graph overlay network according to the network hierarchy structure using ‘locality-aware topic keys’ (LATAK). Using ‘split-forward broadcasting’ (SFB) with LATAK, the locality-awareness can be dramatically improved.

Perceptual Illusions for Multisensory Displays

T. Amemiya

Proc. of IDW 2015 (the 22nd International Display Workshops),

pp. 1276–1279, Ohtsu, Shiga, Japan, December 2015.

Human perceptual properties have been applied for designing multisensory display technologies. This paper overviews the sensory-illusion-based approach we have used to create a force display that elicits illusory continuous force sensation by presenting asymmetric vibrations and a self-motion display based on a cross-modal effect between visual and tactile motion.

Orthogonalized Directional MIMO Transmission Using Higher Order Mode Microstrip Antennas

M. Arai, T. Seki, K. Hiraga, K. Sakamoto, H. Toshinaga, and T. Nakagawa

IEICE Transactions on Communications, Vol. E99-B, No. 1, pp. 48–57, January 2016.

We propose a spatial division method using orthogonal directivities formed by using higher order modes of rectangular microstrip antennas. Each of them is formed by one antenna element so that channels are orthogonalized only by antennas. We verify antenna radiation characteristics by using higher order mode microstrip antennas and confirm that orthogonal directivities are obtained with them. Measurement of two-stream transmission reveals that the method achieves almost the same channel capacity as that of an eigenmode-beamforming method because of the high multiplexing gain it achieves.

A DNA Aptamer Recognising a Malaria Protein Biomarker Can Function as Part of a DNA Origami Assembly

M. Godonoga, T.-Y. Lin, A. Oshima, K. Sumitomo, M. S. L. Tang, Y.-W. Cheung, A. B. Kinghorn, R. M. Dirkwager, C. Zhou, A. Kuzuya, J. A. Tanner, and J. G. Heddle

Scientific Reports, Vol. 6, No. 21266, February 2016.

DNA aptamers have potential for disease diagnosis and as therapeutics, particularly when interfaced with programmable molecular technology. Here we have combined DNA aptamers specific for the malaria biomarker *Plasmodium falciparum* lactate dehydrogenase (*PfLDH*) with a DNA origami scaffold. Twelve aptamers that recognise *PfLDH* were integrated into a rectangular DNA origami, and atomic force microscopy demonstrated that the incorporated aptamers preserve their ability to specifically bind the target protein. Captured *PfLDH* retained enzymatic activity, and protein-aptamer binding was observed dynamically using high-speed AFM. This work demonstrates the ability of DNA aptamers to recognise a malaria biomarker whilst being integrated within a supramolecular DNA scaffold, opening new possibilities for malaria diagnostic approaches based on DNA nanotechnology.

Sequence Alignment as a Set Partitioning Problem

M. Nishino, J. Suzuki, S. Umetani, T. Hirao, and M. Nagata

Journal of Natural Language Processing, Vol. 23, No. 2, pp. 173–194, March 2016 (in Japanese).

Sequence alignment, which involves aligning elements of two given sequences, occurs in many natural language processing (NLP) tasks such as sentence alignment. Previous approaches for solving sequence alignment problems in NLP can be categorized into two groups. The first group assumes monotonicity of alignments; the second group does not assume monotonicity or consider the continuity of alignments. However, for example, in aligning sentences of parallel legal documents, it is desirable to use a sentence alignment

method that does not assume monotonicity but can consider continuity. Herein, we present a method to align sequences where block-wise changes in the order of sequence elements exist. Our method formalizes a sequence alignment problem as a set partitioning problem, which is a type of combinatorial optimization problem, and solves the problem to obtain an alignment. We also propose an efficient algorithm to solve the optimization problem by applying column generation.

Dense Space Division Multiplexed Transmission over Multicore and Multimode Fiber for Long-haul Transport Systems

T. Mizuno, H. Takara, K. Shibahara, A. Sano, and Y. Miyamoto

Journal of Lightwave Technology, Vol. 34, No. 6, pp. 1484–1493, March 2016.

In this paper, we review recent progress on space division multiplexed (SDM) transmission and our proposal of dense SDM (DSDM) with more than 30 spatial channels toward capacities beyond petabit/s. Furthermore, we discuss the requirements for realizing long-haul DSDM transport systems using multicore and/or multimode fiber, including power and space efficient amplification schemes, the use of fibers with large effective areas and transmission lines with low intercore crosstalk, low differential mode delay (DMD), and low mode dependent loss (MDL). Graded index heterogeneous 12-core \times 3-mode fiber with low crosstalk, low DMD and low MDL, parallel multiple-input and multiple-output signal processing, low mode-dependent gain Erbium-doped fiber amplifiers, and MDL equalization technologies are significant in terms of extending the reach of multicore and multimode transmission. We review our long-distance transmission experiment on polarization-division multiplexed 16-quadrature amplitude modulation signaling over 12-core \times 3-mode fiber.

New Indoor Accelerated Weathering Condition for Approximating Molecular Weight Distribution of Outdoor-exposed LDPE

T. Miwa, Y. Takeshita, Y. Akage, M. Watanabe, M. Takaya, and T. Sawada

Journal of Chemistry and Chemical Engineering, Vol. 9, No. 8, pp. 481–493, March 2016.

LDPE (low-density polyethylene) photodegraded through various accelerated weathering tests has molecular weight distribution curves unlike that attained through outdoor exposure. The authors therefore developed new weathering test conditions based on the existing accelerated weathering test using a xenon arc lamp. Samples of LDPE were photodegraded using various accelerated weathering test conditions and outdoor exposure. The physical properties and chemical structures of the photodegraded samples were studied through a tensile test, infrared spectroscopy, and gel chromatography. The authors found that the molecular weight distribution curve of a sample photodegraded using a xenon lamp at a higher BPT (black panel temperature) (73 °C) was more similar to that of an outdoor-exposed sample than that of a sample photodegraded at the standard BPT (63 °C). It is considered that a higher temperature accelerates radical recombination, consequently recreating molecular enlargement similar to the outdoor-exposed sample. Multiple regression analysis using newly introduced Mp (peak-top molecular weight) and Mw (weight-average molecular weight) as explanatory variables was conducted, which successfully enabled the authors to provide a simple explanation for the decrease in polymer tensile strength.

32-core Dense SDM Unidirectional Transmission of PDM-16QAM Signals Over 1600 km Using Crosstalk-managed Single-mode Heterogeneous Multicore Transmission Line

T. Mizuno, K. Shibahara, H. Ono, Y. Abe, Y. Miyamoto, F. Ye, T. Morioka, Y. Sasaki, Y. Amma, K. Takenaga, S. Matsuo, K. Aikawa, K. Saitoh, Y. Jung, D. J. Richardson, K. Pulverer, M. Bohn, and M. Yamada

Proc. of OFC (Optical Fiber Communication Conference and Exhibition) 2016, Th5C.3, Anaheim, CA, USA, March 2016.

We demonstrate 32-core dense space-division multiplexed (SDM) unidirectional transmission of PDM-16QAM (polarization-division multiplexed 16-quadrature amplitude modulation) 20-WDM (wavelength-division multiplexed) signals over 1644.8 km employing a low-crosstalk single-mode heterogeneous 32-core fiber in a partial recirculating-loop system.

A Sparsity Managed Adaptive MIMO Equalization for Few-mode Fiber Transmission with Various Differential Mode Delays

D. Lee, K. Shibahara, T. Kobayashi, T. Mizuno, H. Takara, A. Sano, H. Kawakami, T. Nakagawa, and Y. Miyamoto

Journal of Lightwave Technology, Vol. 34, No. 8, pp. 1754–1761, April 2016.

It is often observed that various differential mode delays (DMDs) coexist in single multi-core fiber and/or few-mode fiber transmission. From a multi-input and multi-output (MIMO) equalization perspective, this indicates that the optimum equalization tap length for each multi-core and/or multi-mode signal varies according to its DMD. Correspondingly, complex calculation to find each optimum tap length is necessary to obtain satisfactory performance. This paper presents a new adaptive MIMO equalization method to deal with various DMDs while avoiding such complex calculation. The method uses the same tap length for all multi-core and/or multi-mode signals according to the maximum DMD to reduce the calculation cost.
