External Awards

FIT2018 Best Paper Award
Winner: Masamichi Hosoda, NTT Service Evolution Laboratories; Hiroshi Sakamoto, Tomoki Murakami, NTT Access Network Service Systems Laboratories; Yasushi Hanakago, NTT Service Evolution Laboratories; Makoto Umeuchi, NTT Access Network Service Systems Laboratories; Tadashi Mouri, NTT Service Evolution Laboratories; Tomoaki Ogawa, NTT Access Network Service Systems Laboratories; Masaru Miyamoto, NTT Service Evolution Laboratories
Date: December 5, 2018
Organization: The 17th Forum on Information Technology (FIT2018)

For "Wireless LAN Station Position Estimation Method by Access Point Using Distributed Antenna System."
Published as: M. Hosoda, H. Sakamoto, T. Murakami, Y. Hanakago, M. Umeuchi, T. Mouri, T. Ogawa, and M. Miyamoto, "Wireless LAN Station Position Estimation Method by Access Point Using Distributed Antenna System," Proc. of FIT2018, CA-007, pp. 59–64, Fukuoka, Japan, Sept. 2018 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Self-foldable Graphene Polymer Bilayer Films

T. F. Teshima, C. S. Henderson, M. Takamura, Y. Ogawa, S. Wang, S. Sasaki, Y. Kashimura, H. Nakashima, and Y. Ueno

Biointerfaces International 2018, p. 93, Zurich, Switzerland, August 2018.

Microscopic three-dimensional (3D) assembly of graphene is of interest in the development of nano-devices, flexible electronics, and biointerfaces with cells or tissues. Self-foldable or manually buckled flexible polymer films have been hitherto utilized to load graphene and induce wrinkling or folding. However, the external force applied from these templates causes mechanical fracture or electrical disconnection of graphene. Therefore, it is technically difficult to construct micro-scale 3D graphene without delamination or slipping of pristine graphene. In this study, we show that the graphene itself transforms into 3D shapes, by using π-π stacking interaction with parylene thin film.

Electrical Spectrum Synthesis Technique Using Digital Pre-processing and Ultra-broadband Electrical Bandwidth Doubler for High-speed Optical Transmitter

F. Hamaoka, M. Nakamura, M. Nagatani, H. Wakita, H. Yamazaki, T. Kobayashi, H. Nosaka, and Y. Miyamoto

Electronics Letters, Vol. 54, No. 24, pp. 1390–1391, November 2018.

Proposed is an electrical spectrum synthesis technique that converts low-speed signals to a high-speed signal using transmitter-side digital signal processing (DSP) and an ultra-broadband electrical bandwidth doubler. The transmitter-side DSP converts a high-speed signal to low-speed upper and lower sideband signals, down- and up-converts the low-speed signals into baseband signals, and adds and subtracts the in-phase and the quadrature components of the baseband signals. The digital pre-processed low-speed signals output from digital-to-analogue converters are multiplexed to the high-speed signal by the bandwidth doubler, which consists of analogue multiplexers designed and fabricated using in-house indium phosphide heterojunction bipolar transistor technologies. A 120 GBaud quadrature phase shift keying signal has been successfully generated by using the proposed technique as a demonstration of a high-speed optical transmitter.

Self-folded Three-dimensional Graphene with Tunable Shape and Conductivity

T. Teshima, C. S. Henderson, M. Takamura, Y. Ogawa, S. Wang, Y. Kashimura, S. Sasaki, T. Goto, H. Nakashima, and Y. Ueno

Nano Letters, Vol. 19, No. 1, pp. 461–470, January 2019.

In this study, we demonstrate the facile formation of predetermined 3D polymeric microstructures simply by transferring monolayer graphene. The graphene adheres to the surface of polymeric films via noncovalent π-π stacking bonding and induces a sloped internal strain, leading to the self-rolling of 3D microscale architectures. Micropatterns and varied thicknesses of the 2D films prior to the self-rolling allows for control over the resulting 3D geometries. The strain then present on the hexagonal unit cell of the graphene produces a nonlinear electrical conductivity across the device. The driving force behind the self-folding process arises from the reconfiguration of the molecules within the crystalline materials. We believe that this effective and versatile way of realizing a 3D graphene structure is potentially applicable to alternative 2D layered materials as well as other flexible polymeric templates.

Power of Uninitialized Qubits in Shallow Quantum Circuits

Y. Takahashi and S. Tani

The 22nd Annual Conference on Quantum Information Processing (QIP 2019), Boulder, CO, USA, January 2019.

We study the computational power of shallow quantum circuits with $O(\log n)$ initialized and $n^{O(1)}$ uninitialized ancillary qubits, where n is the input length, and the initial state of the uninitialized ancillary qubits is arbitrary. First, we show that such a circuit can compute any symmetric function on n bits that is computable by a uniform family of polynomial-size classical circuits. Then, we regard such a circuit as an oracle and show that a polynomial-time classical algorithm with the oracle can estimate the elements of any unitary matrix corresponding to a constant-depth quantum circuit on n qubits. Since it seems unlikely that these tasks can be done with only $O(\log n)$ initialized ancillary qubits, our results give evidence that adding uninitialized ancillary qubits increases the computational power of shallow quantum circuits with only $O(\log n)$ initialized ancillary qubits. Lastly, to understand the limitations of uninitialized ancillary qubits, we focus on sub-logarithmic-depth quantum circuits with them and show the impossibility of computing the parity function on n bits.

120-GBaud 32QAM Signal Generation Using Ultra-broadband Electrical Bandwidth Doubler

F. Hamaoka, M. Nakamura, M. Nagatani, T. Kobayashi, A. Matsushita, H. Wakita, H. Yamazaki, H. Nosaka, and Y. Miyamoto

The Optical Networking and Communication Conference & Exhibition, San Diego, CA, USA, March 2019.

We propose an electrical spectrum synthesis technique using digital pre-processing with an interband crosstalk compensation and newly developed ultra-broadband electrical bandwidth doublers. A 120-GBaud PDM-32QAM (polarization-division-multiplexed 32-level quadrature amplitude modulation) signal (net rate: 954.2 Gb/s) has been successfully generated.