

External Awards

MOC Paper Award

Winners: Toshio Watanabe, Yasuaki Hashizume, and Hiroshi Takahashi, NTT Photonics Laboratories

Date: Nov. 2, 2011

Organization: The Seventeenth Microoptics Conference

For “Double-branched 1×29 Silica-based PLC Switch with Low Loss and Low Power Consumption”.

We propose a novel double-branched circuit configuration for a 1×N optical switch. This compact configuration offers a high port count without greatly increasing power consumption. The fabricated 4-arrayed 1×29 silica-based PLC switch exhibits an insertion loss as low as 2.6 dB.

Published as: T. Watanabe, Y. Hashizume, and H. Takahashi, “Dou-

ble-branched 1×29 Silica-based PLC Switch with Low Loss and Low Power Consumption,” Tech. Dig. 17th Microoptics Conf., No. J-2, Sendai, Japan, Oct. 2011.

Thomson Reuters 2011 Top 100 Global Innovators

Winner: Nippon Telegraph and Telephone Corporation

Date: Nov. 15, 2011

Organization: Thomson Reuters

Thomson Reuters has announced the world’s 100 most innovative organizations with the launch of Thomson Reuters 2011 Top 100 Global Innovators, an initiative that analyzes patent data and related metrics to identify the world leaders in innovation by using a proprietary methodology based on four aspects of patent-related data: volume, success, extent of global patenting, and influence.

Papers Published in Technical Journals and Conference Proceedings

Zr inclusions revealed by microcomputed tomography observations of the CO₂ laser fusion splicing interface between single-mode optical fibers

S. Koike, S. Asakawa, and J. Kobayashi

SPring-8 Research Frontiers, Vol. 2010, pp. 134–135, 2011.

We detected Zr inclusions through microcomputed tomography observations of the CO₂ laser fusion splicing interface between single-mode optical fibers and report process improvements based on the results.

Robust Method of Estimating Noise Mixture Model for Noise Suppression

M. Fujimoto, S. Watanabe, and T. Nakatani

Proc. of the 12th Annual Conference of the International Speech Communication Association, pp. 697–700, Firenze, Italy, 2011.

Noise suppression based on the Vector Taylor series (VTS) usually uses a single Gaussian distribution for the noise model. However, this is insufficient for nonstationary noise that has a multipeak distribution. It is very complex to estimate a multipeak noise distribution when we treat the noise as random or hidden variables. To solve these problems, we investigate a way of estimating a noise mixture model by using a minimum mean square error (MMSE) estimate of the noise. By iterating the MMSE noise estimation and the noise model estimation, the proposed method simultaneously optimizes both the observed signal model and the noise model. It significantly outperformed the VTS-based approach: the maximum improvement in the

word error rate was about 12%.

An Approximately Universal Set Consisting of Two Observables

Y. Takahashi

International Journal of Quantum Information (IJQI), World Scientific, Vol. 9, No. 6, pp. 1393–1412, 2011.

We consider the problem of minimizing the resources required for approximate universality in measurement-only quantum computation. This problem is important not only for realizing a quantum computer, but also for understanding the computational power of quantum computation. The resources that we focus on are observables, which describe projective measurements, and ancillary qubits. We show that, if we are allowed to use two ancillary qubits, then the set of observables $\{\cos(\pi/8)X - \sin(\pi/8)Y, Z \otimes X\}$ is approximately universal for quantum computation. This is the first construction of an approximately universal set consisting only of one one-qubit observable and one two-qubit observable. Using the proof of the approximate universality, we also show that, if we are allowed to use two initialized ancillary qubits, then one two-qubit observable is sufficient for graph state preparation. The use of only one two-qubit observable is optimal in terms of the number of observables available and the number of qubits to be measured jointly.

Auto Bias Control Technique for Optical 16-QAM Transmitter with Asymmetric Bias Dithering

H. Kawakami, T. Kobayashi, E. Yoshida, and Y. Miyamoto
Proc. of the 37th European Conference on Optical Communication (ECOC), Geneva, Switzerland, 2011.

An auto bias control technique for a quadrature amplitude modulation (QAM) transmitter is demonstrated. A 16-state QAM (16-QAM, 10 Gbaud) is generated and controlled using a single IQ modulator and asymmetric bias dithering technique (I: in-phase, Q: quadrature phase). The measured penalty is 0.3 dB.

Advanced Integrated Optical Components for Ultrahigh-speed Optical Networks

S. Suzuki
Proc. of Chitose International Forum 2011, Chitose Institute of Science and Technology (CIST), Chitose, Hokkaido, Japan.

Because of the rapid increase in the Internet traffic, ultrahigh-speed optical network systems with transmission rates of 100 Gbit/s and beyond using digital coherent optical transmission technology have been investigated. This paper reviews recent work on advanced integrated optical component technologies and their applications to digital coherent optical transmission.

Examination of Ion Channel Protein Orientation in Supported Lipid Bilayers

Y. Shinozaki, K. Sumitomo, A. Tanaka, N. Kasai, and K. Torimitsu
Appl. Phys. Express, Vol. 4, No. 10, p. 107001, 2011.

We investigated techniques for regulating the orientation of ion channel-type membrane proteins reconstituted in lipid bilayers. Free ion channel proteins aligned their long axis parallel to the substrate. By contrast, immunochemical and atomic force microscopy images revealed that ion channels reconstituted in supported lipid bilayers oriented upward, with their long axis perpendicular to the substrate. Our data demonstrates that the reconstitution of ion channels into planar lipid bilayers by rupturing small unilamellar proteoliposomes is a promising way of aligning ion channels upward in a membrane and of obtaining ion channels with controlled functions.

Operation of Ultralow-leakage Regulator Circuits with SOI and Bulk Technologies for Controlling Wireless Transceivers

M. Ugajin, A. Yamagishi, K. Suzuki, and M. Harada
IEICE Trans. on Electron., Vol. E94-C, No.10, pp. 1702–1705, 2011.

To reduce the power consumption of wireless terminals, we have developed ultralow-leakage regulator circuits that control the intermittent terminal operation with a very small activity ratio. The regulator circuits supply about 100 mA in the active mode and cut the leakage current to the nanoampere level in the standby mode. The operation of the ultralow-leakage regulator circuits with CMOS/SOI (complementary metal oxide semiconductor; semiconductor on insulator) and bulk technologies is described. The leakage-current reduction mechanism in a proposed power switch based on bulk technology is explained. Measurements show that the power switch using reversely biased bulk transistors has a leakage current that is almost as small as that of conventional CMOS/SOI transistor switches.

Security in Photonic Networks: Threats and Security Enhancement

K. Kitayama, M. Sasaki, S. Araki, M. Tsubokawa, A. Tomita, K. Inoue, K. Harasawa, Y. Nagasako, and A. Takada
Journal of Lightwave Technology, Vol. 29, No. 21, pp. 3210–3222, 2011.

We address emerging threats to the security of photonic networks as these networks become heterogeneous through being opened up to the upper layers, other operators, and end users. We review the potential threats, which are mainly loss of the confidentiality of user data transmitted through optical fibers and network control disturbances, both of which could seriously damage the entire network. We then propose a novel conceptual model of a secure photonic network by introducing a quantum key distribution (QKD) network to its legacy structure. Secure keys generated by the QKD network are managed by key management agents (KMAs) and used to encrypt not only user data but also control signals. The KMAs cooperate with the generalized multiprotocol label-switching controller for secure path provisioning and drive photonic and modern cryptographic engines in appropriate combinations. Finally, we present a roadmap of a deployment scenario, starting from niche applications such as mission-critical and business applications. As an example of a niche application, we present digital cinema distribution through a photonic network.