

External Awards

IEEE Fellow

Winner: Kazuo Hagimoto, NTT Network Innovation Laboratories

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For contributions to research and development of optical transmission systems with erbium doped fiber amplifiers.

Papers Published in Technical Journals and Conferences

Haptics can modulate the Hering and Wundt illusions

K. Omori, N. Kitagawa, Y. Wada, and K. Noguchi

Japanese Psychological Research, Blackwell Publishing, Vol. 49, No. 1, pp. 79–85, 2007.

It is generally believed that, when information from different sensory modalities is in conflict, vision typically outweighs touch. In contrast, it has been shown that haptics can play an important role in the development of visual spatial perception in congenitally blind or early blinded people with restored sight. In the present study, the relationship between touch and vision was investigated by examining the effects of haptics on the appearance of the Hering and Wundt optical illusions in sighted individuals. Participants judged the apparent curvature of two lines in Hering- and Wundt-type figures, while they actively explored a wooden board that was shaped concave, convex, or parallel. They were asked to choose a comparison figure whose shape matched the apparent curvature of the two test lines. The results revealed that the participants' responses were biased towards the curvature obtained by actively touching the haptic stimuli.

Contrast and depth perception: Effects of texture contrast and area contrast

S. Ichihara, N. Kitagawa, and H. Akutsu

Perception, Pion Ltd, Vol. 36, No. 5, pp. 686–695, 2007.

Many objects in natural scenes have textures on their surfaces. Contrast of the texture surfaces (the texture contrast) reduces when the viewing distance increases. Similarly, contrast between the surfaces of the objects and the background (the area contrast) reduces when the viewing distance increases. The texture contrast and the area contrast were defined by the contrast between random dots, and by the contrast between the average luminance of the dot pattern and the luminance of the background, respectively. To examine how these two types of contrast influence depth perception, we ran two experiments. In both experiments two areas of random-dot patterns were presented against a uniform background, and participants rated relative depth between the two areas. We found that the rated depth of the patterned areas increased with increases in texture contrast. Furthermore, the effect of the texture contrast on depth judgment increased when the area contrast became low.

Influence of the Local Environment on Determining Aspect-Ratio Distributions of Gold Nanorods in Solution Using Gans Theory

D. P. Sprunken, H. Omi, K. Furukawa, H. Nakashima, I. Sychugov, Y. Kobayashi, and K. Torimitsu

Journal of Physical Chemistry C, ACS, Vol. 111, No. 39, pp. 14299–14306, 2007.

We apply Gans theory to fit the absorption spectra of gold nanorods with aspect ratios $R \leq 2.5$ in solution using both the longitudinal and transversal surface plasmon resonance absorption peaks and the dielectric constant of the medium, ϵ_m , as a fitting parameter. By fitting the broadened absorption peaks using the absorption spectra of a set of nanorods with a range of aspect ratios, we determine the size distribution of the nanorods in solution. The optimum value of $\epsilon_m = 2.1 \pm 0.1$ is substantially higher than the dielectric constant of the solvent ($\epsilon_{m, \text{water}} = 1.77$), which is most likely due to a change in the effective dielectric constant in the vicinity of the nanorods. The validity of our method is confirmed by comparing the calculated size distributions with transmission electron microscope images, and we obtain a good agreement between the experiments and our calculations. Furthermore, several other recent experimental results are compared with our fitting method, and we find that the discrepancy between Gans theory and those experimental results can be explained by using higher values of ϵ_m .

Analysis of Wear-Out Degradation of a DFB Laser Using an Optical-Beam-Induced Current Monitor

T. Takeshita, M. Yamamoto, R. Iga, M. Sugo, Y. Kondo, and K. Kato

IEEE Trans. Electron Devices, Vol. 54, No. 8, pp. 1852–1859, 2007.

We investigated the degradation behavior of distributed feedback lasers by employing the optical-beam-induced current measurement technique. We showed that the degradation mechanism is governed by diffused defects at the waveguide other than those in the vicinity of the antireflection facet. In addition, we found that a diffused source is probably generated in the upper InP cladding layer above the grating during the growth of the upper InP cladding layer.

Low-energy electron emission using a Si/SiO₂/Si cathode for nano-decomposition

K. Nishiguchi, M. Nagase, T. Yamaguchi, A. Fujiwara, and H. Yamaguchi

Proc. of MNC 2007, pp. 470–471, Kyoto, 2007.

We fabricated an electron-emission cathode with an Si/SiO₂/Si structure using a metal-oxide-semiconductor field-effect transistor (MOSFET) fabrication technology. Electrons travel from an electron-source Si layer to a thin poly-Si through a thin SiO₂ and some of them with high energy, i.e., hot electrons, are emitted from the poly-Si surface. By utilizing an electron-inversion layer as the electron source, high efficiency and electron emission stability were achieved. A material decomposition with a depth of a few nanometers was also demonstrated using low-energy-electron irradiation from the cathode operated in a low vacuum condition.

Strain Analysis of Silicon Nanolayers by Grazing Incidence X-ray Diffraction

H. Omi, T. Kawamura, Y. Kobayashi, S. Fujikawa, Y. Tsusaka, Y. Kagoshima, and J. Matsui

The Surface Science, SSSJ, Vol. 28, No. 12, pp. 678–681, 2007.

Grazing incident X-ray diffraction was observed from a thin silicon nanoscale overlayer fabricated by oxidation and etch-back in a separation by implantation oxygen wafer at incident angles between 0.01° and 0.1° below the critical angle of total reflection (0.18°). We measured {220} reflections by probing the sample with respect to the surface normal and found that the silicon nanoscale overlayer has finite domains under strain close to the surface. We also found that annealing the sample up to 1000°C significantly reduced inhomogeneous strain and increased the size of the domains in the surface region of the silicon nanoscale overlayer.

Modulation of Young's Modulus of Polymethylmethacrylate Nanobeam Due to Electron-Beam Exposure

K. Yamazaki, T. Yamaguchi, and H. Yamaguchi

Jpn. J. Appl. Phys., Vol. 46, No. 49, pp. L1225–L1227, 2007.

We fabricated suspended poly (methyl methacrylate) (PMMA) micro/nanobeams using a novel two-step development process. Young's moduli measured for the fabricated beams were found to decrease with additional electron-beam (EB) exposure. This means that we can locally control Young's modulus in a PMMA structure using EB exposure and thus effectively design nanoelectromechanical systems using this organic material. The effect was more significant for smaller beams, suggesting that the modulus of the near-surface region is largely affected.

Integrated Heterojunction Bipolar Transistor Optically Injection-Locked Self-Oscillating Opto-Electronic Mixers for Bi-Directional Fiber-Fed Wireless Applications

J. Y. Kim, W. Y. Choi, H. Kamitsuna, M. Ida, and K. Kurishima

IEEE Trans. Microw. Theory Tech., Vol. 55, No. 12, pp. 2734–2739, 2007.

A 30-GHz-band third harmonic optically injection-locked self-oscillating opto-electronic mixer is implemented with a 10-GHz InP heterojunction bipolar transistor monolithic microwave integrated circuit oscillator. The monolithic self-oscillating mixer can be optically injection locked in wide operating conditions and can perform efficient frequency up- and down-conversion with low-power optical local-oscillator signals. Using the mixer, bi-directional transmission of 32 quadrature amplitude modulation data in a 30-GHz fiber-fed wireless link is successfully demonstrated.

Haptic Navigation for Broad Social Applications by Kinesthetic Illusion of Pulling Sensation

T. Amemiya, H. Ando, and T. Maeda

ICAT 2007, VRSJ, pp. 129–134, Esbjerg, 2007

This paper discusses the potential of force perception technologies for realizing hand-held devices in the field of social systems. We introduce an interactive system based on force perception technology called "Come Over Here, or Catch You!", which is a force-sensation-based navigation system for waiters. It consists of our new hand-held haptic interface which can provide perceptually continuous and translational force, and a position and posture identification system. Since the proposed compact haptic interface does not require an external ground, it can be used outside the laboratory and does not interrupt human behavior. We verify the feasibility of the system in trials.

Single-electron circuit for stochastic data processing using nano-MOSFETs

K. Nishiguchi and A. Fujiwara

IEDM, IEEE, pp. 791–794, Washington DC, 2007.

A MOSFET-based circuit utilizing single electrons is demonstrated at room temperature. Individual electrons randomly passing through the nanoscale silicon-on-insulator (SOI) MOSFET are monitored by an electrometer in real time. Such a random behavior of single electrons is used for random-number generation suitable for a data processing which stochastically extracts the optimum solution among various ones. The use of electron transport in MOSFETs provides high controllability of the randomness, which prevents extracted solutions from staying at undesirable local minimum, as well as fast generation of random numbers. The present result promises new single-electron applications using nanoscale MOSFETs.