Papers Published in Technical Journals and Conferences

A Formal Approach to Designing Anonymous Software

Y. Kawabe and H. Sakurada

Many Internet services and protocols should guarantee anonymity; for example, an electronic voting system should guarantee to prevent the disclosure of who voted for which candidate. However, a methodology for designing software that preserves anonymity has not yet been established. In the field of software engineering, it is well known that software correctness can be verified with a formal method. Following the formal method approach, this paper introduces an anonymity proof technique. By finding a condition called an anonymous simulation, we prove the anonymity of communication software. Our approach can deal with both eavesdroppers and stronger adversaries. This paper also demonstrates a formal verification of communication software. We employ Crowds, which is an implementation of an anonymous router, and verify the anonymity. After describing Crowds in a formal specification language, we prove its anonymity with a theorem prover. In this verification, we employ a formal verification tool called IOA-Toolkit.

Multilayer holographic recording using a two-color-absorption photopolymer

K. Hirabayashi, H. Kanbara, Y. Mori, T. Kurihara, M. Shimizu, and T. Hiyama

We developed a sensitive two-color-absorption photopolymer in which holograms are recorded by simultaneous irradiation with a 660 nm interference light and a 410 nm gate light. Doped with bis(silyl)pentathiophene as a two-color-photosensitive dye and 2,2-dimethoxy-2-phenylacetophenone as a radical photopolymerization initiator; its matrix contains low-refractive index binding polymers and high-refractive index monomers. The sensitivity and diffraction efficiency of 25 µm thick layers are from $1.2{\times}10^{-9}$ to $3.7{\times}10^{-9}$ cm^2/mJ and from 1% to 4%. We made a three-photopolymer-layer waveguide structure, where each photopolymer layer and high-refractive index adhesive layer serves as a core layer and is sandwiched between two low-refractive index glass substrates that serve as clad layers. Gate light propagated through the adhesive layers, reference and object beams intersected the photopolymer layers, and different diffraction patterns could be written in each layer.

ISSCC2008 Preview: Wireline

Y. Ohtomo

This preview introduces Wireline highlight papers in the ISSCC 2008, which is the premier conference on integrated circuit technology. The papers propose "digital assist technologies" for 10-Gb/s signal reshaping. They enable 300 m transmission with multimode fibers and 100 m transmission with twisted-pair cables and they significantly increase tolerance to conscutive identical digits in burst-mode signal transmission.

A 1ps-Resolution 2ns-Span 10Gb/s Data-Timing Generator with Spectrum Conversion

T. Kawamura, Y. Ohtomo, K. Nishimura, and N. Ishihara

A data-timing generator (DTG) provides a delay of >2ns for DC-to-11Gb/s input data. A spectrum conversion technique that suppresses the effect of the group-delay deviation reduces the output jitter to one-third that of a conventional DTG. The total jitter of 2ns-delayed 10Gb/s output data is 12ps peak-to-peak including 7ps peak-to-peak of input-data jitter. The DTG is fabricated using a 0.25µm SiGe BiCMOS process and consumes 2.5W from a 3.3V supply.

Transformation of Neural Representation of the Auditory Space Along the Collicular Pathway

S. Furukawa and K. Maki

This study explored neural codes for the auditory space in three collicular nuclei, namely the central nucleus of the inferior colliculus (ICc), the external nucleus (ICx), and the superior colliculus (SC). Single unit responses were recorded from the three nuclei of anesthetized gerbils. The stimuli were 50-ms wide-band noise bursts that varied in terms of the azimuth on the horizontal plane. For each unit, the neural responses, represented as temporal spike patterns, were classified by using a pattern recognition algorithm to derive the azimuth-related transmitted information (TI), an information-theoretic measure of information content in the responses. There was no marked difference in the tendency of TI per unit between the nuclei. When the temporal structure of the spike patterns was disrupted, the estimated TI often decreased. Generally, the disruption effect decreased progressively along the pathway from the ICc, through the ICx, to the SC.

Stochastic data processing circuit based on single electrons using nanoscale field-effect transistors

K. Nishiguchi, Y. Ono, A. Fujiwara, H. Inokawa, and Y. Takahashi

A circuit utilizing single electrons is demonstrated at room temperature using a silicon-on-insulator metal-oxide-semiconductor field-effect transistor (MOSFET). Individual electrons randomly passing through the nanoscale MOSFET, which are the origin of shot noise, are monitored by an electrometer in real time. This random behavior of single electrons is used as a random number for a stochastic associative memory for image-pattern matching, in which the most preferable pattern is extracted with the largest probability. The use of electron transport in the MOSFET provides high controllability of the randomness as well as fast generation of random numbers. The present result promises new single-electron applications using nanoscale MOSFETs.