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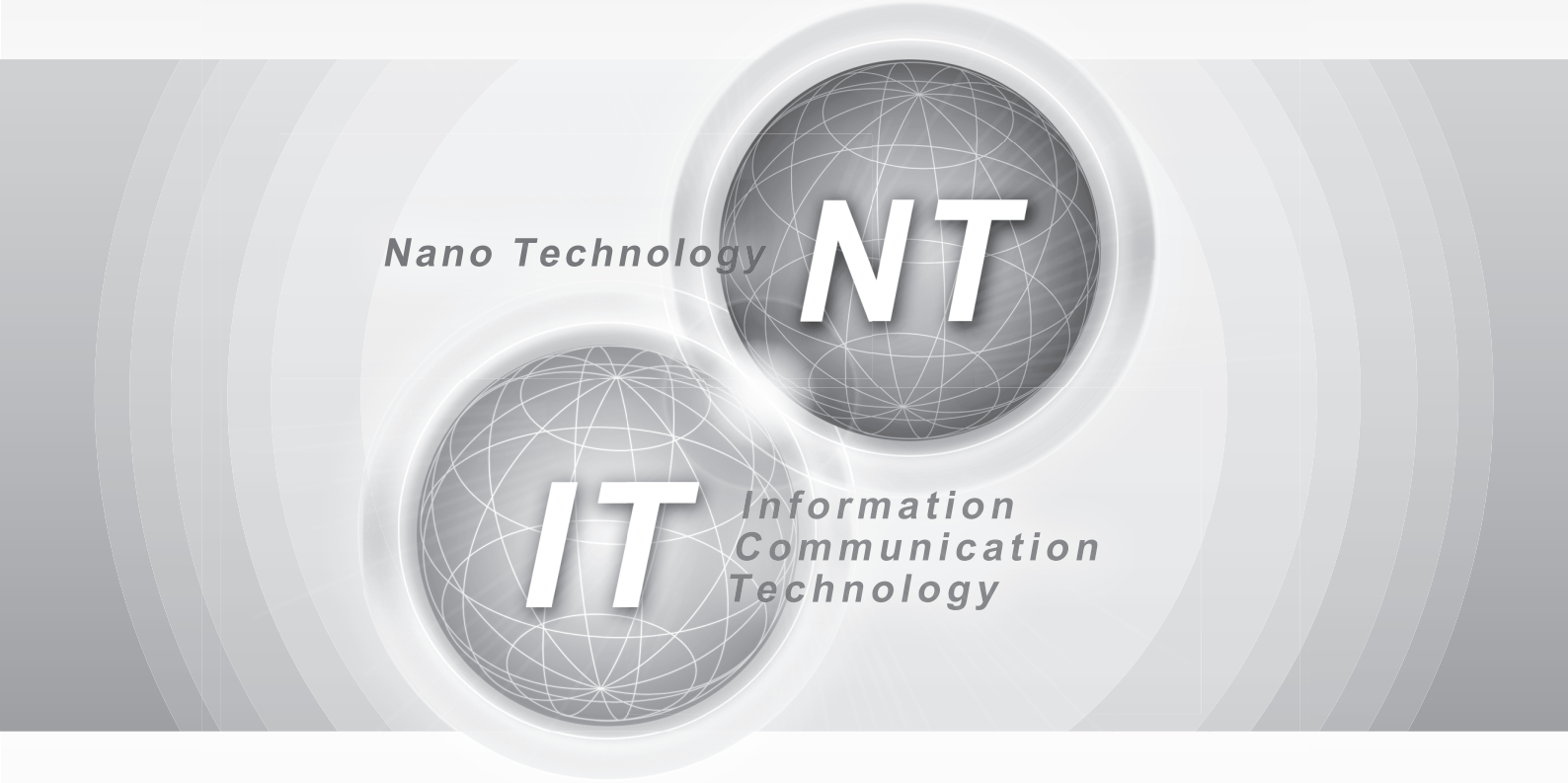

The 3rd International Symposium on Information Electronics Systems

July 13-14, 2009
Sendai Excel Hotel Tokyu 3F, Sendai, Japan
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The 3rd International Symposium on Information Electronics Systems

Program at a Glance

July 13-14, 2009 at Sendai Excel Hotel Tokyu, Sendai, Japan

Monday, July 13

9:00–9:15		**Opening Session**	**Chair: Eijiro Sumii**
		Opening Remarks	Kunio Sawaya
		Welcome Address	Fumiyuki Adachi
9:15–10:30	**Session 1**	**Wireless/Optical Communications and Networks (1)**	**Chair: Xiaohong Jiang**
9:15–9:30	**1–1**	New Frontiers in Optical Communication: Ultrahigh-speed Transmission and Coherent Transmission	Masataka Nakazawa
9:30–9:45	**1–2**	Design of Future All-Optical Routers	Susumu Horiguchi
9:45–10:00	**1–3**	Frequency-Domain Block Signal Detection and Distributed Antenna Network	Fumiyuki Adachi
10:00–10:15	**1–4**	Reflectarray Development for Improvement of Wireless Propagation Channel	Kunio Sawaya
10:15–10:30	**1–5**	A Fault-Tolerant Topology for Broadcasting in Ad-Hoc Networks	Nei Kato
10:30–11:00		**Break**	
11:00–12:30	**Session 2**	**Wireless/Optical Communications and Networks (2)**	**Chair: Toshihiko Hirooka**
11:00–11:45	**2–1(Invited)**	The Progress of National 973 Project "Cognitive Radio Networks"	Zhang Ping
11:45–12:30	**2–2(Invited)**	Distributed Source Coding and its Research in China	Zhang Lin
12:30–13:45		**Lunch**	
13:45–15:15	**Session 3**	**Intelligent Signal Processing and Multimedia Communications Technologies**	**Chair: Yukio Iwaya**
13:45–14:30	**3–1(Invited)**	Haptic Collaborative Virtual Environments with Physics-Based Online -Remesh Volume Models	Hiromi T. Tanaka
14:30–14:45	**3–2**	Toward Highly Realistic Acoustic and Multi-Modal Information Systems	Yôiti Suzuki
14:45–15:00	**3–3**	Closed Form Expressions of the Balanced Realizations of Second-Order Filters	Masayuki Kawamata
15:00–15:15	**3–4**	High-Accuracy Machine Vision Technology Using Phase-Only Correlation – From 3D Measurement to Biomedical Imaging –	Takafumi Aoki
15:15–15:45		**Break**	
15:45–16:30	**Session 4**	**Computing and Algorithm**	**Chair: Tachio Terauchi**
15:45–16:00	**4–1**	Probabilistic Image Processing and Bayesian Networks	Kazuyuki Tanaka
16:00–16:15	**4–2**	Optimal Insertion of a Segment Highway in a City Metric	Takeshi Tokuyama
16:15–16:30	**4–3**	Overview of the TRecS Project	Naoki Kobayashi
16:30–17:45		**Poster Session**	**Ball B**
17:45–19:45		**Banquet**	**Ball A**

Tuesday, July 14

9:00–10:30	**Session 5**	**New Materials and Processing**	**Chair: Masao Sakuraba**
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9:45–10:00	**5–2**	Optoelectronic-Nanodevices Oriented Nanoscopic Plasma Control	Rikizo Hatakeyama
10:00–10:15	**5–3**	Self-Alignment Process for the Fabrication of a Single Electron Transistor Using Anodization of an Aluminum Microelectrode	Michio Niwano
10:15–10:30	**5–4**	Atomically Controlled Processing for Future Si-Based Devices	Junichi Murota
10:30–11:00		**Break**	
11:00–12:30	**Session 6**	**Magnetics and Spintronics**	**Chair: Fumihiro Matsukura**
11:00–11:45	**6–1(Invited)**	Controlling Magnetism with Light	Theo Rasing
11:45–12:00	**6–2**	Future Extendability of Magnetic Recording: Shingle Writing and Bit Patterned Media	Hiroaki Muraoka
12:00–12:15	**6–3**	Tailor-Made Nano Structured Material for Highly Qualified Spin Related Devices	Migaku Takahashi
12:15–12:30	**6–4**	Control of Spin States in Semiconductors	Hideo Ohno
12:30–13:45		**Lunch**	
13:45–15:00	**Session 7**	**VLSI Design and Methodologies**	**Chair: Atsushi Matsumoto**
13:45–14:30	**7–1(Invited)**	Numeric Function Generators	Jon T. Butler
14:30–14:45	**7–2**	Interconnection-Aware High-Level Design Methodologies for Low-Power VLSIs	Michitaka Kameyama
14:45–15:00	**7–3**	High-Throughput Bit-Serial LDPC Decoder LSI Based on Multiple-Valued Asynchronous Interleaving	Takahiro Hanyu
15:00–15:30		**Break**	
15:30–16:30	**Session 8**	**Fundamentals of Materials and Devices**	**Chair: Takahiro Ishinabe**
15:30–15:45	**8–1**	Cross-Sectional Observation of Nano-Domain Dots Formed in Lithium Tantalate Single Crystal	Yasuo Cho
15:45–16:00	**8–2**	Ultrasonic Micro-Spectroscopy Characterization of ZnO and AlN Crystals	Jun-ichi Kushibiki
16:00–16:15	**8–3**	Measurement of Single-Photon-Level Optical Nonlinearities in Waveguide Media	Keiichi Edamatsu
16:15–16:30	**8–4**	Research and Development of High Quality and Large Size Display Based on PLC and DLC Theories	Tatsuo Uchida
16:30–16:45		Closing Session	**Ball A**
		Closing Remarks	Kunio Sawaya

9:00 Opening Session

Wireless/Optical Communications and Networks (1)

9:15 1-1

New Frontiers in Optical Communication: Ultrahigh-speed Transmission and Coherent Transmission

Masataka Nakazawa, RIEC, Tohoku University

Recent progress on ultrahigh-speed transmission and coherent optical transmission, which are two emerging fields in optical communication, is described. As regards ultrahigh-speed OTDM transmission, I will describe a 320 Gbit/s OTDM-DPSK transmission that uses time-domain optical Fourier transformation (OFT). An error-free transmission over 525 km was successfully achieved with a large tolerance to polarization-mode dispersion. Furthermore, long-haul WDM transmission of 320 Gbit/s OTDM signals was demonstrated for the first time, where a 5x320 Gbit/s (1.6 Tbit/s) C-band transmission over 525 km was achieved with a low power penalty by employing OFT. As regards coherent transmission, I will describe a FDM transmission of 128 quadrature amplitude modulation (QAM) signal. 6x1 Gsymbol/s, 128 QAM-FDM data were successfully transmitted over 160 km with a 1.4 GHz spacing, and the spectral efficiency reaches as high as 10 bit/s/Hz with a total capacity of 84 Gbit/s. We also present optical orthogonal frequency division multiplexed (OFDM) coherent transmission with QAM subcarrier modulation as high as 64 levels. Here, 24 Gbit/s data were successfully transmitted with a demodulation bandwidth of 2.5 GHz. These technologies are expected to open a new era in which we will achieve a spectral efficiency of > 10 bit/s/Hz.

9:30 1-2

Design of Future All-Optical Routers

Susumu Horiguchi, Tohoku University

It is expected that the backbones of future large-scale computer networks (e.g., the Internet) will be built on optical WDM technology to guarantee huge transmission bandwidth. One of the key research issues in this direction is the design of optical router to significantly improve the nodal level data processing capability and thus to alleviate the nodal level throughput bottleneck problem associated with the development of current optical backbone networks. In this paper, we introduce our recent work in this direction, in particular our efforts on the design of optical switches, optical buffers and the overall optical router architectures based on the current optical technologies.

9:45 1-3

Recent Advances in Frequency-Domain Equalization and Distributed Antenna Network

Fumiyuki Adachi, Tohoku University

In the future mobile communication systems, the broadband wireless technology which allows Giga-bit/s class data transmissions is necessary. Broadband wireless channels become severely frequency-selective and cause strong inter-symbol interference (ISI). Furthermore, the average received signal power changes in a random manner due to shadowing and path losses. These severely degrade the transmission performance. To overcome this problem, we are studying the frequency-domain block signal detection and distributed antenna network (DAN). The frequency-domain block signal detection takes advantage of channel frequency-selectivity to obtain the frequency-diversity gain. In DAN, a group of distributed antennas serve a user to mitigate the negative impact of shadowing and path losses. This article will introduce the recent research progresses of frequency-domain block signal detection and DAN.

10:00 1-4

Reflectarray Development for Improvement of Wireless Propagation Channel

Kunio Sawaya, Tohoku University

An approach using reflectarrray to eliminate blindness in wireless propagation channel and to increase the multipath richness for MIMO(Multiple Input Multiple Output) communications is studied. Theoretical and numerical approaches are shown to design the reflectarrays which produce a desired reflection beam for the incident wave from a primary wave source, but is transparent for other wave sources at different frequency. The reflectarrays having characteristics such as the dual-polarization control and broad bandwidth are also studied. Some experimental results for a reflectarray composed of printed cross-dipoles and frequency-selective square loops are presented to demonstrate the improvement of propagation environment in wireless communications.

10:15 1-5

A Fault-Tolerant Topology for Broadcasting in Ad-Hoc Networks

Nei Kato, Tohoku University

Broadcasting, in the context of ad-hoc networks, is a costly operation, and thus topology control has been proposed to achieve efficient broadcasting with low interference and low energy consumption. By topology control, each node optimizes its transmission power by maintaining network connectivity in a localized manner. Local Minimum Spanning Tree (LMST) is the state-of-the-art topology control algorithm, which has been proven to provide satisfactory performance. However, LMST almost always results in a 1-connected network, without redundancy to tolerate external factors. In this paper, we propose Local Tree-based Reliable Topology (LTRT), which is mathematically proven to guarantee 2-edge connectivity while preserving the features of LMST. Simulation results have demonstrated the efficiency of LTRT and its superiority over other localized algorithms.

10:30-11:00 Coffee Break

Session 2（Ball A）Monday, July 13th, 11:00-12:30

Wireless/Optical Communications and Networks (2)

11:00 2-1 **The Progress of National 973 Project "Cognitive Radio Networks"**

Zhang Ping, Beijing University of Posts and Telecommunications, China

"Research of the Fundamental Theories and Key Technologies in Cognitive Radio Network" is the National 973 Project. In this presentation, the concept of Cognitive Wireless Networks will be given, the key technologies of Cognitive Wireless Networks will be discussed, including the infrastructure of the multi-domain cognitive network model, the cognition-based radio resource management mechanisms, the efficient spectrum detection and data transmission methods and so on. Specially, the progress of research on the End-to-End reconfiguration will be discussed, including the evaluation mechanism, the components-based protocol stack management for reconfigurable system and the Self-X algorithms for the dynamic optimization of heterogeneous networks.

11:45 2-2 **Distributed Source Coding and its Research in China**

Zhang Lin, Beijing University of Posts and Telecommunications, China

Among many techniques to tackle the energy resource constraint problem in Wireless Sensor Networks (WSNs) or other similar scenarios, Distributed Source Coding (DSC) is an important and prominent enabling approach to achieve high energy efficiency and extend the lifetime of WSNs applications. DSC means to independently encode the correlated outputs of several sensors that can't communicate with each other, and to jointly decode the compressed results at a central decoder. Based on the Slepian-Wolf theorem, the distributed compression can be as efficient as the joint design.

Applying DSC in data-intensive video compression allows the implementation of lightweight encoders and complex decoders, referred as Distributed Video Coding (DVC). In contrast with traditional video encoders such as MPEG and AVC/H.264, DVC performs motion estimation during decoding to recover the original data. DVC promises a large extension in the area of video application especially on tiny devices. In addition, robustness to channel failures and scalable video quality can also be achieved with little overhead by using DVC.

Due to the nature of independent, separate and multi-rate information processing in DSC, it is suggested that jointing DSC with routing mechanism, the medium access control, channel codes and modulation schemes in WSNs could exploit gains of energy savings. Moreover, these combinations can be introduced in relay channel, multiple-antenna system and data aggregation in traditional wireless networks to improve decoding quality.

The great potential of application of DSC heats up the international concern from academia and industry. The key international conferences, transactions and journals have published many papers on it. Since 2005, National Natural Science Foundation of China (NSFC) has approved more than ten projects of researches on DSC and its applications. We just finished a NSFC project on DSC algorithms during which several novel schemes have been proposed concerning DSC, DVC, routing, and target estimation. Currently, a large number of problems are still open in this area including modeling, analysis, and implementation.

12:30-13:45 Lunch Break

Intelligent Signal Processing and Multimedia Communications Technologies

13:45 3-1

Haptic Collaborative Virtual Environments with Physics-Based Online -Remesh Volume Models

Hiromi T. Tanaka, Ritsumeikan University

We have developed a novel volume-based haptic communication system, which allows participants at remote-sites on the network to simultaneously interact with the same target object in virtual environments, by only exchanging a small set of manipulation parameters for the target object.

We first developed an online-remesh volume model,we call dynamic adaptive grids, for simulating deformable objects such as soft tissues in each remote site. Then haptic sensation during interaction with the target object, is achieved by rendering the reflection force from the object, simulated with the online-remesh volume model from the manipulation parameters exchanged among all remote sites.

14:30 3-2

Toward Highly Realistic Acoustic and Multi-Modal Information Systems

Yôiti Suzuki, RIEC, Tohoku University

Human beings are to be regarded as extreme source and recipient of information in any communication systems. Therefore, to develop advanced acoustic communication systems, good knowledge of human auditory system as well as multi-modal perception relating to hearing is essential. Our main interest is thus in human multi-modal information processing including hearing. Simultaneously, we aim at realizing a comfortable and highly realistic acoustic communication systems exploiting digital signal-processing techniques. Three-dimensional sound image control by high-definition virtual auditory displays are one of the examples. These systems are expected to provide high-quality 3D virtual sound space, which is required to realize in multimedia communication, cyberspace systems, and high-definition audio-visual display systems. In addition, basic studies relating to auditory space perception are conducted to enhance virtual auditory displays' performance. Furthermore, we developed signal-processing algorithms for extracting various acoustic properties, such as position, directivity, and source signal of a sound source, which enables a highly realistic acoustic rendering. Moreover, as for the research on the human multi-modal perceptual processing, we are currently focusing on the spatiotemporal integration process of audio-visual and audio-vestibular information, e.g. effects of self motion on distance estimation for sound sources; effects of stimulus onset/offset on audio-visual synchrony perception.

14:45 3-3

Closed Form Expressions of the Balanced Realizations of Second-Order Filters

Masayuki Kawamata, Tohoku University

This paper derives the balanced realizations of second-order filters directly from the transfer function. We first consider the case of digital filters. Second-order digital filters are categorized into the following three cases: complex conjugate poles, distinct real poles, and multiple real poles. For each case, simple formulas are derived for the synthesis of the balanced realizations of second-order digital filters. As a result, we obtain closed form expressions of the balanced realizations of all types of second-order digital filters. Furthermore, we show that closed form expressions for second-order digital filters can be applied for also second-order analog filters by simple modifications of definitions of some parameters.

15:00 3-4

High-Accuracy Machine Vision Technology Using Phase-Only Correlation - From 3D Measurement to Biomedical Imaging -

Takafumi Aoki, Tohoku University

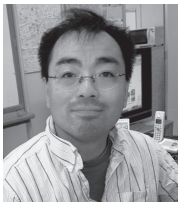
This paper presents fundamentals of Phase-Only Correlation (POC) --- a technique for high-accuracy registration of 1D, 2D and 3D signals using phase information of discrete Fourier transform --- and its potential application examples. Since 1990s, our research group has developed a novel technique of phase-based image matching for fingerprint verification and industrial machine vision applications. By extending the underlying principle of the developed technique, we have recently proposed an efficient image correspondence algorithm using POC, which can find pairs of corresponding points between the given two images with sub-pixel accuracy. The proposed correspondence algorithm could be applied not only to 2D signals (e.g., images) but also to 1D signals (e.g., waveforms) and to 3D signals (e.g., volume data). This allows us to apply the POC technique to a wide range of applications, including smart image sensors, super-resolution video signal processing, microscope image analysis, 3D machine vision using stereo cameras, and automotive image processing for driver assistance. In this paper, we especially focus on human interface applications aiming at producing advanced home appliances, biometrics applications employing a variety of biometrics features (e.g., fingerprint, palmprint, iris, dental radiograph and 3D facial data), and medical imaging applications.

15:15-15:45 Coffee Break

Session 4 (Ball A) Monday, July 13th, 15:45-16:30

Computing and Algorithm

15:45 4-1 **Probabilistic Image Processing and Bayesian Networks**



Kazuyuki Tanaka, Tohoku University

Bayesian network is one of the methods for probabilistic inferences in artificial intelligence. Some probabilistic models for image processing are also regarded as Bayesian networks. Many researchers in computer sciences and statistics are interested in probabilistic image processing as one of the powerful methods to treat uncertainty of massive data in the real world computer vision successfully and systematically.

In this talk, we give some practical schemes of Bayesian network to probabilistic image processing. Models and algorithms in the probabilistic image processing are based on the statistical sciences and statistical-mechanical informatics. The first part is an introduction of probabilistic model for image processing based on the basic framework of Bayesian networks and Markov random fields. The second part is a brief review of belief propagation. In the third part, we survey fundamental algorithms of belief propagations for probabilistic image processing. Some recent developments of Bayesian image analysis in computer sciences are also shown.

16:00 4-2 **Optimal Insertion of a Segment Highway in a City Metric**

Takeshi Tokuyama, Tohoku University

Given two sets of points in the plane, we are interested in locating a highway h such that an objective function on the *city distance* between points of the two sets is minimized (where the city distance is measured with speed $v>1$ on a highway and 1 in the underlying metric elsewhere). We give a unified approach to this problem to design polynomial-time algorithms for several combinations of objective functions and types of the inserted highway (*turnpike* or *freeway*).

16:15 4-3 **Overview of the TRecS Project**

Naoki Kobayashi, Tohoku University

We give an overview of the TRecS project, which aims to construct a software model checker for higher-order functional programs. Software model checking has been recently studied as one of the promising approaches to program verification. The exising software model checkers are based on either finite state or pushdown model checking, and are not suitable for verifying programs written in modern programming languages featuring higher-order functions and objects. In the TRecS project, we exploit a brand new approach to software model-checking: higher-order programs are first translated into higher-order recursion schemes, and then the recursion schemes are model-checked. We have constructed a prototype checker TRecS for recursion schemes and plan to construct a model checker for higher-order functional programs on top of it.

16:30-17:45 Poster Session (Ball B)

17:45-19:45 Banquet (Ball A)

New Materials and Processing

9:00 5-1 **Group-IV Heteroepitaxial Films for Micro and Opto Electronic Devices**

Joerg Schulze, University of Stuttgart, Germany

The molecular beam epitaxy (MBE) is a powerful technology for the manufacturing of group-IV heteroepitaxial films with doping concentrations ranging from $10^{14}cm^{-3}$ to solubility and thicknesses down to a few monolayers. Combined with a CMOS-compatible (CMOS: Complementary Metal-Oxide-Semiconductor) device technology novel device concepts for high-speed electronics and optoelectronics based on crystalline group-IV-alloys can be manufactured, tested and studied.

In the talk several of these concepts – as high speed Germanium infrared detectors fully integrable in Silicon-based mainstream, Esaki-tunneling diodes and CMOS-compatible Esaki-tunneling field-effect transistors – will be discussed.

This includes the discussion of the manufacturing of ultra-thin virtual substrates for the necessary lattice accommodation between the active device layers and the standard Silicon substrates, the formation of contact layers with very high doping concentrations and the discussion of special doping strategies for the manufacturing of abrupt doping concentration transitions in the heteroepitaxial films.

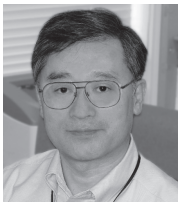
9:45 5-2 **Optoelectronic-Nanodevices Oriented Nanoscopic Plasma Control**

Rikizo Hatakeyama, Tohoku University

In the current fiscal year, our research activity has mainly been concentrated upon optoelectronic-nanodevice related subjects on carbon nanotubes (CNTs) synthesized and functionalized by nanoscopic plasma process control. Firstly, the photoluminescence from vertically- and individually-freestanding single-walled carbon nantubes (SWNTs) is observed to be strongly brightened as a result of the direct transition from isolated to bundled morphology. Secondly, photoinduced electrical transport properties of C_{60} or $C_{59}N$ encapsulated (@) SWNTs and DWNTs (double-walled carbon nanotubes) are investigated. The distinct photoinduced electron transfer phenomenon is observed in C_{60}@SWNTs under light illumination (390-1000 nm), being reflected in a fully-recoverable shift of threshold gate voltage of field-effect-transistors (FETs). On the other hand, the photoresponse of $C_{59}N$@SWNTs appears as an abrupt conductance decrease of the FET devices upon incident light illumination, for which the specific sensitivity of electronic structure of $C_{59}N$ to light is considered to be responsible. Moreover, photoinduced currents are observed in the case of C_{60}@DWNT-FETs which display negative differential resistance characteristics, suggesting a different photoinduced charge transfer mechanism. Thirdly, gas-liquid interfacial plasmas are applied to create a novel nanocomplex consisiting of CNTs and nanoparticles.

10:00 5-3

Self-Alignment Process for the Fabrication of a Single Electron Transistor Using Anodization of an Aluminum Microelectrode



Michio Niwano, RIEC, Tohoku University

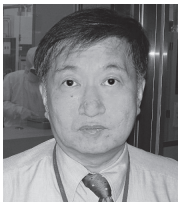
A technology for fabricating nanostructures has been extensively studied in order to develop electronic or photonic nano-scaled devices based on new types of mechanisms such as quantum effects. Development of such nano-devices requires noble technologies not only for fabricating nanostructures but also for wiring them. It is therefore important to develop self-alignment processes for fabrication and wiring nanostructures at solid state surfaces. There are generally two complementary approaches to the fabrication of nanostructures. One is the so-called top-down process and the other is the bottom-up process. Previously, we have proposed a self-alignment process using a hybrid technique of these complementary techniques to fabricate a single-electron transistor (SET) by partially anodizing patterned aluminum (Al) microelectrodes [1]. The "partial" anodization of the microelectrodes, which causes inhomogeneous porous alumina formation, is crucial to formation and self-alignment of Al nanodots which function as the Coulomb island in the SET.

In this study, we have investigated the inhomogeneous anodization process of an Al microwire (microelectrode). We found that nanostructures formed by the inhomogeneous anodization process depend strongly on the cross-sectional aspect ratio of the Al microwires. We demonstrated that a room-temperature operation SET can be fabricated by optimizing the cross-sectional aspect ratio of the Al microwires.

[1] Yasuo. Kimura et al., Appl. Phys. Lett. 90, 093119 (2007).

10:15 5-4

Atomically Controlled Processing for Future Si-Based Devices



Junichi Murota, RIEC, Tohoku University

One of the main requirements for Si-based ultrasmall device is atomic-order control of process technology. Here, we show the concept of atomically controlled processing for group IV semiconductors based on atomic-order surface reaction control in Si-based CVD epitaxial growth. Si or $Si_{1-x}Ge_x$ epitaxial growth on N, P or C atomic layer formed on Si(100) or $Si_{1-x}Ge_x$(100) surface, that is atomic-layer doping, is achieved at below 500°C. In the $Si_{0.5}Ge_{0.5}$ epitaxial layer, a N doping dose of $6x10^{14}$ cm^{-2} is confined within an about 1.5 nm thick region and the confined N atoms in $Si_{1-x}Ge_x$ preferentially form Si-N bonds. In Si cap layer growth on the P atomic layer formed on $Si_{1-x}Ge_x$(100) with the P atom amount below about $4x10^{14}$ cm^{-2} using Si_2H_6 instead of SiH_4, the incorporated P atoms are almost confined within the 1 nm region around the heterointerface. Heavy C atomic-layer doping suppresses strain relaxation as well as intermixing between Si and Ge at the nm-order thick $Si_{1-x}Ge_x$/Si heterointerface. These results open the way to atomically controlled processing for channel engineering, heavy impurity doping and so on in ULSIs.

10:30-11:00 Coffee Break

Magnetics and Spintronics

11:00 6-1

Controlling Magnetism with Light

Theo Rasing, Radboud University, Netherlands

The interaction of light with magnetic matter is well known: magneto optical Faraday or Kerr effects are frequently used to probe the magnetic state of materials. or manipulate the polarisation of light .

The inverse effects are less known but certainly as fascinating: with light one can manipulate magnetic matter, for example orient their spins. Using femtosecond laser pulses we have recently demonstrated that one can generate ultrashort and very strong (~Tesla's) magnetic field pulses via the so called Inverse Faraday Effect. Such optically induced magnetic field pulses provide unprecedented means for the generation, manipulation and coherent control of magnetic order on very short time scales, including the complete reversal of a magnet with a single 40 femtosecond laser pulse. In principle this opens the way for all-optical recording of magnetic bits at extremely high data rates. The basic ideas, including their limitations, behind these discoveries will be discussed and illustrated with recent results.

A.V.Kimel, A.Kirilyuk, P.A.Usachev, R.V.Pisarev, A.M.Balbashov and Th.Rasing,Ultrafast nonthermal control of magnetization by instantaneous photomagnetic pulses, Nature 435 (2005), 655-657

C.D.Stanciu, F.Hansteen, A.V.Kimel, A.Kirilyuk, A.Tsukamoto, A.Itoh and Th.Rasing, All-optical Magnetic Recording with Circularly polarized Light, Phys.Rev.Lett.99, 047601 (2007)

Demonstration of compact all-optical recording of magnetic bits by femtosecond laser pulses. This was achieved by scanning a circularly polarized laser beam across the sample and simultaneously modulating the polarization of the beam between left and right circular. White and black areas correspond to 'up' and 'down' magnetic domains, respectively.

11:45 6-2

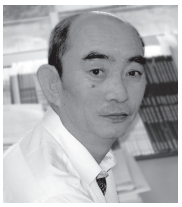
Future Extendability of Magnetic Recording: Shingle Writing and Bit Patterned Media

Hiroaki Muraoka, RIEC, Tohoku University

In order to ensure continuous growth of areal density in magnetic recording, several possibilities are being investigated. Bit-patterned media, in which each bit is physically separated by lithography, is believed to be one of the most promising candidates that can compromise the super-paramagnetic limit. We have pointed out the significance of the writing head field and uniformity of magnetic characteristics of media including patterned bit location and size deviations. Interestingly the bit patterned media can be theoretically understood as a reasonable extension of conventional granular media, although its recording mechanism is completely different.

Recently a new strong candidate was proposed; shingled writing. The recording scheme has a significant practical advantage that a regular granular medium can be used. Since a write pole much wider than track width can be used, a strong head field can be generated to cope with a high anisotropy medium. Our computer simulation showed that the shingled writing could successfully realize more than 2 Tbit/inch^2 areal density. We also showed that its off-track capability was able to be increased by around 30 %, because of its unique unidirectional writing scheme.

12:00 6-3



Tailor-Made Nano Structured Material for Highly Qualified Spin Related Devices

Migaku Takahashi, Tohoku University

Highly qualified spin related devices such as ultra-high density hard disk drive (HDD) and magnetic random access memory (MRAM), inductor and antenna for high frequency use are inevitable requirements for recent IT technology. Tailor-made spin nano structured materials by precisely controlled fabrication technology with nano-scale in each devices and understanding their nanomagnetics are essential from the view point of material, process, and physics.
Our newly proposed non-magnetic interlayer (NMIL) consists of three individual functional layers: a seed layer with highly orientated sheet texture, a inter layer of small grains and another inter layer of isolated grains, which successfully realized greatly small Ru grains with average dia. of 4.8 nm retaining small orientation dispersion of 4.1° by using Mg/ Ru/ Ru-SiO_2 NMIL. Our newly developed process for ultra-thin MgO barrier formation with retaining high crystallization of ultra-thin MgO barrier layer demonstrates the giant TMR ratio (200%) even at low RA (2 $\Omega\mu m^2$), resulting in the required performance for the 1 Tbpsi heads. Furthermore, our developed mono-dispersed superparamagnetic Fe nanoparticles with 3nm in diameter could achieve high frequency response (4 -5 GHz) over the intrinsic ferromagnetic resonance frequency (1.5 GHz) due to high thermal field over 2 kOe, which could possibly realize miniaturization of high frequency devices.
Within the frame work of the present paper, correlation between tailor-made nano structured material and magnetic properties developed for each categorized research items mentioned above will be widely discussed in connection with spin related devices.

12:15 6-4

Control of Spin States in Semiconductors

Hideo Ohno, RIEC, Tohoku University

We are working on the control of the spin states in semiconductor structures, where localized magnetic spins, itinerant electron spins, nuclear spins are of our interest. In this presentation, we focus on the two topics on ferromagnetic and nonmagnetic semiconductor structures. (1) We demonstrated the modulation of magnetic anisotropy and accompanied magnetization rotation in a (Ga,Mn)As thin film by purely electrical means, e.g., by the application of electric-fields. (2) We demonstrated phase coherence control of spin-3/2 ^{75}As nuclei with multipulse nuclear magnetic resonance (NMR) sequences in a GaAs/AlGaAs quantum well by optically-detected NMR.

12:30-13:45 Lunch Break

Session 7（Ball A）Tuesday, July 14th, 13:45-15:00

VLSI Design and Methodologies

13:45 7-1 **Numeric Function Generators**

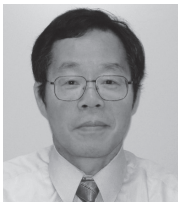
Jon T. Butler, Naval PostGraduate School, USA

Charles Babbage's mechanical computer, the difference engine, was intended to compute logarithmic and trigonometric functions. 150 years ago, this would have provided improved tables for navigating the sea. Up to that point, such tables were computed by hand. Babbage's approach was to use polynomials to approximate these functions.

In this talk, we will focus on the use of piecewise linear approximations to realize high-speed circuits that realize some specified arithmetic function, like log(x), sin(x), sqrt(x), etc.. An advantage of our approach is that we can realize composite functions like sin(log(sqrt(x))) in one circuit without having to compute the three functions separately. It provides both a speed and complexity advantage. Our approach combines combinatorial logic with memory, and an important issue is how the desired accuracy determines the complexity of the logic and memory. We will discuss this important issue.

Both analytic and experimental results will be discussed, as well as approaches to increase the speed and reduce the cost of the circuits. This talk is tutorial, and is intended for someone who has a background in logic design. Experience in computer architecture will be useful but not necessary.

14:30 7-2 **Interconnection-Aware High-Level Design Methodologies for Low-Power VLSIs**



Michitaka Kameyama, Tohoku University

In designing state-of-art VLSIs with parallel architecture, one major concern is to reduce complexity of the interconnection network between functional units and memory modules without degrading the performance. This paper presents two interconnect-aware high-level optimization techniques. One is scheduling and functional unit allocation minimizing the total power consumption under time and area constraints based on data-transfer patterns. The other is memory allocation minimizing the number of memory modules and functional units with a parallel access capability for image processing.

14:45 7-3 **High-throughput Bit-Serial LDPC Decoder LSI Based on Multiple-Valued Asynchronous Interleaving**

Takahiro Hanyu, RIEC, Tohoku University

This paper presents a high-throughput bit-serial low-density parity-check (LDPC) decoder using an asynchronous interleaver. Since consecutive log-likelihood message values on the interleaver are similar each other, node computations are continuously performed by using the most recently arrived messages without significantly affecting bit-error rate (BER) performance. In the asynchronous interleaver, each message's arrival rate is based on the delay due to the wire length between nodes, so that decoding throughput is not restricted by the worst-case latency, which achieves a higher average rate of computation. Moreover, the use of a multiple-valued data representation makes it possible to multiplex control signals and data from mutual nodes, thus minimizing the number of handshaking steps in the asynchronous interleaver and eliminating the clock signal entirely. As a result, the decoding throughput becomes 1.3-times faster than that of a conventional bit-serial synchronous decoder using a 90nm CMOS technology under a comparable BER.

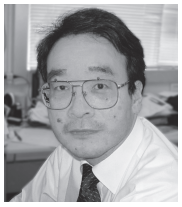
15:00-15:30 Coffee Break

Session 8 (Ball A) Tuesday, July 14th, 15:30-16:45

Fundamentals of Materials and Devices

15:30 8-1

Cross-Sectional Observation of Nano-Domain Dots Formed in Lithium Tantalate Single Crystal



Yasuo Cho, RIEC, Tohoku University

Cross-sectional shapes of polarization-reversal nano-domain dots, formed in both congruent and stoichiometric $LiTaO_3$ single-crystal recording media, were studied using scanning nonlinear dielectric microscopy. It was confirmed that the thickness of the domain wall of the nano-domain formed in stoichiometric $LiTaO_3$ is much smaller than that in congruent $LiTaO_3$. The variation in the domain wall thickness was evaluated as a function of sample thickness and depth position. It was confirmed that the domain wall thickness at the bottom of the sample was thinner than that at the top surface of the sample.

15:45 8-2

Ultrasonic Micro-Spectroscopy Characterization of ZnO and AlN Crystals

Jun-ichi Kushibiki, Tohoku University

We have been studying material characterization with the ultrasonic micro-spectroscopy (UMS) technology using ultrasonic focused waves and ultrasonic plane waves in the VHF and UHF ranges. The UMS technology, in which the line-focus-beam ultrasonic material characterization (LFB-UMC) system plays a central role, the capabilities of analyzing and evaluating elastic properties with a higher accuracy in surface-wave velocity measurement, 0.001%. The usefulness and effectiveness of the LFB-UMC system has been verified for resolving various kinds of scientific and industrial problems associated with piezoelectric materials as well as nonpiezoelectric materials.
In this talk, we extend the applications to characterization of ZnO and AlN crystals, wide band-gap semiconductors, which are attractive and promising materials for applications to optical devices and high-power / high-frequency devices, discussing the following subjects:
(1) homogeneity evaluation of ZnO and AlN single crystals and thin films,
(2) determination of their accurate, acoustical physical constants, and
(3) development of a new method of evaluating resistivity distributions in ZnO single crystals.

16:00 8-3

Measurement of Single-Photon-Level Optical Nonlinearities in Waveguide Media

Keiichi Edamatsu, RIEC, Tohoku University

We demonstrate the nonlinear phase shifts in a photonic crystal fiber (PCF) and a silicon wire waveguide (SWWG) at the single-photon-level. Taking advantage of large nonlinearity and managed dispersion of the PCF, we have successfully measured very small (10^{-7} to 10^{-8}) conditional cross-phase modulation induced by weak coherent pulses that contain one or less than one photon per pulse on average. For the low-loss SWWG, cross-phase modulation originating from the optical Kerr effect as well as the free carrier dispersion was observed down to the single photon level.

16:15 8-4

Research and Development of High Quality and Large Size Display Based on PLC and DLC Theories.

Tatsuo Uchida, Tohoku University

The accurate evaluation and the control of molecular alignment of liquid crystal is necessary to realize high quality liquid crystal displays. For this purpose, the surface anchoring strength of various surface alignment materials of liquid crystal are measured and evaluated. From these results, it is shown that most homeotropic alignment materials give satisfactory results but that careful selection is necessary for future advanced display. Large size display is also discussed and new design rule of a optimized screen-brightness is established base on DLC (diffused light control) theory to realize a high performance projection display system.

16:30-16:45 Closing Session

Poster Session

Monday, July 13rd, 2009

16:30-17:45

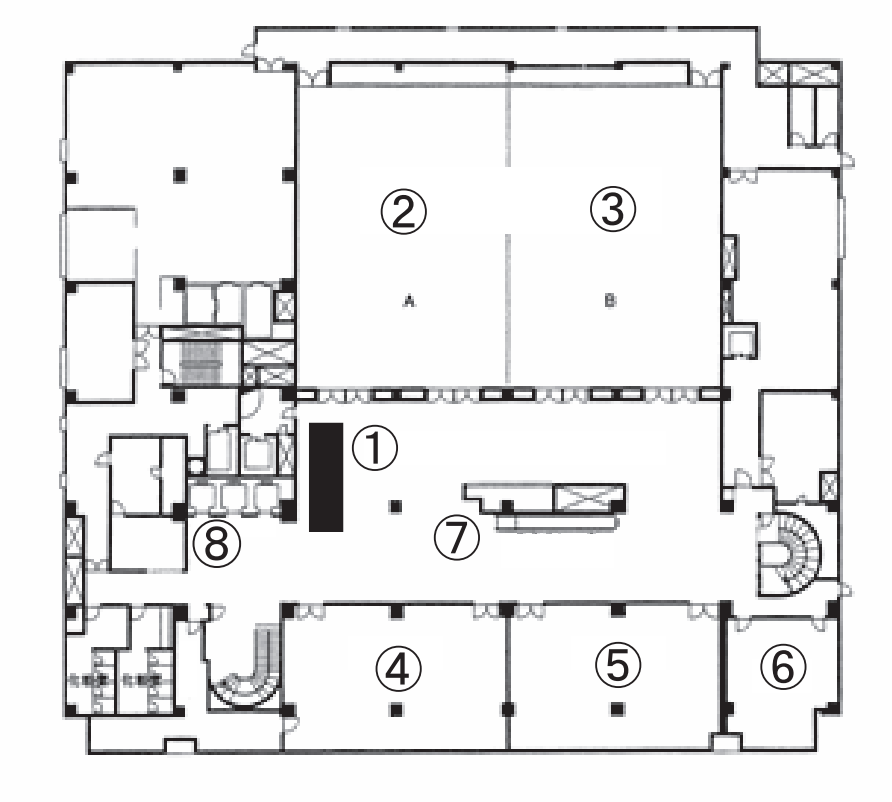
Ball B

PO-01	**Recent Activities on Ultrahigh-speed Optical Communication** **Masataka Nakazawa, RIEC, Tohoku University**
PO-02	**Design of Future All-Optical Routers** **Susumu Horiguchi, Tohoku University**
PO-03	**Giga-bit Wireless Signal Processing and Distributed Network Technology** **Fumiyuki Adachi, Tohoku University**
PO-04	**Relation between MIMO Channel Capacity and Directivity of Receiving Antennas** **Kunio Sawaya, Tohoku University**
PO-05	**A Fault-Tolerant Topology for Broadcasting in Ad-Hoc Networks** **Nei Kato, Tohoku University**
PO-06	**Toward Highly Realistic Acoustic and Multi-Modal Information Systems** **Yôiti Suzuki, RIEC, Tohoku University**
PO-07	**Closed Form Expressions of the Balanced Realizations of Second-Order Filters** **Masayuki Kawamata, Tohoku University**
PO-08	**High-Accuracy Machine Vision Technology Using Phase-Only Correlation** **- From 3D Measurement to Biomedical Imaging -** **Takafumi Aoki, Tohoku University**
PO-09	**Machine Learning Algorithm for Image Processing** **Kazuyuki Tanaka, Tohoku University**
PO-10	**Optimal Insertion of a Segment Highway in a City Metric** **Takeshi Tokuyama, Tohoku University**
PO-11	**SPiCA: Type-Based Automatated Verification Tool for Cryptographic Protocols** **Naoki Kobayashi, Tohoku University**

PO-12	**Optoelectronic-Nanodevices Oriented Nanoscopic Plasma Control** **Rikizo Hatakeyama, Tohoku University**
PO-13	**Self-Formation of Bilayer Lipid Membranes on Agarose-Coated Silicon Surfaces Studied by Simultaneous Electrophysiological and Surface Infrared Spectroscopic Measurements** **Michio Niwano, RIEC, Tohoku University**
PO-14	**Atomically Controlled Processing for Future Si-Based Devices** **Junichi Murota, RIEC, Tohoku University**
PO-15	**Challenge to Terabit per Square Inch Magnetic Recording** **Hiroaki Muraoka, RIEC, Tohoku University**
PO-16	**Tailor-Made Nano Structured Material for Highly Qualified Spin Related Devices** **Migaku Takahashi, Tohoku University**
PO-17	**Semiconductor Spintronics** **Hideo Ohno, RIEC, Tohoku University**
PO-18	**VLSI Platform for Real-World Applications** **Michitaka Kameyama, Tohoku University**
PO-19	**Fundamental Technologies towards New Paradigm VLSI Computing** **Takahiro Hanyu, RIEC, Tohoku University**
PO-20	**Cross-Sectional Observation of Nano-Domain Dots Formed in Lithium Tantalate Single Crystal** **Yasuo Cho, RIEC, Tohoku University**
PO-21	**Evaluation of Zero-CTE Temperature of TiO_2-SiO_2 Ultra-Low-Expansion Glass Using the Line-Focus-Beam Ultrasonic Material Characterization System** **Jun-ichi Kushibiki, Tohoku University**
PO-22	**Measurement of Single-Photon-Level Optical Nonlinearities in Waveguide Media** **Keiichi Edamatsu, RIEC, Tohoku University**
PO-23	**Research and Development of High Quality and Large Size Display Based on PLC and DLC Theories** **Tatsuo Uchida, Tohoku University**

Conference Space Layout

3F



① Registration Desk
② Ball Room A
③ Ball Room B
④ Maple
⑤ Oak
⑥ Wood
⑦ Escalator
⑧ Elevator

Transportation

Sendai Airport

Sendai Airport Access Line (25 minutes)

Narita International Airport

Railway (JR East)
Ltd. Express “Narita Express”
(60 minutes)

Tokyo Station

Railway (JR East)
Tohoku Shinkansen “Hayate/Komachi” or “Yamabiko”
(2.0 hours)

Sendai Station

TAXI: 5 minutes

WALK: 15 minutes straight down “AOBA DORI”

BUS: 5 minutes
Take bus marked:
(No.9 bus stop)
715:“宮教大" (MIYAKYODAI)
710"青葉台" (AOBADAI)
(No. 11 bus stop)
700:“緑ヶ丘三丁目” (MIDORIGAOKA)
(No. 12 bus stop)
707“長町南駅･長町(営)” (NAGAMACHI-MINAMI)
Get off at "晩翠草堂前" (BANSUISODO MAE). It is the second stop.

Sendai Excel Hotel Tokyu

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