Department of Electical and Electronic Engineering

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Robot Motion Decision-Making System in Unknown Environments, Somchai BOONPHOAPICHART*, Satoshi KOMADA, Takamasa HORI*, and William A. Gruver*: Proceedings of 2003 IEEE International Conference on Robotics and Automation, vol. 3, pp.4197-4202, 2003.

A fuzzy decision-making system for multi-criteria robot motion planning and control is described for a constant speed omni-directional mobile robot with active stereo cameras capable of panoramic viewing. The robot can be commanded to move to a target point through an unknown environment while satisfying multiple criteria. Advantages of the proposed method are confirmed by simulation. A multi-agent approach is also described for path planning with multiple robots.

Position Control of LSM by Gain-scheduled H8 Control, Kazuhiro YUBAI, Shinya TAKASHIMA, and Takamasa HORI*: Proceedings of International Conference on Computer, Communication and Control Technologies CCCT'03, vol. 3, pp.509-514, 2003.

The gain scheduled H8 control is known as an effective method to control linear parameter varying (LPV) systems with real-time measured parameters.Generally, control performance is greatly affected by modeling error and load change.In this paper, we consider them as deviation of plant parameters.Firstly, we apply the gain scheduled H8 control to design high performance controller with time varying parameters, and find it by solving LMIs.Secondly, we estimate time varying parameters based on least square estimation and use them instead of real parameters.Finally, we verify the effectiveness of the proposed control system by some experimental results.

Visual Servoing of Robots using Estimated Image Features, Satoshi KOMADA, Masaya YOSHIDA*, and Takamasa HORI*: IEEJ Transactions on Industry Applications, vol. 123, no. 10, pp.1200-1205, 2003.

A major problem in a visual servo system arises because of longer sampling period of image processing as compared to that of manipulator control. This paper proposes a new visual servo system compensating the delay time of the image processing. To obtain an image feature of manipulators without delay time, variation of image feature during delay time is estimated by a Jacobian matrix from joint velocity to image feature. Moreover, a criterion function using the estimated image features is adopted so that manipulators can avoid obstacles using redundancy. Here, a strategy that enables less computational time and easy programming by using the Jacobian matrix is proposed. A feature based visual servo system without inner loop speed or position controller and 3D reconstruction is proposed. The system utilizes the estimated image feature without delay in each manipulator control period. The proposed system is applied to trajectory control and obstacle avoidance using redundancy experimentally.

Improvement of Sensorless Control Performance for IPMSM by Suppression of Harmonic Current with Fourier Transform and Repetitive Control, Jeong-seong KIM, Shinji DOKI* and Muneaki ISHIDA, IEEJ Transactions on IA, Vol123, No.10, p.p.1176-1184 (In Japanese)

In the case of the sensorless control for the PMSM that estimates position and velocity from EMF using the model of a synchronous motor with the voltage and current, it is desirable for voltage and current to be perfect sine waves. However, in fact, various harmonic components are contained in the voltage and current, and they have bad influence on the estimation performance of a sensorless control. In this paper, we propose a improving method of sensorless control performance for the IPMSM by suppression of harmonic component in current control loop of the vector control using Fourier transform and repetitive control. To suppress harmonic components, compensation signals are acquired using Fourier transform and repetitive control, and feedforward control is implemented with the acquired compensation signals. To evaluate our proposed system, the sensorless control system for the IPMSM is taken for instance. The system is constructed on the basis of the extended EMF

disturbance observer with the current and voltage command whose harmonic components are suppressed. As a result, we can have a margin in the pole assignment of disturbance observer, and the performance of sensorless control can be improved. The effectiveness of the proposed method is confirmed by experimental results.
Harmonics Suppression of PMSM Using Repetitive Control and Application to Improvement of Sensorless Control Performance, Jeong-seong KIM, Shinji DOKI* and Muneaki ISHIDA, Proceedings of The 29th Annual Conference of the IEEE Industrial Electronics Society (IECON2003), p.p.908-912

Using the repetitive control, Authors have proposed the suppression method of harmonic currents in the vector control system for PMSM. In this paper, we propose a new simplified harmonics suppression system and a method improving the stability margin of the control system and convergence speed of harmonics. With stability analysis and experimental results, we confirm the proposed method. Moreover, this paper shows that the proposed control system can be used for improvement of position/velocity sensorless control performance with voltage commands and currents that are purified by the repetitive control. To evaluate our proposed system, the sensorless control system which is constructed on the basis of the extended EMF disturbance observer is taken as an example, and the improvement effectiveness of the proposed control system is confirmed by experimental results.

Modeling and Decision Support System Based on Time Series Information Clustering,Masato KOBAYASHI*, Shinji DOKI* and Muneaki ISHIDA, The 2nd International Conferenceon Mechatronics and Information Technology(ICMIT 2003), p.p.696-700

In this paper, we propose a novel modeling and decision support system of human action based on time-series information (TSI) clustering. Recently,the situation is increasing where human and machine collaborate in some way. It is reported, in such situation, many accidents have occurred, and most causes of them are depended on human error. Therefore, it is anxious for the means which prevents them. To prevent them and support action decision, especially for non-expert, action decision of expert should be accumulated and used. Therefore, we propose a "Modeling and Decision Support System" which is able to model human decision and instruct humans when and what to do next using the proposed model. Our proposing system consists of two parts. One part covers "Making models from past human action decision", and another part takes "Instructing humans when and what to do next using the proposed model". We show them just below.

DIRECT VISUALIZATION OF ELECTROMAGNETIC MICROFIELDS BY NEW DOUBLE-EXPOSURE ELECTRON HOLOGRAPY, Akinori OHSHITA, Hiroki SUGI* and Masaaki OKUHARA, Yohei YAMAKAWA and Koichi HATA: Proc. of the Institute of Physics Conference, Oxford, pp.215-218, 2003

Three-electron-wave and four-electron-wave interference methods are very useful for direct visualization of pure phase objects such as electromagnetic microfields, but two electron biprisms are indispensable. In this paper, we describe a new double-exposure electron holographic method using an electron biprism and present an experimental result of electric-field observation.

Long-Term Fetal Monitoring: An Approach Based on Abdominal ECG, Muhammad Ibn IBRAHIMY, Shinji TSURUOKA, M.A. Mohd ALI, Edmond ZAHEDI, and F. AHMED, Proc. of World Congress on Medhical Physics and Biomedical Engineering (WC2003), p.152, 2003.

A fetal monitor has been developed for the measurement of the fetal and maternal heart rates from maternal abdominal electrocardiogram during pregnancy and labor for ambulatory monitoring. Developed algorithm of the fetal monitor is based on digital filtering, adaptive thresholding, statistical properties in the time domain and differencing of local maxima and minima. Five volunteers with low risk pregnancies, between 35 to 40 weeks of gestation and no evidence of labor, were studied for the fetal heart rate detection. A Doppler ultrasound fetal monitor was used to compare the accuracy of the measurement system. Results showed an

average percent rms difference (PRD) of 5.32% in comparison with the reference ultrasound method. The fetal heart rates curve remained inside a ±5 beats/min limit relative to the reference ultrasound method for 84.1% of the time.

Automatic Display of an Additional Explanation on a Keyword Written by a Lecturer for e-Learning Using a Pen Capture Tool on WhiteBoard and Two Cameras, Kazuyuki NISHIKIMI, Yuuki YADA, Shinji TSURUOKA, Tomohiro YOSHIKAWA, Tsuyoshi SHINOGI, Proc. of 4th International Symposium on Advanced Intelligent Systems (ISIS2003), pp.102-105, 2003.

In this paper, we propose a new automatic display method of an additional explanation on a keyword written by a lecturer for e-Learning using a whiteboard capture tool and two cameras. The proposed display system uses the lecture image database with the time tag, and shows three windows, that is, the moving image by the whiteboard capture tool, the moving image by the active camera and the window for the additional explanation of a keyword written by a lecturer on whiteboard. If the lecturer would write characters on whiteboard, then the system would display the whiteboard and the additional explanation on the characters from the full text database. We implemented the above system using MS-Visual C# on Windows, and we confirmed the effectiveness of our method for some lectures.

Document Structure Understanding on Subjects Registration Table, Yuuichi ITO, Masanaga OHNO, Shinji TSURUOKA, Tomohiro YOSHIKAWA, Tsuyoshi SHINOGI, Proc. of 4th International Symposium on Advanced Intelligent Systems (ISIS2003), pp.571-574, 2003.

We propose a table structure understanding system for some table types, and it has some steps. The first step is that the document images on a paper are read from the image scanner. The second step is that a document image segments into some tables. In the third step, the character strings is extracted using image processing technology and the property of the character strings is determined. And the structured database is generated automatically. The proposed system consists of two systems. "Master document generation system" is used for the table form definition, and it doesn't include the handwritten characters. "Structure analysis system for completed table" is used for the written form, and it analyzes the table form filled in the handwritten character. We implemented the system using MS Visual C++ on Windows, and it can get the correct extraction rate 98% among 51 registration tables written by the different students.

Tissue Characterization of Local Myocardium Using Phase Frequency Spectrum of Ultrasonic RF Signal, Hirotake ISHII, Shinji TSURUOKA, Muhammad Ibn IBRAHIMY, Fumikata KIMURA, Tetsushi WAKABAYASHI, Wataru OHYAMA and Kiyotsugu SEKIOKA*, Proc. of IEEE EMBS Asian-Pacific Conference on Biomedical Engineering (IEEE EMBS APBME2003), CD-ROM, #4.4.3, pp.1-2, 2003.

In this paper, to evaluate fine myocardium structure change from ultrasonic RF signal, we propose a new "Phase Frequency Spectrum (PFS)" analysis about a specified local myocardium during cardiac cycle. The analysis employs the small range centering on the point tracked by our tracking system on a RF signal, and applies time-frequency analysis (wavelet transform) to the envelope of the RF signal. The result of our analysis is shown as the two-dimensional image between frequency spectrum and cardiac-phase. We measured the change of the phase frequency spectrum, and we confirmed experimentally the diagnostic usefulness of our analysis for a lot of normal and abnormal hearts.

Study on the Improvement in Accuracy of Automatic Tracking for Regional Myocardium Using Ultrasonic RF Echo Signal, Yoshikazu YASUMOTO, Shinji TSURUOKA, Tomohiro YOSHIKAWA, Tsuyoshi SHINOGI, Fumikata KIMURA, Tetsushi WAKABAYASHI, Wataru OHYAMA and Kiyotsugu SEKIOKA*, Proc. of IEEE EMBS Asian-Pacific Conference on Biomedical Engineering (IEEE EMBS APBME2003), CD-ROM, #4.10.4, pp.1-2, 2003.

This paper describes a study on the improvement in accuracy of the automatic tracking "correlation method with confidence (CMC) proposed by our grope. The tracking method employs the correlation coefficients at a position as the degree of confidence of the tracking for a specified observing point, that is, it employs the position obtained by hierarchical correlation method for an observing points if the correlation coefficient of the observing point is high, and it employs the mean moved position of two nearby observing points at the same time

if the correlation coefficient of the observing point is low. However, we found the unfortunate case for the tracking method, that is, the fact that the many points have low correlation coefficients at the same time. We found that the large movement of my ocardium causes the tracking error for CMC.

Local Myocardial Motion Tracking Based on Correlation Weighted Phase Difference Method, Wataru OHYAMA, Norlaila binti ISMAIL, Tetsushi WAKABAYASHI, Fumitaka KIMURA, Shinji TSURUOKA, and Kiyotsugu SEKIOKA, The Institute of Electronics, Information and Communication Engineers (IEICE) Transactions (Japanese Edition), Vol.J86-A, No.9, pp.917-928, 2003

In this paper, we propose a new method for automatically tracking the motion of local region in left ventricular myocardium by means of ultrasonic pulsed Doppler signal. This method consists of a velocity detection procedure based on correlation weighted mean instantaneous velocity and a motion tracking procedure employing a myocardial elastic model. Most of ultrasonic pulsed Doppler signals observed in clinical diagnosis contain considerable amount of speckle noise, which causes detection error of velocity. The detection error is accumulated in the motion tracking procedure and yields obviously incorrect motion trajectory. The procedure of correlation weighted mean velocity is aimed to reduce the velocity detection error, and the myocardial elastic model is used to avoid the accumulation of the error to keep track of the motion of the myocardium in reasonable accuracy. The result of evaluation test shows that this method is able to improve the accuracy of tracking approximately 40 % relative to a conventional CLS approach.

Between-core Vector Overlapping for Test Cost Reduction in Core Testing, Tsuyoshi SHINOGI, Yuki YAMADA, Terumine HAYASHI, Tomohiro YOSHIKAWA, and Shinji TSURUOKA, Proceedings of the Twelfth Asian Test Symposium(ATS 2003), pp.268-273, 2003

This paper proposes a novel method, called "Between-core vector overlapping" for parallel core testing of an SoC consisting of full-scanned cores. This method uses small number of input pins in the parallel core testing. An "Overlapped vector" obtained by overlapping all the vectors for all the core is supplied to all the cores in common for parallel core testing. Two methods for short overlapped vectors, "Invert overlapping" and "Split overlapping" are presented. The impact of further reduction in the number of input pins is also reported.

Fitness Inference System Considering Similarity of Chromosomes [in Japanese], Hiroharu Kawanaka, Tomohiro Yoshikawa, Reiko Mitsuhashi, Yoshifumi Banno, Tsuyoshi Shinogi and Shinji Tsuruoka, The Transactions of The Institute of Electrical Engineers of Japan, Vol.123-C, No.3, pp.568-575, 2003

Recently, Evolutionary Computations (ECs) are widely studied. Generally, it takes a lot of time for the calculation of ECs to acquire expected solutions because they need repeated calculation for searching solutions. In this paper, we propose a new fitness inference method with similarity of chromosomes to reduce the total number of evaluation in GA. This method uses an idea of territory that represents the threshold of similarity of chromosomes, and it infers most of the fitness values of chromosomes without actual evaluation process using other evaluated chromosomes. The time for evaluation can be reduced drastically and the effective search can be done by the proposed method. This paper also studies the territory of the proposed method.

Constraints and Search Efficiency in Nurse Scheduling Proble, Hiroharu Kawanaka, Tomohiro Yoshikawa, Tsuyoshi Shinogi and Shinji Tsuruoka, Proc. of the 5th IEEE International Symposium on Computational Intelligence in Robotics and Automation (CIRA2003), pp.312-317, 2003

The Nurse Scheduling problem (NSP) is that of allocating shifts for nurses under various constraints. Generally, the extensive number of constraints requires a great deal of knowledge and experience to make a nurse's scheduling table. This task requires a lot of time and effort and there is demand for an automatic scheduling. This study focuses the relationship between constraints and search efficiency, and discusses the affect for search efficiency with the way to take the constraints into GA. This paper especially focuses the constraints that must be satisfied absolutely in the coding and genetic operations, and shows that this method can

reduce the search area of GA drastically using numerical approximation method. Scheduling tables are acquired by the conventional and proposed method, and the result shows that effective search can be done and effective nurse scheduling tables can be generated by the proposed method.

A Study on Territories by Similarity of Chromosomes for Fitness Inference Method, Hiroharu Kawanaka, Tomohiro Yoshikawa, Yoshifumi Banno, Tsuyoshi Shinogi and Shinji Tsuruoka, Proc. of IEEE International Conference on Systems, Man and Cybernetics (SMC2003), pp.3571-3576, 2003

Recently, Evolutionary Computations (ECs) have been widely studied. Generally, it takes a lot of time for the calculation of ECs to acquire expected solutions because they need repeated calculation for searching solutions. In this paper, we propose a new fitness inference method with the similarity of chromosomes to reduce the total number of evaluation in GA. This method uses an idea of territory that represents the threshold of the similarity of chromosomes, and it infers most of the fitness values of chromosomes without actual evaluation process using other evaluated chromosomes. The time for evaluation can be reduced drastically and the effective search can be done by the proposed method. This paper also studies the territory of the proposed method.

A Proposal of Fuzzy Modeling on Fusion Axes Considering the Data Structure, K. Yamamoto, T. Yoshikawa, T. Furuhashi, Proc. of The IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2003), pp348-353, 2003

Fuzzy modeling is known as one of the effective methods to identify unknown non-linear input-output relationships. In gathering information from constructed models or constructing models from known information, the model's understandability becomes essential. This paper defines new axes by fitting distributed data in input space and proposes a fuzzy modeling method considering data structure. This paper calls these axes, "fusion axes". The effectiveness of the proposed method is shown through some numerical experiments.

A Study on Fuzzy Modeling for Incorporating Human Knowledge using Fusion Axes, K. Yamamoto, T. Furuhashi, T. Yoshikawa, S. Horikawa, the 5th IEEE International Symposium on Computational Intelligence in Robotics and Automation (CIRA2003), pp.198-200, 2003

Fuzzy modeling is an effective method to construct an interpretable model. This paper proposes a method that incorporates human knowledge using "Fusion Axes". Human knowledge is often available with simplified expressions. The fusion axes proposed by the authors are linear combinations of multiple inputs that reduce input dimensions for visualizing models with multi-input system. This paper is dealing with a method that makes the simple linguistic expressions by humans and the model in the "fused space" correspond with each other. A simulation is carried out to demonstrate the potentiality of the fusion axes.

Transmission Power Control Based on Predicted SIR for Downlink Common Channel Transmissions in CDMA Cellular Packet Communications, Kazuo MORI, *Tomotaka Nagaosa, and Hideo Kobayashi, IEICE Trans. on Commun., Vol.E86-B, no.1, pp.96-104, Jan. 2003

This paper investigates transmission power control for packet transmissions by using code division multiplexing (CDM) in the downlink common (shared) channel of CDMA cellular packet systems and proposes a transmission power control scheme to improve throughput performance and geographical fairness of communication services. In the proposed scheme, downlink transmission power is controlled based on the signal-to-interference ratio predicted at mobile stations. Throughput performance and transmission delay are evaluated under perfect power control conditions. Simulation results show that by using site diversity technique

the proposed scheme improves the downlink throughput for light load conditions and geographical fairness for all offered channel loads under both non-fading and fading environments.

Proposal of Symbol Timing and Carrier Frequency Synchronization Methods for Burst Mode OFDM Signal, Hideo Kobayashi, Kazuo Mori, and *Tomotaka Nagaosa, IEICE Trans on Commun., vol.E86-B, no.1, pp.238-246, Jan. 2003

This paper proposes a novel synchronization method of jointly estimating symbol frame timing and carrier frequency-offset for Orthogonal Frequency Division Multiplexing (OFDM) signal operating in the burst mode which is usually employed in the wireless LAN communications systems. The proposed method enables a fast and accurate synchronization for the burst mode OFDM signal even under the presence of large frequency-offset, very low C/N and frequency selective fading environments by using only two preamble symbols inserted at the start of every burst frame. This paper presents the various computer simulation results to verify the performance of proposed synchronization methods both for symbol timing and carrier frequency.

Proposal of Grouping Adaptive Modulation Method for Burst Mode OFDM Transmission System, Yuanrun Teng, *Tomotaka Nagaosa, Kazuo Mori, and Hideo Kobayashi, IEICE Trans. on Commun., vol.E86-B, no.1, pp.257-265, Jan. 2003

This paper proposes an Orthogonal Frequency Division Multiplexing system with Grouping Adaptive Modulation method (GAM-OFDM). The salient feature of the proposed system is to enable the reduction of required transmission bits for adaptive modulation information (AMI) that is required in the demodulation process at the receiver. This paper also proposes an efficient AMI transmission method for the GAM-OFDM system to enable the efficient transmission of AMI bits by using only two preamble symbols, and the Multi-Carrier Spectrum Spreading (MC-SS) technique to achieve the excellent performance of AMI transmission even under severe multi-path fading environments. This paper presents the various computer simulation results to verify the performance of proposed GAM-OFDM system.

Slot Assignment Method for CDMA/NC-PRMA Systems in Multi-cell Environments, *Akio Kato, *Tomotaka Nagaosa, Kazuo Mori, and Hideo Kobayashi, IEICE Trans. on Fundamentals, Vol.E86-A, no.7, pp.1619-1626, July 2003

The CDMA/NC-PRMA protocol has been proposed to deal with multimedia traffic flexibly in mobile communications systems. The Load-Balancing (LB) method has been investigated for information slot assignment in CDMA/NC-PRMA systems. However, the LB method may be not effective in multi-cell environments due to inter-cell interference although this method is effective for single cell environments. In this paper, we propose new information slot assignment methods for multi-cell environments; a total reception power based assignment method and a signal to interference ratio (SIR) based assignment method. The former one assigns information slots based on the total reception power from both inside and outside the cell for each slot in the previous frame. The latter one predicts the SIR of receiving packets and assigns information slots to MSs only when predicted SIR exceeds the target SIR. The results of computer simulation show that the proposed schemes have superior transmission performance to the conventional scheme.

Uplink Packet Transmission Control for Asymmetric Traffic in CDMA/Shared-TDD Cellular Packet Communications, Kazuo Mori, *Tomotaka Nagaosa, and Hideo Kobayashi, IEICE Trans. on Commun., Vol.E86-B, no.9, pp.2620-2627, Sept. 2003

A shared--TDD scheme has been proposed for accommodation of asymmetric communications between uplink and downlink traffic. The application of shared--TDD scheme to CDMA cellular systems causes inter-link interference because CDMA cellular systems use the same frequency band for all cells. This paper proposes a transmission control scheme for uplink packets to relieve the effect of inter-link interference in CDMA/shared-TDD cellular packet systems. In the proposed scheme, mobile stations select transmission slots based on their location and the status of slot allocations in own and the adjacent cells. Computer simulations

show that the proposed scheme relieves the effect of inter-link interference, and thus improves the downlink transmission efficiency.

Single Carrier OFDM Technique with Adaptive Modulation Method, Hideo Kobayashi, *Tadayuki Fukuhara, *Hao Yuan and *Yoshio Takeuchi, IEICE Trans. on Fundamentals, Vol.J86-A, no.12, pp.1329-1339, Dec. 2003

The single carrier OFDM (SC-OFDM) technique, which can improve the peak to averaged power ratio (PAPR) has recently received a lot of attention as the alternative transmission technique to the conventional OFDM. This paper proposes a novel estimation method for the received CNR of SC-OFDM signal, which is required in the introduction of adaptive modulation method to the SC-OFDM technique so as to improve the channel capacity. The salient feature of proposed method is to enable the precise estimation of channel conditions under the multi-path fading environments by using the preamble symbols, which are usually inserted at the start of every burst frame. This paper also presents various performances of the proposed SC-OFDM with adaptive modulation method as comparing with the conventional OFDM.

Frequency Band and Slot Selection Scheme for Downlink Packet Transmission in Cellular Band Division MC-CDMA Systems, Kazuo Mori, *Tetsuya Kunichi, *Tomotaka Nagaosa, and Hideo Kobayashi, Proc. of the IEEE Wireless Communications and Networking Conference (WCNC2003), TS62-6, CD-ROM, New Orleans, March 2003.

This paper proposes a downlink frequency band and slot selection scheme for cellular bandwidth division MC-CDMA systems. The proposed scheme selects transmission frequency band and slot according to the signal-to-interference ratio estimated by using the pilot signal at mobile stations. Simulation results show that the proposed scheme improves the downlink throughput but degrades delay performance and it has a trade off between throughput and delay performance. By selecting suitable control parameters, the proposed scheme achieves the throughput improvement without sacrificing the delay performance.

Proposal of Adaptive Subchannel and Bit Allocation Method for OFDM Access Wireless LAN Systems, Yuanrun Teng, *Tomotaka Nagaosa, Kazuo Mori, and Hideo Kobayashi, Proc. of IEEE VTC 2003-Spring, CD-ROM, April 2003

This paper proposes an adaptive subchannel and bit allocation method for OFDMA (Orthogonal Frequency Division Multiple Access) based Wireless LAN systems. The proposed adaptive subchannel and bit allocation method combines the adaptive subchannel allocation technique and adaptive modulation technique to improve the channel capacity of OFDMA system. This paper presents computer simulation results to demonstrate that the proposed method can achieve the higher frequency bandwidth efficiency and excellent signal quality even under severe frequency selective fading environment for point to-multipoint Wireless LAN systems.

Proposal of Single Carrier OFDM Technique with Adaptive Modulation Method, Hideo Kobayashi, *Tadayuki Fukuhara, *Hao Yuan, and *Yoshio Takeuchi, Proc. of IEEE VTC 2003-Spring, CD-ROM, April 2003

The single carrier OFDM (SC-OFDM) technique in conjunction with frequency domain equalization method has recently received a lot of attention as the alternative transmission technique to the conventional OFDM. The SC-OFDM technique can achieve the better performance in bit error rate performance and peak to averaged power ratio (PAPR) as compared with the conventional OFDM. The SC-OFDM has also a potential capability to improve the channel capacity by employing the adaptive modulation method. This paper proposes a novel estimation method for the received CNR of SC-OFDM signal, which is required in the introduction of adaptive modulation method. This paper also presents various performances of the proposed SC-OFDM with

adaptive modulation method as comparing with the conventional OFDM.

A Novel Channel Estimation Method for OFDM Transmission Technique under Fast Time-variant Fading Channel, *Tadayuki Fukuhara, *Hao Yuan, *Yoshio Takeuchi, and Hideo Kobayashi, Proc. of IEEE VTC 2003-Spring, CD-ROM, April 2003

This paper proposes a novel channel frequency response estimation method of channel frequency response for orthogonal frequency division multiplexing (OFDM) systems operating in fast time-variant fading channels. The proposed methods enables accurate coherent detection demodulation without using pilot signals, which are usually inserted in the data symbols periodically to cope with in the fast time-variant fading channel. Compared with conventional method which provides the BER performance of 5.2E-2, theThe computer simulation results show that the proposed method can keep the better BER performance even when the vehicle provides the BER performance of 2.1E-3 at the speed of 180 km/h.

Proposal of Clipping and Inter-Modulation Noise Mitigation Method for OFDM Signal in Non-Linear Channel, Pisit Boonsrimuang, Kazuo Mori, Hideo Kobayashi, and *Tawil Paungma, Proc. of WPMC03, CD-ROM, Oct. 2003

One of the disadvantages of using OFDM is its larger peak to averaged power ratio (PAPR) as compared with the conventional single carrier transmission method. The OFDM signal with larger PAPR will cause the un-desirable spectrum re-growth and the larger degradation of bit error rate performance due to the inter-modulation products occurring in the non-linear amplifier at the transmitter. The clipping method in conjunction with the Decision Aided Reconstruction (DAR) method is well known as one of the solutions to improve the PAPR of OFDM signal and provide the better BER performance. In this paper, we propose the Improved DAR (IDAR) method in which the clipping noise and inter-modulation noise due to the non-linear amplifier are mitigated on the basis of DAR method. The proposed method enables the efficient usage of transmission amplifier with keeping the lower PAPR and better BER performance. This paper presents various computer simulation results to verify the performance of proposed IDAR method in the non-linear channel.

Performance Analysis of SDM-OFDM System with Adaptive Modulation Method over MIMO Channels, Yuanrun Teng, Kazuo Mori, and Hideo Kobayashi, Proc. of WPMC03, CD-ROM Oct. 2003

The Multiple Input Multiple Output (MIMO) technique is motivating the world-wide researchers to realize the next generation wireless LANs with the higher channel capacity and higher signal quality. This paper proposes and analyzes the Space Division Multiplexing OFDM (SDM-OFDM) system with adaptive modulation method over MIMO channels for wireless LANs. We propose the Carrier-to-Noise Power Ratio (CNR) estimation method for each OFDM sub-carrier over multi-path fading channels, which can be used for the assignment of the optimal modulation scheme to each sub-carrier in each transmit antenna. In regard to realistic considerations, we also propose the adaptive modulation aided SDM-SCOFDM (Single Carrier OFDM) system that can reduce the number of required feedback adaptive modulation information (AMI) bits remarkably and also improve the PAPR (Peak to Average Power Ratio) performance. This paper presents the various computer simulation results to verify the proposed methods under a typical wireless LAN environment.

A Novel Channel Estimation Method for SC-FDE Technique in Fast Time-variant Fading Channel, *Tadayuki Fukuhara, *Hao Yuan , *Yoshio Takeuchi, and Hideo Kobayashi, Proc. of WPMC03, CD-ROM, Oct. 2003

A novel channel estimation method is proposed in this paper for a single carrier with frequency domain equalization (SC-FDE) system operating in fast time-variant fading channels. The proposed method enables accurate coherent detection without pilot signals, which are usually inserted in the OFDM data symbols for channel estimation. Computer simulation results show that the proposed method provides excellent BER performance even in the fast time-variant fading environment up to 180 km/h in the 5 GHz band.

Effect of Regularization Term upon Fault Tolerant Training, Haruhiko TAKASE, Hidehiko KITA, and Terumine HAYASHI: Proc. of 2003 International Joint Conference on Neural Networks (IJCNN2003), pp.1048-1053, 2003.

To enhance fault tolerance of multi-layer neural networks, we proposed PAWMA (partially adaptive weight minimization approach). This method minimizes not only output error but also the sum of squares of weights (the regularization term). This method aims to decrease the number of connections whose faults strongly degrade the performance of MLNs (important connections). On the other hand, weight decay which aims to eliminate unimportant connections is base on the same idea. This method expects to keeping important connections and decaying unimportant connections. In this paper, we discuss about the contradiction between two effects of the regularization term, (1) weight decay (2) decrease the number of important connections. Through some experiment, we show that the difference between these two effects is brought by the partially application of the regularization term.

Manipulation of hidden units activities for fault tolerant multi-layer networks, Yusei KATSUDA, Haruhiko TAKASE, Hidehiko KITA, and Terumine HAYASHI: Proc. of 2003 IEEE International Symposium on Computational Intelligence in Robotics and Automation, pp.19-24, 2003.

We propose a new training algorithm to enhance fault tolerance of multi-layer neural networks (MLNs). This method is based on the fact that faults on connections between hidden layer and output layer have a harmful effect on fault tolerance of MLNs. To decrease these effects, we introduced two approaches, (1) reduce of the number of strong connections between hidden layer and output layer, (2) neutralize the activities of hidden units. The first approach aims to reduce the undesirable connections. The second one aims to increase redundancy of internal representation.

On Test Data Compression Using Selective Don't-Care Identification, Terumine HAYASHI, Haruna YOSHIOKA, Tsuyoshi SHINOGI, Hidehiko KITA, and Haruhiko TAKASE: Proc. of IEEE 4th Workshop on RTL and High Level Testing (WRTLT'03), pp.104-109, 2003.

This paper proposes an effective method for reducing test data volume under multiple scan chain designs. The proposed method is based on reduction of distinct scan vectors using selective don't-care identification. Selective don't-care identification is repeatedly performed under conditions that each bit of frequent scan vectors is fixed to binary values (0 or 1). Besides, a code extension technique is adopted for shortening the code length for frequent scan vectors in the manner that the code length for rare scan vectors is designed as double of that for frequent ones. The effectiveness of the proposed method is shown through experiments for ISCAS'89 and ITC'99 benchmark circuits.

A Method of Immediately Classifying Description-Answers in a Large Class, Naoki MORITA, Hidehiko KITA, Haruhiko TAKASE, and Terumine HAYASHI: Proc. of International Conference on Computers in Education 2003 (ICCE 2003), pp.130-132, 2003.

To make a lecture easy to comprehend, the teacher needs to grasp the students' comprehension and go on the lecture taking it into consideration. We propose a real-time description-answer test system to grasp their comprehension in a large class. The system immediately classifies students' description-answers according to keywords extracted from them. The classified answers help the teacher to grasp students' comprehension. We have implemented the system and applied to the actual lectures. We have found that teachers are able to give appropriate advices immediately.

Epitaxial lateral overgrowth of GaN on selected-area Si (111) substrate with nitrided Si mask, Hiroyuki NAOI, Mitsuhisa NARUKAWA, Hideto MIYAKE, Kazumasa HIRAMATSU: J. Cryst Growth., 248, pp.573-577, 2003.

Epitaxial lateral overgrowth (ELO) of GaN by metalorganic vapor phase epitaxy was carried out on Si substrates using new ELO-mask patterns. The groove or SiO2 mask pattern employed was a stripe in combination with a larger period grid (100 mm_100 mm): the former is for the ELO of the GaN to reduce the threadingdislocation (TD) density and the latter is for limiting the area of growth and to suppress the formation of cracks in the grown GaN. Crack-free GaN layers with a reduced TD density were successfully obtained for both types of Si substrate, i.e., the grooved Si substrate and the SiO_2-masked Si substrate. The properties of GaN layers grown on these Si substrates are compared.

GaN-based Schottky barrier photodetectors from near ultraviolet to vacuum ultraviolet (360- 50 nm), Kazumasa HIRAMATSU and Atsushi MOTOGAITO: Phys. Stat Sol. (a), 195, pp.496-501, 2003.

The characterization of Schottky type ultraviolet (UV) detectors with a transparent electrode from the near UV to vacuum UV (VUV) region using synchrotron radiation is described. The responsivity of the photodetectors with a transparent Schottky electrode is about 0.15 A/W at 360 nm and is about 0.01 A/W in the VUV region. Furthermore the antireflection film and annealing of the Schottky transparent electrode are effective to improve the device performance. Therefore, Schottky type photodetectors are available to operate from the near UV and the VUV light (360- 50 nm).

Study of point defects in $CuGaSe_2$ single crystals by means of electron paramagnetic resonance and photoluminescence, Gennadiy A. MEDYEDKIN*, Takao NISHI*, Yuji KATSUMATA*, Hideto MIYAKE and Katsuaki SATO: Solar Energy Materials and Solar Cells, 75, pp.135-143, 2003.

Point defects in $CuGaSe_2$ single crystals as vacancies VSe, VCu and defect pair ($2V^{-}_{Cu}$ +Ga^{2+}_{Cu}) have been studied by means of electron paramagnetic resonance (EPR) andlow-temperature photoluminescence (PL). EPR hyperfine structure has been found attemperatures as low as 1.45–45K and the temperature dependence of EPR line is discussed.Photo-EPR spectrum reveals optically active behavior of intrinsic point defects in $CuGaSe_2$ crystals. Three bands of PL emission show different origins and two low-energy bands at 1.55 and 1.58 eV have been found to be steady despite H_2-, O_2- and Se_2-annealings. The experimental data added with electric characterization in accordance with the used annealings and together with a defect physics model allow consideration of the point defect ensemble in $CuGaSe_2$ in more detail.

Photoluminescence of Mg-doped GaN grown by metalorganic chemical vapor deposition, B. Z. OU*, Q. S. ZHU*, X. H. SUN*, S. K. WAN*, Z. G. WANG*, H. NAGAI*, Yasutoshi KAWAGUCHI*, Kazumasa HIRAMATSU, and Nobuhiko SAWAKI*: J. Vacuum Science & Technology A, 21, pp. 838-841, 2003.

Two Mg-doped GaN films with different doping concentrations were grown by a metalorganic chemical vapor deposition technique. Photoluminescence (PL) experiments were carried out to investigate the optical properties of these films. For highly Mg-doped GaN, the PL spectra at 10 K are composed of a blue luminescence (BL) band at 2.857 eV and two excitonic luminescence lines at 3.342 eV and 3.282 eV, in addition to a L2 phonon replica at 3.212 eV. The intensity of the L1 line decreases monotonously with an increase in temperature. However, the intensity of the L2 line first slowly increases at first, and then decreases quickly with an increase in temperature. The two lines are attributed to bound excitonic emissions at extended defects. The BL band is most likely due to the transition from deep donor Mg–VN complex to Mg shallow acceptor. From the temperature dependence of the luminescence peak intensity of the BL band, the activation energy of acceptor Mg was found to be 290 meV.

Metalorganic vapor phase epitaxy growth and study of stress in AlGaNusing epitaxial AlN as underlying layer, Yoshihiro KIDA, Tomohiko SHIBATA, Hideto MIYAKE and Kazumasa HIRAMATSU: Jpn. J. Appl. Phys., 42, pp. L572-L574, 2003.

The crystalline quality of AlGaN with high AlN molar fraction grown by low-pressure metalorganic vapor phase epitaxy (LPMOVPE) was improved by using high-quality epitaxial AlN film on sapphire (0001). Atomically flat $Al_xGa_{1-x}N$ ($0.2 < x < 0.8$) without any cracks was fabricated on the epitaxial AlN film. Lattice constants of the $Al_{0.48}Ga_{0.52}N$ and the AlN at growth temperature were estimated from high-temperature X-ray diffraction measurement. The results showed that the in-plane lattice constant of the Al0:48Ga0:52N was stress-free or slightly compressed even at the growth temperature. The smaller in-plane lattice constant of AlN than that of AlGaN is considered to play a great important role in restraining generation of cracks.

X-ray analysis of twist and tilt of GaN prepared by facet-controlled epitaxial lateral overgrowth (FACELO), Yasushi IYECHIKA*, Masaya SHIMIZU*, Takayoshi MAEDA*, Hideto MIYAKE and Kazumasa HIRAMATSU: Jpn. J. Appl. Phys., 42, pp. L732-L734, 2003.

The tilt and twist of GaN prepared by facet-controlled epitaxial lateral overgrowth (FACELO) were evaluated by the X-ray rocking curve measurement of symmetric and asymmetric reflections. Compared to the underlying GaN, the tilt and twist values became substantially smaller at 130 and 250 arcsec, respectively, which are consistent with published results of transmission electron microscopy and cathode luminescence analyses. Moreover, FACELO-GaN is almost free of small angle tilt boundaries in contrast to GaN prepared by simple epitaxial lateral overgrowth.

Characterization of GaN based Schottky UV detectors in the vacuum UV (VUV) and the soft X-ray (SX) region (10–100 nm), Atsushi Motogaito, Hironobu Watanabe, Kazumasa Hiramatsu, Kazutoshi Fukui*, Yutaka Hamamura*, and Kazuyuki Tadatomo*: Phys. Stat. Sol (a), 200, pp. 147-150, 2003.

Responsivity spectra of GaN based Schottky type ultraviolet (UV) photodetectors with transparent electrode from the Vacuum Ultraviolet (VUV) region to soft X-ray (SX) region (10–100 nm, 124–12.4 eV) are described for the first time. The calculated transmittance of 10 nm-thick transparent Ni/Au electrode from the transmittance of Ti/Au membrane is about 0.5–0.7 in the VUV and SX region (10–100 eV). Thus it is considered that the 10-nm-transparent Ni/Au electrode is thin enough to transmit VUV and SX light into the transparent electrode. The value of responsivity in the SX region (at 13 nm) is about 0.05 A/W.

High performance Schottky UV detectors (265–100 nm) using n-$Al_{0.5}Ga_{0.5}N$ on AlN epitaxial layer, Hideto MIYAKE, Hiroyuki YASUKAWA, Yoshihiro KIDA, Keiichi OHTA, Yasuhuro SHIBATA, Atsushi MOTOGAITO, Kazumasa HIRAMATSU, Youichiro OHUCHI*, Kazuyuki TADATOMO*, Yutaka HAMAMURA*, and Kazutoshi FUKUI*: Jpn. J. Appl. Phys. Stat. Sol (a), 200, pp. 151-154, 2003.

A high responsivity spectrum in the near ultraviolet (UV) and the vacuum UV (VUV) region was realized using Schottky UV detectors consisting of Al0.5Ga0.5N on an AlN epitaxial layer. The cut-off wavelength of AlGaN UV detectors was 4.7 eV (265 nm), a value that corresponds to the band gap of $Al_{0.5}Ga_{0.5}N$. The contrast of responsivity between the near UV and the visible was about 104. The GaN Schottky detector had a high responsivity region in the near-UV from 3.4 to 5.0 eV (250–360 nm), whereas the AlGaN UV detector had a high responsivity in the UV–VUV region from 4.7 to 12.4 eV (100–265 nm). From these results, the fabricated AlGaN-based UV photodetectors can likely be used in detectors for the UV– VUV region.

High-quality AlN epitaxial films on (0001)-faced sapphire and 6H-SiC substrate, Tomohiko SHIBATA, Keiichiro ASAI*, Shigeaki SUMIYA*, M. Mouri*, Mitsuhiro TANAKA*, Osamu ODA*, Hiroyuki KATSUKAWA*, Hideto MIYAKE and Kazumasa HIRAMATSU: Phys. Stat. Sol. (c), 0, pp. 2023-2026, 2003.

This paper presents crystal qualities of high-quality AlN epitaxial films on (0001)-faced sapphire and 6H-SiC substrates. The AlN epitaxial films are grown using a low-pressure metal organic vapor phase epitaxy (LP-MOVPE) method. 0.5–1 μm-thick AlN films without any cracks are realized on both substrates. Both of AlN films are found to have similar crystal qualities in spite of large difference in in-plane lattice mismatch between AlN and each substrate. The AlN films have an atomically flat surface with clear atomic steps. Results of X-ray rocking curve (XRC) measurement indicate that both of the AlN films have small tilted mosaicity, however relatively large twisted mosaicity. Dislocation density of the AlN films in its surface region is approximately as low as 1×10^{10} cm^{-2} and most of dislocations consist of edge-type dislocations.

MOVPE growth and n-type conductivity control of high-quality Si-doped Al0.5Ga0.5N using epitaxial AlN as an underlying layer, Yoshihiro KIDA, Akira ISHIGA, Tomohiko SHIBATA, Hiroyuki NAOI, Hideto MIYAKE, ,Kazumasa HIRAMATSU, and Mitsuhiro TANAKA*: Phys. Stat. Sol. (c), 0, pp. 2128-2131, 2003.

Conductivity control of 1-μm-thick Si-doped $Al_{0.5}Ga_{0.5}N$ using an epitaxial AlN underlying layer was realized by introducing CH_3SiH_3 during low-pressure metalorganic vapor phase epitaxy. Cathodoluminescence measurements indicated that luminescence from a deep-level transition was caused by silicon doping. X-ray diffraction measurements showed hat fluctuations of the tilt component of the *c*-axis increased with an increasing the silicon dopant flow rate. The electron concentration increased linearly with increasing the CH_3SiH_3 flow rate from $3.5 \times 10^{17}$$cm^{-3}$ to 9.3×10^{17} cm^{-3}.

Growth of high-quality GaN on FACELO substrate by raised-pressure HVPE, Shinya BOHYAMA, Kenji YOSHIKAWA, Hiroyuki NAOI, Hideto MIYAKE, Kazumasa HIRAMATSU, and Takayoshi MAEDA: Phys. Stat. Sol. (c), 0, pp. 2159-2162, 2003.

High-quality thick GaN was obtained by raised-pressure HVPE on GaN template grown by the facetcontrolled epitaxial lateral overgrowth (FACELO) technique. The threading dislocation density of the thick GaN is 2×10^{7} cm_{-2}. The FWHM value of the (0004) X-ray rocking curve is 94.7 arcsec.

TEM analysis of threading dislocations in crack-free $Al_xGa_{1-x}N$ grown on an AlN(0001) template, Noriyuki Kuwano, T. Tsuruda*, Yoshihiro KIDA, Hideto MIYAKE, Kazumasa HIRAMATSU, and Tomohiko SHIBATA : Phys. Stat. Sol. (c), 0, pp. 2444-2447, 2003.

Cross sectional transmission electron microscope (TEM) observation was performed to understand the behavior of threading dislocations (TDs) in an A*l*x*G*a1–*x*N layer epitaxially grown on an AlN/*a*-sapphire (0001) template. In the AlN template, TDs with ***c***-component, or ***c***-type and/or (***a*** + ***c***)-type, are annihilated so that most of the TDs remaining in the upper region of the AlN template are of ***a***-type. In an $Al_xGa_{1-x}N$ (x = 0) layer grown on the AlN template, pairs of the TDs are annihilated very quickly at or just above the hetero-interface of GaN/AlN. In the case of $Al_xGa_{1-x}N$ (x = 0.27, 0.61), TDs penetrate into the $Al_xGa_{1-x}N$ layer and some of these are arranged to be tied-up in the region several hundreds nm from the hetero-interface. The height of the region where TDs are arranged and the number of surviving TDs increase with the Al content x. These phenomena show that the TDs are annihilated by stress due to lattice mismatch between $Al_xGa_{1-x}N$ and AlN.

Improved optical properties using self-organized GaN nanotip structure, Hiroki YAMAJI, Yusuke TERADA, Harumasa YOSHIDA, Hideto MIYAKE, and Kazumasa HIRAMATSU: Phys. Stat. Sol. (c), 0, pp. 2566-2569, 2003.

A self-organized GaN nanotip structure, which was a nanoscale tip-shaped pillar, was fabricated on a GaNsurface by reactive ion etching (RIE) using chlorine plasma. The nanotip structure with periods smaller than the wavelength of light can provide antireflection and enhanced transmission effects from the ultraviolet (UV) to the visible region (300 nm - 900 nm). We have found that the height and the density of the nanotip structure can be controlled from 0.1 μm to 2.0 μm and from 10^9 cm^{-2} to 10^{11} cm^{-2} by changing etching conditions, respectively. The nanotip structure with controlled height and density exhibited the drastic improvement of the transmission property in the UV region compared with what is conventionally fabricated. These excellent optical properties of the nanotip structure are expected to improve the performances of light-emitting and photo-detective devices.

Spatially resolved cathodoluminescence study of selected-area ELO-GaN grown on Si(111) substrates, Hiroyuki NAOI, Mitsuhisa NARUKAWA, Hideto MIYAKE, and Kazumasa HIRAMATSU: Mat. Phys. Stat. Sol. (c), 0, pp. 2644-2649, 2003.

Crack-free thick (>10 μm) GaN layers that were grown on Si(111) substrates using selected-area epitaxial lateral overgrowth (ELO) method were investigated by spatially resolved cathodoluminescence microscopy at 15 K. ELO-mask materials employed in this study are SiO2 deposited by sputtering and SiNX formed by nitriding Si-surface areas (grooves) between GaN seeds. Local CL spectra near the GaN surface exhibited sharp excitonic luminescence with FWHM of 4.3 meV for the layers grown on a SiO_2- masked Si substrate. The intensity of the sharp excitonic luminescence continued to increase, without any observable saturation, as the sampling position approaches to the surface. It is experimentally proven that thick high-quality GaN without cracks can be grown on Si(111).

Antireflection structure of self-organized GaN nanotips, Harumasa YOSHIDA, Yuusuke Terada, Hideto MIYAKE and Kazumasa HIRAMATSU: Proc. 2002 COMMAD, pp.79-82, 2003.

Self-organized GaN nanotips, which were nanoscale tip-shaped pillar structure, were fabricated by reactive ion etching using chlorine plasma. It has been found that the structure has a two-dimensional isotropic distribution with broadband periodicity of subwavelength from the ultraviolet (UV) to the visible (VIS) region periodicity of 96 nm and a height of approximately 200 nm on the GaN surface. The reflectance of the nanotip surface was significantly suppressed to less than 0.01 compared with 0.3 of the smooth surface in UV region. The transmittance was also improved approximately 12% at lower wavelength than the band edge (~365 nm). We have found that the nanotip surface provides antireflection and enhanced transmission effects from the UV to the VIS region (300 nm – 900 nm). These excellent antireflective-properties of self-organized GaN nanotips are expected to improve the performance of light-emitting and photo-detective devices.

Self-organized GaN nanotips for cold cathode application, Yuusuke Terada, Harumasa YOSHIDA, Hideto MIYAKE and Kazumasa HIRAMATSU: Proc. 2002 COMMAD, pp.103-106, 2003.

We investigated self-organized GaN nanotips for the cold cathode application, which was fabricated by reactive ion etching (RIE). The density of the nanotips fabricated by RIE was approximately $2 \times 10^{10} cm^{-2}$. Its height was approximately 200 nm. It is observed that the distribution of the nanotips fabricated on Epitaxial lateral over growth (ELO) GaN is uniform in spite of window and mask region on ELO GaN surface. This fact supports that the formation mechanism of nanotips is attributed to a masking effect of nanometer-scale SiO_2 masks not to the threading dislocations in the GaN layer. Field emission from the GaN nanotips was observed. The current *I* was 1 ? A at 900 V. The field enhancement factor *bd*, which is related to the top structure of the emitter and is the product of the field conversion factor *b* and the sample-anode gap *d*, was estimated to be 460 from the Fowler-Nordheim (F-N) plot.

Responsivity and Electrical Characteristics of GaN Based Schottky Barrier UV Detectors with Transparent Electrode in the Near UV and VUV Region, Atsushi MOTOGAITO, Keiichi OHTA, Hironobu WATANABE, Kazumasa HIRAMATSU,Youichiro OHUCHI*, Kazuyuki TADATOMO*, Yutaka HAMAMURA* and Kazutoshi FUKUI*: Proc. 2002 COMMAD, pp.107-110, 2003.

Responsivity spectra and electrical characteristics of GaN based Schottky type ultraviolet (UV) photodetectors with transparent electrode from the near UV region to the vacuum ultraviolet (VUV) region (3.4-25 eV) are described. In order to improve device performance in applying reverse bias, the annealed transparent Schottky electrode in N_2 ambient is used. The dark current of samp les after annealing Schottky electrode is reduced by hundredth part of that of samples before annealing Schottky electrode. The responsivity spectra with reverse bias are improved by annealing Schottky electrode.

Hydride Vapor Phase Epitaxy, Thick epitaxially laterally overgrown GaN by hydride vapor phase epitaxy, Kazumasa HIRAMATSU: Vacuum Science and Technology: Nitrides as seen by the Technology 2002" RESEARCH SIGNPOST, pp.125-145, 2003.

HVPE has again been attracting much attention as a superior method for preparing thick GaN layers which can be used as substrates. HVPE-grown films also have among the best electrical and optical properties. In addition, epitaxial lateral overgrowth (ELO) has lately attracted considerable attention, since ELO is a useful technique to obtain epitaxial layers with low dislocation density on heteroepitaxy systems. In this review, it is described that the reaction process for HVPE GaN, the growth of thick GaN films, the electrical and optical characteristics of the grown films, and studies for obtaining high quality GaN layer using the ELO technique by HVPE.

Energy distributions of field emitted electrons from a multi-wall carbon nanotube, A. TAKAKURA*, K. HATA, Y. SAITO*, K. MATSUDA*, T. KONA*, C. OOSHIMA*: Ultramicroscopy, 95, pp.139-143, 2003.

Field emission energy distributions of electrons from one of the six pentagons located at the end of a multi-wall carbon nanotube have been measured by means of a high-resolution cylindrical energy analyzer. In a clean pentagon, the sub-peak was obtained at about 500meV below the main peak, exhibiting a shift with increasing applied voltage. For electrons emitted from an adsorbate onto the pentagon, no fine structure was observed in the spectra. The broadening of the leading edge was also observed for both clean and adsorbed pentagon, indicating the field penetration into the nanotube due to its semimetallic nature. The full-width at half-maximum was 280 meV at the applied voltage of 660 V and increased linearly with applied voltage.

Field emission from multiwall carbon nanotubes in controlled ambient gases, H_2, CO, N_2 and O_2, Koichi HATA, Akihiro TAKAKURA*, Ya hachi SAITO*: Ultramicroscopy, 95, pp.107-112, 2003.

Adsorption and desorption on clean pentagons at a tip of multiwall carbon nanotube (MWNT) have been investigated by field emission microscopy (FEM) in an atmosphere of various gases, i.e., hydrogen, carbon monoxide, nitrogen and oxygen. A MWNT with clean surface which is obtained by heat treatment gives FEM patterns consisting of six bright pentagonal rings. Adsorbates are recognized as bright spots in the FEM pattern. They reside preferentially on the pentagonal sites where the strong electric field is concentrated, and bring about stepwise increase in the emission current. Heat treatment of the MWNT emitter at about 1300 K allows adsorbates to desorb. After the desorption of hydrogen and nitrogen, the original clean surface with pentagons is recovered, while the tip structure is destroyed after the desorption of carbon monoxide and oxygen.

Energy Spectra of Field Emission Electrons from Multiwalled Carbon Nanotubes, C. OOSHIMA*, K. MATSUDA*, T. KONA*, Y. MOGAMI*, T. YAMASHITA*, Y. SAITO*, K. HATA, A. TAKAKURA*: J. Vac. Sci. Technol., B21, pp.1700-1704, 2003

We have measured energy spectra of field emission (FE) electrons from multiwalled carbon nanotubes in various conditions such as a tip temperature, electric fields, the emission direction, and adsorption. The observed spectra indicated that peak near E_F originated from the FE electrons from the inner walls, while FE electrons forming the shoulder changed from one specimen to the others: no spectra were the same as the others. The Fermi level of the surface wall is different from that of the inner walls under the FE condition.

Vertically aligned carbon nanotubes grown by plasma enhanced chemical vapor deposition Hideki SATO, Hitoshi TAKEGAWA*, Yahachi SAITO*: J. Vac. Sci. Technol., B 21 pp.2564-2568, 2003

Plasma enhanced chemical vapor deposition, which enables growth of carbon nanotubes directly onto substrates, is potentially suitable for preparing carbon nanotubes as electron sources in field emission displays.,In this article, we report the growth of aligned carbon nanotubes by microwave plasma enhanced chemical vapor deposition and investigate the effect of various parameters on the growth. Comparison among three catalysts (Fe, Co, and Ni) revealed that Fe gives the longest carbon nanotubes, while Co gives the carbon nanotubes with the smallest diameter. The growth of the carbon nanotubes strongly depends on the treatment time in the plasma. Field emission characteristics from the carbon nanotubes grown by the microwave plasma enhanced chemical vapor deposition are also shown.

Magnetic properties of carbon nanotubes grown on Fe catalyst layer by microwave plasma enhanced chemical vapor deposition Yuji FUJIWARA, Hitoshi TAKEGAWA*, Hideki SATO, Koji MAEDA, Yahachi SAITO*, Tadashi KOBAYASHI, Shigeru SHIOMI: J. Appl. Phys., 95, pp.7118-7120, 2004

The magnetic properties of carbon nanotube films grown on an Fe catalyst layer were investigated. The easy magnetization direction of the nanotube films was perpendicular to the film plane when the growth time was more than 2 min. In these films, conical Fe catalyst particles could be found at the tips of the nanotubes. The origin of the perpendicular magnetic anisotropy of these films was considered to be due to the anisotropic shape of the conical Fe catalyst particles at the tips. A large perpendicular coercivity of about 1 kOe was obtained in a nanotube film grown for 10 min.

Percolation Phenomena and Critical Exponent of Dielectric Breakdown Strength of Carbon Black-Polyethylene Composites, Tetsuya Tomimura, Tetsushi Okamoto*, Shuhei Nakamura and Akinori Ohshita: IEEJ Trans. FM, Vol. 123, No. 1, pp. 76-82(2003-1)

This paper addresses the critical exponent of dielectric breakdown strength of composites made with carbon black and polyethylene below the percolation threshold for the first time. At first place, the percolation threshold p_c is determined based on the critical exponents of resistivity and relative permittivity of the composites. Dielectric breakdown strength E_B of the composites below p_c is measured by using an impulse voltage in the range of 10 kV to 40 kV in order to avoid the effect of joule heating. Although the observed data of E_B seem to be well fitted to the straight line with the slope of 0.9 on a double logarithm of (p_c-p) and E_B, a method of least squares gives the slopes of 0.72 ± 0.12 and 0.96 ± 0.05 for the composites made with BP2000 and Asahi-Thermal, respectively. It has been found that finite carbon black clusters play an important role in the dielectric breakdown of the composites.

Relative Permittivity and Conductivity of Water-treed Region in XLPE Estimated by an Equivalent Circuit, Tamon Ozaki, Noriyuki Ito, Jiro Kawai* and Shuhei Nakamura: IEEJ Trans. FM, Vol. 123, No. 5, pp. 506-512(2003-6)

By dividing a water-treed XLPE sheet sample of 1 mm thickness into a non-degraded region and a water-treed one, relative permittivity e_{r2}' and ac conductivity s_{AC2} of the water-treed region have been estimated using an equivalent circuit. The way of changes of e_{r2}' and s_{AC2} with the length r of the water-treed region has been discussed based on the Sillars model. It has been concluded that the volume fraction of water in the water-treed layer is in the range of 0.5 % to 1.5 % for the most-degraded XLPE sheet, which depends on the ratio of axes of spheroids to which water-filled voids and channels are compared. It is also concluded that ac conductivity of water in the water-treed region is in the range of 3×10^{-3} S/m to 2×10^{-2} S/m.

Ac Loss Current of a Penetrated Water-Treed XLPE, Tamon Ozaki, Shuhei Nakamura and Jiro Kawai*: Int. Conf. on Properties and Applications of Dielectric Materials, pp.443-446(2003-6)

A model, by which why ac charging current of water-treed insulation contains higher harmonics is explained, has been developed by the authors. The aim of this paper is to discuss the ac loss current of a penetrated water-treed XLPE by using the model because the sample without a healthy region more directly tells us the dynamic behavior of interconnecting channels between water-filled voids. It has been found that the conductive region where channels are filled with water from voids grows under voltage application and the length of it reaches the whole penetrated water-treed region.

Electrically Conductive Composites Made with TPE and Graphite, Shuhei Nakamura, Tetsuya Tomimura, Kenichiro Sanji, Mitsuhiro Hishida and Yoshio Hayakawa: Int. Conf. on Properties and Applications of Dielectric Materials, pp.794-797(2003-6)

It has been requited to replace a thermosetting polymer used for the separator in a proton exchange membrane fuel cell (PEMFC) with a thermoplastic elastomer fro m the point of view of cost and size down. The separator used in the PEMFC is requited to have low resistivity, low hydrogen permeability and resistance to acid liquids. This paper addresses resistivity, results obtained by the Hall measurement, mechanical strength and hydrogen permeability of the composites made with a thermoplastic elastomer and graphite. It was found that the composites made with the thermoplastic elastomer and a graphite show a resistivity less than 20 mO and low hydrogen permeability, which means that the composite is one of a promising candidate for the separator of PEMFC.

Critical Exponent of Dielectric Breakdown Strength of Composites Made with Polyethylene and Fillers, Tetsuya Tomimura, Naoki Tanimoto, Mitsuhiro Hishida, Shuhei Nakamura and Tetsuhi Okamoto*: Int. Conf. on Properties and Applications of Dielectric Materials, pp.966-969(2003-6)

Electrical properties at high electric fields of composites have not been investigated based on the percolation theory in depth. Works on numerical modeling of dielectric breakdown have been done for a random resistor-capacitor network. The aim of this paper is to discuss the dielectric breakdown phenomena of the composites made with polyethylene and fillers such as carbon black, Fe_3O_4 and SiC. It has been found that the dielectric breakdown strength of the composites is described by a function of a power law of the distance from the volume fraction of filler to the percolation threshold with the critical exponent of 0.9.

Properties of High-Thermal Conductive Composite with Two Kinds of Fillers, Tetsuhi Okamoto*, Fumio Sawa*, Tetsuya Tomimura, Naoki Tanimoto, Mitsuhiro Hishida and Shuhei Nakamura: Int. Conf. on Properties and Applications of Dielectric Materials, pp.1142-1145(2003-6)

Thermal conductive composites made with several types of filler have been studied based on the electrical and mechanical properties. It is clarified that the thermal conductivity of the composite made with a boron nitride increases by further introducing carbon black into the matrix resin.

Surface Migration is a Crucial Factor for Growth of a-c Oriented YBCO Thin Films, Tamio ENDO, Hideaki KOHMOTO, Shin-ichi IWASAKI, Masaomi MATSUO, Masahito MATSUI, Yasushi KUROSAKI, Hitoshi NAKANISHI* and Kazuhisa NIWANO* : Proceeding of JSPS-DST (India) Asia Academic Seminar 2001, (Hyderabad), pp.205-223, 2003.

In order to clarify mechanisms of a-c orientation growth of $YBa_2Cu_3O_X$ thin films, the films were deposited on MgO by ion beam sputtering employing various deposition parameters. The "surface migration" model is proposed by the results. At lower substrate temperatures (T_S), the a-phase growth is dominated. With increasing T_S, the c-phase ratio increases due to larger thermal surface migration. The a-phase growth is enhanced by the plasma. The a-phase ratio increases while the c-phase ratio decreases with increasing oxygen partial pressure P_O. This can be interpreted by sputtered particles kinetic energy assisted surface migration. The plasma has larger collision cross section, then the particle energy is reduced, resulting in the enhancement of a-phase growth. The proposal of surface migration mechanism can be supported by three additional experiments. The growth of a-phase is enhanced by increases in (1) "film" surface roughness, (2) "substrate" surface roughness based on "polishing" and (3) "substrate" surface roughness due to "plasma exposure". This is because the surface migration is suppressed by larger surface barrier.

Fabrication of LBMO Films and Magnetic Properties at Low Temperatures, Kouji YOSHII, Sin-ichi IWASAKI, Masaki TADA, Gufran AHMAD, Jose COLINO* and Tamio ENDO : Physica B 329-333, pp.791-793, 2003.

Thin films of LBMO are prepared with a supply of oxygen molecules or plasma at various partial pressures. Magnetic properties of the films are investigated by measuring the magnetic susceptibility and the resistivity, and by ferromagnetic resonance. The film shows a Curie transition at 174 K and a metal-insulator transition at 84.2 K. Magnetic homogeneity is studied in relation to the preparation condition.

Temperature Dependence of FMR of La-Ba-Mn-O Thin Films, Shin-ichi IWASAKI, Masaki TADA, Jiro YAMADA, Youichiro INAMORI, Josep NOGUES* and Tamio ENDO : Physica B 329-333, pp.794-796, 2003.

Ferromagnetic resonance is studied on as-grown and annealed LBMO thin films deposited by ion beam sputtering. The as-grown film is extremely magnetically homogenious in the temperature range of 100-140 K.Even in other temperature range, the homogeneity can be improved by the annealing except for this temperature range.

Microwave Absorption Spectrum and Reentrant Phase in Bi2212 Single Crystal: Microwave Power Dependence, Gufran AHMAD, Akinori HASHIZUME, Shin-ichi IWASAKI, Kouji YOSHII, B. J. REDDY, M. SHAHABUDDIN*, S. UTHAYAKUMAR, R. JAYAVEL* and Tamio ENDO : Physica C 388-389, pp.687-688, 2003.

Microwave power (Pm) dependence of microwave absorption (MA) was investigated on Bi2212 crystals at liquid nitrogen temperature. At low Pm of 0.1 mW, MA spectrum shows only a sharp first peak near zero magnetic fields, which correspond to Meissner phase. MA spectrum shows a dip and broad second peak when Pm is increased. Sample temperature rise is estimated.

Oxygen Partial Pressure Dependences of a-c Phase Ratio, Crystallinity, Surface Roughness and In-plane Orientation in YBCO Thin Film Deposition by IBS, Tamio ENDO, Kouji YOSHII, Shin-ichi IWASAKI, Hideaki KOHMOTO, Hiroshi SARATANI, Shigeru SHIOMI, Masahito MATSUI, Yasushi KUROSAKI : Supercond. Sci. Technol. 16, p.110-119, 2003.

YBCO thin films were deposited by ion beam sputtering at various conditions. The growth mechanism of a- and c-oriented phases are clarified by their oxygen partial pressure dependence. Surface migration is a crucial factor. The crystallinity, surface roughness and in-plane orientation of the films can be controlled.

Growth of Bi2Sr2Ca(Cu1-xMnx)2O8 Bulk Textured Crystals by IHFZ Technique, S. UTHAYAKUMAR, E. SRINIVASAN*, R. JAYAVEL*, C. SUBRAMANIAN* and Tamio ENDO : Physica C 392-396, pp.463-467, 2003.

Bulk textured crystals of Bi2Sr2Ca(Cu1-xMnx)2O8 have been grown by immersed heater floating zone technique. The crystal size is influenced by Mn doping and for higher doping concentration the growth interface becomes narrow and no melt flow is observed.

Growth of LBMO Thin Films by Ion Beam Sputtering – Crystallinity and Ferromagnetic Resonance, Shin-ichi IWASAKI, Kouji YOSHII, Michi OGATA, Saji AUGUSTINE* and Tamio ENDO : Trans. Mat. Res. Soc. Jpn 28-4, pp.1117-1120, 2003.

The LBMO thin films were deposited by ion beam sputtering on MgO and LAO at 700 and 750℃ with oxygen molecular and plasma supply under various oxygen partial pressures. The intragrain and intergrain crystallinities, and the surface roughness of deposited films at 700℃ are investigated.

Preparation of Perovskite Bi-Sr-Ca-Cu-O Thin Films by Ion Beam Sputtering: Effects of Oxygen Molecules and Plasma, S. UTHAYAKUMAR, Shin-ichi IWASAKI, Kouji YOSHII, Ahmad GUFRAN, R. DHANASEKARAN and Tamio ENDO : Trans. Mat. Res. Soc. Jpn 28-4, pp.1121-1124, 2003.

Ca-doped and nondoped Bi2201 thin films were grown at low temperatures by ion beam sputtring with supplying oxygen molecule or plasma at various partial pressures. Crystallinity of the Ca-doped film is improved by the plasma only in the low pressure regions while that of the nondoped films is improved by the molecule in the whole region of pressure.

Depositions of YBCO Thin Films by Ion Beam Sputtering: a-c Orientations, Crystallinities and In-plane Orientations, Kouji YOSHII, Shin-ichi IWASAKI, Takahisa SAKURADA and Tamio ENDO : Trans. Mat. Res. Soc. Jpn 28-4, pp.1125-1128, 2003.

YBCO thin films were grown on MgO by ion beam sputtering at various substrate temperatures and oxygen partial pressures with a supply of either oxygen molecules or plasma. At low pressures single c-axis oriented phase can be grown at 650℃ and the c-phase decreases while the a-axis oriented phase increases with increasing pressure.

Variations of Lattice Parameters of YBCO and YBCO/LBMO Nano-Composite Thin Films Deposited by IBS Method, Kouji YOSHII, Takahisa SAKURADA, R. DHANASEKARAN and Tamio ENDO : Proc. 10th Int. Conf. on Composites/Nano Engineering (New Orleans) pp.795-796, 2003.

YBCO and YBCO/LBMO composite thin films were deposited on MgO and LaAlO3 substrates by ion beam sputtering technique at different deposition conditions such as substrate temperature, supply of oxygen molecule or plasma, and oxygen partial pressure. The lattice parameters of films have been investigated as functions of these contitions.

LBMO Thin Film Fabrication and Nano Double structures, and Microwave Magnetic Properties, Tamio ENDO, Kouji YOSHII, Michi OGATA, Takahisa SAKURADA, Josep NOGUES* and Jose COLINO* : Proc. 10th Int. Conf. on Composites/Nano Engineering (New Orleans), pp.171-172, 2003.

The double layers of LBMO/YBCO are successfully fabricated by IBS at 600-700 C. The conversion of a- to c-phase of the underlying YBCO are caused during the high temperature LBMO deposition, but it can be suppressed using the pure a-phase YBCO. The crystallinity of the overlying LBMO has the strong correlation with that of the underlying YBCO layer after the second deposition.

Synthesis, Growth and characterization of Lead Molybdate and Lead Tungustate Single Crystals, R. DHANASEKARAN, G. MADESWARAN*, P. RAMASAMY* and Tamio ENDO : Proc. 10th Int. Conf. on Composites/Nano Engineering (New Orleans), pp.145-146, 2003.

Lead molybdate was synthesized by mixing stoichiometric ratio of starting oxide materials using solid-state reaction method. Lead tungstate synthesis was carried out using PbO and WO3. Crystal growth has been carried out by the Czochralski method using platinum crucible. The XRD patterns were compared with the standard data. The both spectra show the peaks corresponding to the lead molybdate. The crystalline spectrum has less noise than the synthesized spectrum.

Crystal Growth of Excellent Perovskite Oxide thin Films of LBMO by IBS, Tamio ENDO, Shin-ichi IWASAKI, Kouji YOSHII, A. GUFRAN, Michi OGATA, Takahisa SAKURADA, S. UTHAYAKUMAR : Proc. Ninth National Seminar on Crystal Growth, (Chennai), pp.2-3, 2003.

LBMO thin films were grown on YBCO thin films at various deposition conditions of substrate temperature and oxygen partial pressure. Good crystalline LBMO overlying layers could be grown on the YBCO underlying layers as well as on substrates.