

# 研究論文抄録

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## 物質生命理工学科

R. Saito, S. Naruse, K. Takano, K. Fukuda, A. Katoh, and Y. Inoue : “Unusual Temperature Dependence of Enantioselectivity in Asymmetric Reductions by Chiral NADH Models”, *Organic Letters*, Vol. 8, No. 10, pp.2067-2070, 2006. 6

邦文題目：キラルNADHモデルによる不斉還元におけるエナンチオ選択性に対する異常な温度依存性

Unusual stereoselectivity changes, i.e., enhancement and inversion of enantioselectivity with increasing temperature, were observed in the asymmetric reduction of methyl benzoylformate with chiral 1,4-dihydropyridines possessing amino acid residues as ligating chiral auxiliaries. The differential activation parameters,  $\Delta\Delta H^\ddagger_{S-R}$  and  $\Delta\Delta S^\ddagger_{S-R}$ , obtained from the Eyring plots demonstrate that the entropy term controls the enantiodifferentiating step, accounting for the observed unique temperature dependence.

Y. Adachi, J. Yoshida, Y. Kodera, A. Katoh, J. Takada, and H. Sakurai : “Bis(allixinato)oxovanadium (IV) Complex is a Potent Antidiabetic Agent: Studies on Structure-Activity Relationship for a Series of Hydroxypyron-Vanadium Complexes”, *Journal of Medicinal Chemistry*, Vol. 49, No. 11, pp.3251-3256, 2006.6

邦文題目：ビス（アリキシナト）オキソバナジウム(IV)錯体は有力な抗糖尿病剤である：一連のヒドロキシピロンバナジウム錯体における構造—活性相関

There is an urgent medical need for orally effective drugs to replace insulin injections for the treatment of diabetes mellitus. Vanadium complexes with insulin-mimetic activities have recently been proposed as candidates as new antidiabetic drugs. Following in vitro and in vivo studies on a group of bis(3-hydroxy-4-pyronato)oxovanadium(IV) (**1**) complexes with

VO(O<sub>4</sub>) coordination mode, bis(allixinato) oxovanadium(IV) (**3**) which contains allixin, a garlic component, was found to be the most potent antidiabetic agent among them. Complex **3** with a high in vitro insulin-mimetic activity in terms of both free fatty acid (FFA)-release inhibitory and glucose-uptake enhancing activities in isolated rat adipocytes exhibited a high hypoglycemic effect in type 1 diabetic model mice by both intraperitoneal injections and oral administrations. Complex **3** is thus proposed to be one of the most effective candidates for antidiabetic therapy.

H. Sakurai, A. Katoh, and Y. Yoshikawa : “Chemistry and Biochemistry of Insulin-Mimetic Vanadium and Zinc Complexes: Trial for Treatment of Diabetes Mellitus”, *Bulletin of the Chemical Society of Japan*, Vol. 79, No. 11, pp. 1645-1664, 2006.11

邦文題目：バナジウムとジンク錯体の化学及び生化学：糖尿病治療の試み

The number of patients suffering from diabetes mellitus (DM), which is a chronic metabolic disorder and mainly classified as either insulin-dependent type 1 or non-insulin-dependent type 2, is increasing throughout the world. Sequence of DM makes this disease a major health risk in regard to microvascular disease that leads to kidney failure, blindness, and nerve damage as well as macrovascular disease that leads to amputations, cardiovascular disease, and stroke. To treat DM, several types of insulin preparations and synthetic drugs for type 1 and type 2 DM, respectively, are in clinical use. However, there are several problems concerning the insulin preparations and synthetic drugs, such as physical and mental pain due to daily insulin injections

and defects involving several side effects, respectively. Thus the disease demands extraordinary effects to define pathobiochemical pathways and strategies for prevention and to find new therapeutic approaches. For this purpose, oxovanadium(IV) (vanadyl,  $\text{VO}^{2+}$ ) and zinc(II) containing complexes are anticipated to treat both types of DM. This article reviews the current state of research on insulin mimetic and antidiabetic metal complexes, with special focus on the paramagnetic vanadyl and diamagnetic zinc(II) complexes with different coordination modes, together with the possible action mechanisms. New drug delivery systems involving enteric-coated capsulation and a biopolymer are also reviewed.

K. Aimoto, S. Aoyagi, N. Kato, N. Iida, A. Yamamoto, M. Kudo, : "Evaluation of secondary ion yield enhancement from polymer material by using TOF-SIMS equipped with a gold cluster ion source" Appl. Surface Scie., pp.6547-6549, 2006.4

邦文題目：金クラスターイオン源を備えたTOF-SIMSを用いたポリマーからの二次イオン収率増大効果の評価

We investigated the enhancement of the secondary ion intensity in the TOF-SIMS spectra obtained by  $\text{Au}^+$  and  $\text{Au}_3^+$  bombardment in comparison with  $\text{Ga}^+$  excitation using polymer samples with different molecular weight distributions. Since the polymer samples used in this experiment have a wide molecular weight distribution, the advantages of the gold cluster primary ion source over monoatomic ion could accurately be evaluated. It was observed that the degree of fragmentation decreased by the usage of cluster primary ion beam compared with monoatomic ion beam, which was observed as a shift of the intensity distribution in the spectra. It was also found out that the mass effect of  $\text{Au}^+$  and  $\text{Ga}^+$  as monoatomic primary ion, resulted in about 10 to 60 times of enhancement for both samples with different molecular distributions. On the other hand, the  $\text{Au}_3^+$  bombardment caused intensity enhancement about 100 to 2600 compared with  $\text{Ga}^+$  bombardment, depending on the mass range of the detected secondary ion species. The cluster

primary ion effect of  $\text{Au}_3^+$ , compared with  $\text{Au}^+$ , therefore, was estimated to be about 10 to 45.

濱野裕之・小島紀徳・河原崎里子・高橋伸英・田原聖隆・田内裕之・江頭靖幸・齊藤昌宏・安部征雄・山田興一：「乾燥地における焼成ボーキサイトの土壌改良としての利用」, 沙漠研究, 16-1, pp.31-38, 2006. 6

Three years' field test of *Casuarina obesa* planting was conducted to test the possibility of use of calcined bauxite, available in large quantities and at relatively low cost, as soil conditioner for the afforestation in arid land of Western Australia. The effect of utilization of calcined bauxite was evaluated from the changes in water content in soil and average tree height, biomass after three years and eye observation of root system. Four soil conditions were tested : natural soil, 5cm top gravel followed by 20 cm calcined bauxite, 5cm top gravel followed by 20 cm 10% calcined bauxite mixed with natural soil, and 25cm gravel layer. As the result, the following conclusions were obtained.

- (1) The survival rates of the trees with and without soil modification were 100% and 80%, respectively, though some effects of damage by Kangaroo exist.
- (2) The tree growth data under the various soil conditions were Bauxite only > Gravel only > 10% bauxite layer > natural soil.
- (3) The intermittent rainfall of about 10-20mm was more effective to the soil moistures increment and tree growth than concentrated rainfall over 40mm.
- (4) The biomass increase after the three years' growth with soil modification was found to be larger than that without soil modification.
- (5) The improvement of water retention capacity with bauxite was suggested by the averaged tree growth data and eye observation, though the statistic analyses could not show clear difference between the cases with gravel and with bauxite.

N. Saikia, S. Kato, T. Kojima : "Behavior of B, Cr, Se, As, Pb, Cd, and Mo Present in Waste Leachates Gen-

erated from Combustion Residues During the Formation of Ettringite”, Environmental Toxicology and Chemistry, Vol. 25(7), pp.1710-1719, 2006. 7

邦文題目：焼却残渣から生じる浸出水中に存在するB, Cr, Se, As, Pb, Cd および Moのエトリンガイト形成時の挙動

The behavior of B, Cr, Se, As, Pb, Cd, and Mo in the leachates generated from two combustion residues, coal-fired power plant fly ash and municipal solid waste incineration ash, during precipitation of ettringite is presented. Experiments also were performed using modeled waste leachates as well as controlled solutions containing all the investigated elements. Moreover, to determine the possible effect of pH, lime treatment was conducted using the waste and modeled leachates. Results indicated the removal of B, Se, and Cr from the leachates because of incorporation of their oxyanions in the ettringite structure. The removal of B could further be explained by considering the structure of ettringite and monosulfoaluminate. The removal of Pb also occurred, probably because of lime-induced precipitation of  $Pb(OH)_2$ . Similarly, the removal of As was observed as a result of lime-induced precipitation of  $Ca_3(AsO_4)_2$  and incorporation into the ettringite structure. On the other hand, the precipitation of ettringite did not reduce the concentrations of Mo and Cd because of the complex nature of these elements in the leachates. The results also suggest that the presence of high amounts of constituents such as  $Cl_2$ , an alkali metal in the solution, also affected ettringite precipitation behavior. Moreover, elemental speciations as well as the presence of other constituents in the solution affected the incorporation by ettringite.

T. Matsumoto, T. Kojima : “Simulations of salt accumulation at soil surface under different annual precipitation amounts in arid Leonora area, Western Australia”, J. Arid Land Studies, 16-1, pp.53-59, 2006.

6

邦文題目：西オーストラリア・レオノラ地域での降雨量の違いによる土壌表層の塩濃度予測

Sequestration of  $CO_2$  is necessary for mitigating global warming and recently, large-scale afforestation in desert is focused on the need for  $CO_2$  fixation. We set up the research site for afforestation in Leonora area, Western Australia. *Eucalyptus camaldulensis* (*Eucalyptus* is abbreviated as *E.* in the following) has the highest carbon fixation ability in all trees of Leonora area, the amount of carbon fixation ability is about  $300kg \cdot Carbon/tree$  and the growth time of *E. camaldulensis* is about 20 years (Yamada *et al.*, 1999). Salt tolerance maximum of *E. camaldulensis* is about  $0.02 g/cm^3$  (Peter and Glen 1993). The water source of *E. camaldulensis* is also estimated to be groundwater in Leonora area. Soils around *E. camaldulensis* plantation, it is necessary to evaluate salt accumulation and water movements in soils for *E. camaldulensis* plantation. In this paper, relationship between the calculated time variation of salt concentration in soils and growth year of *E. camaldulensis* was reported. The salt concentration change in soils for one year to 100 years scales are discussed by changing of many precipitation patterns are also evaluated. The results of calculation indicated that time of salt concentration in soils until  $0.02 g/cm^3$  takes from 50 to 90 years. Thus, because it is said that the growth time of *E. camaldulensis* in Leonora area is about 20 years (Yamada *et al.*, 1999), it was cleared that salt accumulation problem against *E. camaldulensis* plantation would not occur for short period.

菅沼秀樹・長谷修平・安部征雄・田内裕之・小島紀徳・山田興一：「植生指数と植生分類を組み合わせた乾燥地林分バイオマス推定手法の有効性の検討」,日本リモートセンシング学会誌,26(2) 95-106,2006.4

As one of the activities for  $CO_2$  sequestration source by afforestation at the project level, a systematic afforestation method in an arid area has been proposed, and Australia was chosen as the research area. In Australia, a pioneering trial called the National Carbon Accounting System (NCAS) has already been established,

but most of the arid areas are left unmeasured using the NCAS. Therefore, the carbon sequestration estimation techniques based on the time change of forest inventory information has not been determined. Thus, in this research, the combination of vegetation classification using the decision tree method and the stand biomass estimation method utilizing vegetation indices was examined. These vegetation indices were described as mitigating influence of background soil reflection. The vegetation classification accuracy of this study was 77~90%. Strong correlations between the vegetation indices except MSAVI<sub>1</sub> and the stand biomass were observed even in this open canopy forest. Among the examined vegetation indices, MSAVI<sub>2</sub> and OSAVI were particularly considered to have sufficient accuracy and robustness for stand biomass estimation and considered to be applicable to other arid land vegetation. However, from the result of this study, the accuracy of stand biomass estimation with vegetation classification resulted in lower than that without classification. If the vegetation classification accuracy is not sufficiently high, the stand biomass estimation utilizing satellite imagery, which has low spatial resolution and has low spectral resolution, was considered to be handled with as simple process as possible

堀 雅文・田野中 新・若林 洋・小島紀徳：「用水中に含まれるダム排砂土の水稻生育への影響」農業土木学会論文集 74 (5) 通巻245号 683-689, 2006.10

黒部川出し平ダムからの排砂により、ダム湖に堆積した土砂が黒部川に排出される。この土砂が用水に混ざり、圃場に流入した場合の水稻の生育に与える影響を検討するため、黒部川扇状地内の圃場で実験を行った。出し平ダムから採取した土砂を、圃場に設置した試験区に散布し、水稻の生育、収量等を調査した。1993年度は、苗の活着期及び穂ばらみ期への影響を調査するため、5月及び8月に土砂を散布した。1994年度は、活着期への影響を再度調査するため、5月に土砂を散布した。1993年度の実験では、活着期に散布した場合は、茎数には土砂散布の影響はあったが、収量については影響が見られな

かった。穂ばらみ期に散布した場合では草丈、茎数、収量のいずれにも影響はなかった。また、1994年度の実験では、圃場に流入する用水の土砂濃度が10,000mg/l以下であれば、生育状況、水稻の養分、跡地土壌の化学特性、収量のいずれについても影響のないことが明らかになった。

H. Liu, C. Luo, S. Kato, S. Uemiya, M. Kaneko and T. Kojima : "Kinetics of CO<sub>2</sub>/Char Gasification at Elevated Temperatures. Part I : Experimental Results", Fuel Processing Technology, 87, pp.775-781, 2006.10  
邦文題目：高温条件下でのCO<sub>2</sub>/チャーガス化速度：第一部，実験結果

The gasification kinetics of char has so far been mainly studied based on data measured at low temperatures and low heating rates with a thermo-gravimetric analyzer. The results cannot be directly applied to high temperature gasifiers such as entrained flow gasifiers. In this work, gasification of seven types of chars in CO<sub>2</sub> at elevated temperatures and high heating rates was investigated with a uniquely made fluidized bed. It was found that the reaction rates for various chars were very different in low and high temperature ranges, and two orders of magnitude more pronounced in the lower temperature range. From 1273 K to 1673 K, all chars demonstrated a strong tendency to increase reaction rate with temperature. However, at a high temperature range (1773 to 1873 K), different chars demonstrated different temperature dependences. The seven types of chars studied can be roughly separated into three groups based on ash fusion temperature. Each group demonstrated a different temperature dependence at a high temperature range. For chars with low ash fusion temperatures, the reaction rate leveled off, or even decreased a little as temperature increased, which was presumed to be because of the ash fusion at elevated temperatures. These results suggest that a high temperature does not necessarily raise the gasification rate.

H. Liu, C. Luo, M. Toyota, S. Uemiya and T. Kojima: "Kinetics of CO<sub>2</sub>/Char Gasification at Elevated Tem-

peratures. Part II : Clarification of Mechanism through Modeling and Char Characterization”, Fuel Processing Technology, 87, pp. 769-774, 2006.10

邦文題目：高温条件下でのCO<sub>2</sub>/チャーガス化速度：第二部，モデル化とチャーのキャラクタリゼーションによる機構解明実験結果

Char gasification experiments in a batch fluidized bed reactor at high temperatures revealed that for chars with low ash fusion temperatures, the reaction rate levelled off or even decreased a little as temperature increased. The mechanism was studied through modelling and char characterization. Investigation through modelling revealed that the increase in external mass transfer resistance with temperature was not the main factor accounting for the leveling off or decrease of gasification rate of a char at elevated temperatures. At high temperatures, the porosity and specific surface area increased with pyrolysis temperature for a char with a high ash fusion temperature, but decreased for a char with a low ash fusion temperature. For a char with a low ash fusion temperature, the surface became smooth and ash accumulation near the char surface was apparent after pyrolysis at an elevated temperature. However, for a char with a high ash fusion temperature, its surface became porous and no ash accumulation occurred after pyrolysis at an elevated temperature. According to the results of this work, ash fusion and ash accumulation near the char surface were very likely the main factors accounting for the leveling off, or decrease, of gasification rate at elevated temperatures.

N. Saikia, S. Kato and T. Kojima : “Production of cement clinkers from municipal solid waste incineration (NSWI) fly ash”, Waste Management, 27 (2007)1178-1189, 2007. 3

doi:10.1016/j.wasman.2006.06.004(online available 22 Aug. 2006)

邦文題目：都市ゴミ焼却灰からのセメントクリンカーの製造

This communication reports the laboratory scale study on the production of cement clinkers from two types of municipal solid waste incinera-

tion fly ash (MSW ash) samples. XRD technique was used to monitor the phase formation during the burning of the raw mixes. The amount of trace elements volatilized during clinkerization and hydration, as well as leaching behaviours of the clinkers obtained from optimum compositions, were also evaluated. From the results it is observed that all of the major components of ordinary Portland cement (OPC) clinkers are present in the produced clinkers. Results also show the volatilization of considerable amounts of Na, K, Pb, Zn and Cd during the production of clinkers. However, major parts of the toxic elements remaining in the clinkers appear to be immobilized in the clinkers phases. Hydration studies of the clinkers obtained from optimum compositions show that the clinkers prepared from raw MSW ash are more reactive than the washed MSW ash based clinkers. TG/DTA analyses of the hydrated pastes show the formation of hydration products, which are generally found in OPC and OPC derived cements. The initial study, therefore, shows that more than 44% of MSW ash with the addition of very small amounts of silica and iron oxide can be used to produce cement clinkers. The amount of CaCO<sub>3</sub> necessary to produce clinkers (approximately 50%) is also smaller than the same required for the conventional process (more than 70%).

P. S. Vijayanand, S. Kato and T. Kojima : “Synthesis and characterization of 3, 5-dimethoxyphenyl methacrylate and methyl methacrylate copolymers: determination of monomer reactivity ratios”, *J. Macromolecular Science-Pure Applied Chem.*, 44(3).pp 277-283, 2007.1

邦文題目：3, 5-dimethoxyphenyl methacrylateとmethyl methacrylateとの共重合体の合成とキャラクタリゼーション：モノマー活性比の決定

A new monomer, 3, 5-dimethoxyphenyl methacrylate (DMOPM) has been synthesized from the precursor viz., 3,5-dimethoxy phenol. Copolymerization of DMOPM with methyl methacrylate (MMA) has been carried out in ethyl methyl ketone (EMK) by free radical solu-

tion polymerization at 70+18C utilizing benzoyl peroxide (BPO) as initiator. Poly(DMOPM-co-MMA) copolymers were characterized by <sup>1</sup>H-NMR, <sup>13</sup>C-NMR, and the copolymer compositions were evaluated by <sup>1</sup>H-NMR spectroscopy. The monomer reactivity ratios were estimated using Fineman-Ross, Kelen-Tudos and extended Kelen-Tudos methods. The solubility was tested in various polar and non polar solvents. The molecular weight and polydispersity indices of the copolymers were determined by using gel permeation chromatography. By TGA and DSC analyses, the thermal properties of the polymers have been studied.

K. Miura, D. Tsuda, Y. Kaneta, R. Harada, M. Ishikawa and N. Sasaki: "Dynamics of Graphite Flake on a Liquid", Applied Physics Letters, Vol.89, pp.2231041- 2231043, 2006.11

邦文題目：液体上のグラファイト薄膜の動力学

This is one of our nanomechanical studies from experimental standpoints of view. One-directional motion, where graphite flakes are driven by a nanotip on an octamethylcyclotetrasiloxane (OMCTS) liquid surface, is presented. A transition from quasi-periodic to chaotic motions occurs in the dynamics of a graphite flake when its velocity is increased. The dynamics of graphite flakes pulled by the nanotip on an OMCTS liquid surface can be treated as that of a nanobody on a liquid.

N. Sasaki, N. Itamura, D. Tsuda and K. Miura : "Nanomechanical Studies of Superlubricity", Current Nanoscience. Vol.3, pp. 105-115, 2007.2

邦文題目：超潤滑のナノ力学的研究

This is one of our nanomechanical studies from both experimental and theoretical standpoints of view. We briefly review the nanomechanical studies of ultralow friction in the following carbon hybrid systems: atomic force microscopy (AFM) tip on graphite surface, AFM tip on C60/graphite, graphite on graphite surface, graphite/C60/graphite, and C60 intercalated graphite. For the atomic and flake frictions, frictional force maps

are compared between simulations and experiments, which can be explained by stick-slip motion of the tip apex atom and flake. For the graphite/C60/graphite system, superlubricity appears, where the maximum static frictional forces have finite values but denote that dynamical frictional forces are zero within the resolution of the experiment. Furthermore, for the C60 intercalated graphite system, greater superlubricity appears. It is clarified that fullerene intercalated graphite films exhibit ultralow average friction force, and excellent friction coefficients. Our results propose one of the simple guidelines of designing a practical superlubric system - reduction of the contact area between intercalated C60 and graphite sheet to the point contact. Clearly, the C60 intercalated graphite system will contribute to solving energy and environmental problems in the future.

K. Shimizu, N. Kobayashi, A. Satsuma, T. Kojima, S. Satokawa : "Mechanistic study on adsorptive removal of *t*-butanethiol on Ag-Y zeolite under ambient conditions", J. Phys. Chem. B, 110, pp.22570-22567 (2006), 2006.10

邦文題目：常温常圧下でのAg-Yゼオライトによるターシャリーブタンチオール吸着除去機構

The dynamics and surface chemistry of *tert*-butanethiol (TBT) adsorptive removal over silver-exchanged Y zeolite (Ag-Y) were studied under ambient conditions. Saturation uptake on Ag-Y was higher than that on H-Y and Na-Y. The structural analyses by a combination of X-ray diffraction, Ag K-edge X-ray absorption near-edge structure (XANES)/extended X-ray absorption fine structures (EXAFS), Ag LIII-edge XANES, S K-edge XANES, and in situ UV-vis show that the AgSH molecule, Ag<sub>2</sub>S monomer, and Ag<sub>4</sub>S<sub>2</sub> cluster are the dominant silver species in TBT-saturated Ag-Y. Dynamic changes in adsorbed intermediates, gas-phase products, and the silver sulfides were followed by in situ FTIR, mass spectroscopy and in situ UV-vis, respectively. The results show the following reaction mechanism: (1) formation of *iso*-butene and adsorbed H<sub>2</sub>S on the Ag<sup>+</sup> site via

C-S cleavage of hydrogen-bonded TBT initially adsorbed on the  $\text{Ag}^+$  site; (2) conversion of the adsorbed  $\text{H}_2\text{S}$  to  $\text{AgSH}$  and  $\text{H}^+$  on zeolite; (3) the reaction of two  $\text{Ag-SH}$  species to yield  $\text{Ag}_2\text{S}$  and  $\text{H}^+$  on zeolite.

S. Satokawa, J. Shibata, K. Shimizu, A. Satsuma, T. Hattori, T. Kojima : “Promotion effect of hydrogen on lean  $\text{NO}_x$  reduction by hydrocarbons over  $\text{Ag}/\text{Al}_2\text{O}_3$  catalyst”, Chem. Eng. Sci., 62, pp.5335-5337 (2007), 2006.12

邦文題目: 銀アルミナ触媒上での炭化水素による $\text{NO}_x$ 還元反応における水素の反応促進効果

Addition of  $\text{H}_2$  in the lean exhausts significantly improves the  $\text{NO}_x$  reduction activities at low temperatures by hydrocarbons over  $\text{Ag}/\text{Al}_2\text{O}_3$  catalyst. This discovery “hydrogen effect” provides a novel approach to the design of SCR systems. We concluded that the catalytic activity is promoted by the reductive activation of  $\text{O}_2$  with  $\text{H}_2$  and the production of moderately agglomerated  $\text{Ag}_n^{\delta+}$  clusters on the catalyst surface. However, the other research groups concluded that the formation of  $\text{Ag}_n^{\delta+}$  cluster is not essential for the enhancement of the SCR activity and it is proposed that hydrogen itself participates directly in the reaction mechanism. Although the mechanism of the “hydrogen effect” is under debate, the oxidative activation of hydrocarbons is the key step to obtain high SCR activity at lower temperatures.

K. Shimizu, S. Komai, T. Kojima, S. Satokawa, A. Satsuma : “Mechanism of adsorptive removal of *tert*-butanethiol under ambient conditions with silver nitrate supported on silica and silica-alumina”, J. Phys. Chem. C, 111, pp.3480-3485 (2007), 2007.2

邦文題目: 常温常圧下でのシリカ及びシリカアルミナ担持硝酸銀によるターシャリーブタンチオール吸着除去機構

Vapor-phase adsorptive removal of *tert*-butanethiol (TBT) over silver nitrate supported on silica ( $\text{AgSi}$ ) and silica-alumina ( $\text{AgSiAl}$ ) is tested under ambient conditions. Saturation uptakes on  $\text{AgSi}$  and  $\text{AgSiAl}$  are close to that on  $\text{Ag}$ -exchanged Y

zeolite, which was shown to have high sulfur capacity in the literature. The structural analyses by XRD, TEM, Ag K-edge XANES/ EXAFS, and in situ UV-vis show that the reaction of  $\text{Ag}^+$  species on these samples with TBT yields  $\text{AgSH}$  species,  $\text{Ag}_2\text{S}$  monomer,  $\text{Ag}_4\text{S}_2$  cluster, and  $\text{Ag}_2\text{S}$  particles. Dynamic changes in adsorbed intermediates and the silver sulfides were followed by in situ FTIR and in situ UV-vis, and the following reaction mechanism is presented: (1) reaction of  $\text{Ag}^+$  with TBT to produce butenes and  $\text{AgSH}$  species; (2) reaction of the two  $\text{AgSH}$  to produce  $\text{Ag}_2\text{S}$  monomer and  $\text{H}_2\text{S}$ ; (3) aggregation of  $\text{Ag}_2\text{S}$  monomer to  $(\text{Ag}_2\text{S})_n$  clusters and  $\text{Ag}_2\text{S}$  particle.

里川重夫: 「銀イオン交換ゼオライトを用いた都市ガス常温吸着脱硫に関する研究」成蹊大学理工学研究報告, Vol.43, No.2, pp.11-14 (2006), 2006.12

燃料ガス中に微量含まれる硫黄化合物、ジメチルスルフィド (DMS) 及び *t*-ブチルメルカプタン (TBM), を常温で吸着除去できる脱硫剤を開発する目的で各種金属イオン交換ゼオライトの硫黄吸着性能の評価を行った。燃料ガス中に不純物の水分が含まれている場合、 $\text{Ag}$ イオン交換Y型ゼオライトの硫黄吸着容量が高く、 $\text{Ag}$ 量の増加と共に硫黄吸着容量も増加した。また、リーク硫黄濃度も0.1 ppm以下と低かった。硫黄化合物の吸着が進むにつれて白色から茶色へと色相変化が観察された。DMSは分子状で吸着されていると推測されたが、TBMは吸着後に分解反応が進行し、最終的には硫化銀様クラスターを形成して発色しているものと結論した。

K. Takizawa and Y. Yokota : “High Accuracy and High Sensitivity measurements of the Electrooptic Effect in Undoped and  $\text{MgO}$ -Doped  $\text{LiNbO}_3$  Crystals”, Opt. Rev., Vol. 13, No. 3, pp.161-167, 2006.5

邦文題目: ノンドープおよび $\text{MgO}$ ドープ $\text{LiNbO}_3$ 結晶の電気光学効果の高感度・高精度測定

Composite electrooptic (EO) coefficients  $r_c$  consisting of the EO coefficients  $r_{13}$ ,  $r_{33}$ , and the piezoelectric constant  $d_{31}$  in undoped and  $\text{MgO}$ -doped  $\text{LiNbO}_3$  (LN) crystals were measured by extracting the fundamental and the third harmonic components from photo-detection sig-



nals of the parallel Nicol optics including the LN crystal driven by minimal sinusoidal voltage. The analysis of relationship between multiple-reflection rays in the LN crystal and the accuracy of measurement indicates that anti-reflection films must be coated on the end faces of the crystal for highly accurate measurements. Measured values of  $r_e$  of undoped and MgO-doped LN crystals at a wavelength of 0.6328  $\mu\text{m}$  were  $19.8 \pm 0.1 \text{ pm/V}$  and  $19.2 \pm 0.1 \text{ pm/V}$ , respectively.

滝沢國治:「高分子分散液晶ライトバルブとシュリーレン光学系を用いた投射型3-Dディスプレイ:システム提案と基礎実験」成蹊大学理工学研究報告, Vol.43, No.1, pp.39-47, 2006.6.

偏光眼鏡を使用する投射型3-Dディスプレイが提案されている。このディスプレイは高分子分散型液晶ライトバルブ, 偏光ビームスプリッタおよびシュリーレン光学系からなり, 高分子分散液晶の光散乱特性を利用して, 高輝度・高コントラストな大面積3-D映像を表示するシステムである。このシステムは, 3-D画像を1台の投射装置で表示可能, 従来の装置の1/2のサイズ・重量, 画像の拡大縮小を自由にできる, など多くの特長を有している。高分子分散液晶素子を作製し, クロスニコル・シュリーレン光学系を用いてその電気光学特性明らかにするとともに, 薄膜トランジスタで駆動する新しい高分子分散液晶ライトバルブを提案している。

L. Jin, K. Yonekura and K. Takizawa: "Fast and Simultaneous Measurement of Both Birefringence and Azimuth Angle Using a y-Cut LiNbO<sub>3</sub> Phase Modulator", Jpn. J. Appl. Phys., Vol. 45, No. 6A, pp. 5244-5247, 2006.6.

邦文題目: YカットLiNbO<sub>3</sub>位相変調器による複屈折と方位角の高速・同時計測

A technique using a transverse phase modulator is proposed for fast and simultaneous measurement of both birefringence and azimuth angle of quartz and LiNbO<sub>3</sub> crystals. The measurement system consists of He-Ne laser as a light source, a polarizer and an analyzer, a y-cut z-propagation LiNbO<sub>3</sub> phase modulator, a quartz quarter-wave plate, a photo-detector and a signal processing

system including two lock-in amplifiers, a low-pass filter, a function generator, a high-power amplifier and a personal computer. Several experiments using rotating quarter-wave plate and LiNbO<sub>3</sub> crystal in presence of direct voltage have been performed, and the measurement results agree well with predicted theoretical data.

K. Takizawa, Y. Yoshida and N. Saito: "Design Consideration of a Television Camera Detecting Oil Slicks on the Sea", Opt. Rev., vol. 13, No. 5, pp.361-370, 2006.10.

邦文題目: 油膜検出用TVカメラの設計

We have proposed an oil-slick image detection television camera that extracts automatically the image of slicks floating on the surface of the sea. The system includes two optical wavelength filters (WFs), two charge coupled devices and a differential image circuit in which the output image signal is the absolute value of a difference signal between two input image signals. The operating principle is based on the fact that, due to the multiple-beam interference in the slick, there is a marked difference of intensity between light reflected from the surface of the sea and that from the slick. The probabilities to sense the slick in various conditions were calculated by use of two types of WF, i.e., a space-invariant WF and a space-variant WF and it was found that the latter was far superior to the former.

滝沢國治:「空間光変調素子とシュリーレン光学系を用いた立体投射型ディスプレイの解析」, 成蹊大学理工学研究報告, Vol. 43, No. 2, pp.39-47, 2006.12.

偏光眼鏡を使用する新しい3次元投射型ディスプレイの基本特性を解析した。このディスプレイは, 高分子分散液晶ライトバルブ, 偏光ビームスプリッタ, シュリーレン投射光学系などで構成され, 小型・コンパクトで画像の拡大縮小を自由にできるという特長をもつ。Muller行列を用いてこのディスプレイのクロストーク(右眼用画像が左眼に入る現象あるいはその逆の現象)および消光比(画面全体を白または黒にしたときの明るさの比)を解析し, このシステムのクロストークが従来の3-Dシステムより各段に少ないこと, および消光比が従来システムより

やや劣ることなどを明らかにした。

米倉和也・金 蓮花・滝沢國治：「多重反射干渉法の測定精度改善とLiNbO<sub>3</sub>結晶の電気光学係数 $r_{22}$ の測定」，成蹊大学理工学報告，Vol. 43, No. 2, pp.49-61, 2006.12.

測定試料内の多重反射光の干渉を利用して，試料の光学特性を測定する多重反射干渉法は，きわめて単純な光学系であるにも関わらず，従来のMichelson干渉計やMach-Zehnder干渉計などと比べても同等以上の測定性能を有している。しかし，この方法は試料の屈折率が大きくなると測定精度が低下するという課題を抱えていた。この論文では，干渉信号に含まれる基本波成分が最大になるように試料の静的位相と動的位相を調整し，屈折率に基づく系統誤差を解消する改善策が提案されている。この改善方法で数種類のLiNbO<sub>3</sub>結晶の電気光学係数 $r_{22}$ を測定し，波長632.8 nmにおいて $6.54 \pm 0.02$  pm/Vを得た。この値は従来の測定値ともよく一致し，改良された多重反射干渉法の有効性が確かめられた。

米倉和也・金 蓮花・滝沢國治：「反射干渉法の測定精度改善とLiNbO<sub>3</sub>結晶の電気光学係数 $r_{22}$ の測定」，信学会論文誌C，Vol. J.89-C, No. 12, pp.1124-1127, 2006.12.

電気光学結晶内の多重反射による干渉を利用して結晶の電気光学係数を測定する反射干渉法は，(1)測定光学系が非常にシンプル，(2)全ての電気光学係数を測定できる，(3)従来の干渉法に比べて誤差が少ない，など多くの特長を有している。しかし，高次反射光に起因する理論系統誤差をもつという課題を抱えていた。この論文ではこの誤差を最小にする新しい零位測定方法を提案し，応力一定状態のLiNbO<sub>3</sub>結晶の電気光学係数 $r_{22}$ を測定し，波長632.8 nmにおいて $6.54 \pm 0.02$  pm/Vを得た。この値は従来の測定値ともよく一致した。

Takeo Nakano and Shigeru Baba : “Gas Pressure Effects on Thickness Uniformity and Circumvented Deposition during Sputter Deposition Process”, Vacuum, Vol. 80 No. 7 pp. 647-649, 2006.5

邦文題目：スパッタ製膜プロセスにおける膜厚均一性・まわりこみ付着にガス圧力が及ぼす効果

In sputter deposition processes the thickness distribution of the film is affected by experimental conditions such as gas pressure, target-substrate (T-S) distance, and target elements.

To study these effects, we have designed a sample holder with 3 QCM thickness monitors on its surface and measured the distribution of the depositing flux around the sample holder, including the circumvented deposition onto the back face. As for the gas pressure dependence for a T-S distance of about 50mm, the relative deposition flux on the back face was found to be at its maximum at pressures of 1~2 Pa. Above this pressure, the uniformity of the flux on the front face became gradually worse. The observed characteristics could be reproduced by a Monte-Carlo simulation of the particle transport process. The reduction of the circumvented deposition and the uniformity degradation at high gas pressures were ascribed to the start of thermalization of sputtered particles and the shrinkage of its spatial profile toward the target.

Takeo Nakano, Takashi Fujimoto, Daisuke Nakada and Shigeru Baba : “Dielectric Breakdown Phenomena during the Secondary Electron Emission Measurement of Sputter Deposited MgO Films”, Japanese Journal of Applied Physics, Vol.45, No.10, pp.7875-7878, 2006.10

邦文題目：スパッタ製膜したMgO膜の二次電子放出測定における絶縁破壊現象

The ion-induced secondary electron emission (SEE) characteristics of sputter-deposited magnesium oxide (MgO) films have been investigated. Using an RF magnetron sputtering apparatus, MgO films of 50 ~ 200 nm thickness were deposited on Si substrates from a sintered MgO target. Under irradiation of 1 keV of Ar<sup>+</sup> ions, secondary electrons were collected by a positively biased electrode. The secondary electron current increased as the bias voltage increased, and saturated to give an SEE coefficient of 2 ~ 2.5 in all samples. The deposition condition (gas pressure 2 ~ 20 Pa) did not strongly affect this  $I$ - $V$  characteristic of the SEE, while the increase in film thickness resulted in the increase in the voltage at which the SEE current began to rise. This rising voltage depended neither on the energy nor on the current of the primary ion beam.

We concluded that the rising voltage was determined by an electric breakdown phenomenon by which the positive charge accumulating on the

surface was compensated from the substrate. The field strength was estimated to be as large as  $10^9$  V/m.

## 情報科学科

岩崎 学・阿部貴行：「打ち切りおよびトランケーションの下でのパラメータ推定に及ぼす切断点の影響評価」，応用統計学，Vol. 35，No. 1，pp. 49-60, 2006. 7

打ち切り (censoring) とトランケーション (truncation) は，データの不完全性を惹起する要因となる。これらでは共に，ある閾値 (切断点)  $c$  に対し， $c$  以下 (もしくは以上) となる観測値  $x$  の値そのものは得られない。これまでの研究では，切断点  $c$  はあらかじめ定められたものであり，その下での母集団パラメータの推測法が多く論じられてきている。ここでは，切断点  $c$  の値がパラメータ推定に及ぼす影響を，切断点  $c$  の微小な変化により考察している。その影響評価は，尤度方程式から導かれる陰関数を用いて行ない，特に，応用上重要な指数分布および正規分布について，数値例を交えて詳しく議論している。その結果，打ち切りとトランケーションでは切断点  $c$  の影響が逆向きであること，およびトランケーションの場合には  $c$  の影響が観測データ数に依存しないことが示された。

阿部貴行・稲葉由之・岩崎 学：「不完全データの統計解析とそのソフトウェアの比較」，計算機統計学，Vol. 18，No. 2，pp. 79-94, 2007. 2

医学研究をはじめとする実証分析では，様々な理由によりデータに欠測が生じるなど，研究者は不完全データに直面することが多い。その種の不完全データは不可避であり，その処置は実際のデータ解析を実行する上で，研究者の悩みの種となっている。この種の状況に対処するため，近年，不完全データの解析をサポートする商用のソフトウェアが現れつつある。本論文では，不完全データの解析をサポートするいくつかのソフトウェアの機能や特徴の比較検討を行なっている。不完全データの解析手法として，主にEMアルゴリズムおよびMultiple Imputationを取り上げ，各種ソフトウェアの出力を比較すると同時に，実際のデータを用いて不完全データの下での実践的な対処法を議論した。

なお，本論文により，第一著者の阿部貴行は日本計算機統計学会の奨励賞を受賞した。

上田 徹，佐藤 啓，廣津信義：「ハンドボールへのマルコフモデルの適用」オペレーションズ・リサーチ，Vol. 51，No. 6, 2006. 6

野球やサッカーなどについては，モデリングに関する研究が多くなされているが，ハンドボールに関するものは体育学的な文献が主であり，シュートやミスなどに関する統計的な調査やシミュレーションソフトの開発事例などがいくつか公表されている程度である。本研究では，ハンドボールの試合をモデル化するために，様々なマルコフモデルを適用し，これらを期待得点と実試合の結果とを比較することでモデルを評価してみた。また，モデルを簡易化・詳細化することによりどの程度の違いがあるか検討すると共に，各プレーの得点に対する影響を，弾性値を用いて分析してみた。ハンドボールについては，ゲームのモデリングの試みが緒についたばかりであり，研究としてはまだまだこれからといえるが，具体的なモデルと検討結果を例示したので，モデリングに当たっての今後の研究のための参考事例となると考えている。

廣津信義，秋山大輔，上田 徹：「サッカー選手のDEAの視点からの評価」オペレーションズ・リサーチ，Vol. 51，No. 10, pp. 655-661, 2006. 10

DEA (Data Envelopment Analysis) によるスポーツ選手の評価としては，野球に関する事例が主であり，サッカーについては，選手や監督への報酬を入力とし観客数や歳入などを出力としてチームを評価した事例はあるものの個々の選手の評価は試みられていないようである。ところが，近年サッカーでも，細かいゲームの分析がなされるようになり，オプタポイントという選手の評価指標が公開されている。本研究では，このオプタポイントの算出のために取得されたデータの内，基本となる10項目のデータを活用してサッカー選手のDEA評価を試みている。まずは，最も一般的なCCR(Charnes, Cooper, Rhodes)モデルでの評価をした後，領域限定を行いポジション毎で選手の評価をしている。また，効率的な選手の相対評価をするため，クロス効率値を利

用した総合評価も試みている。これらの試みにより、従来は得点数に偏りがちであった選手評価をDEAの視点から総合的に多角的に評価することができた。またオプタポイントなど他の指標と本手法で得られた結果を比較することで、他の指標の特徴などについて考察している。

山本瑞秋, 米倉達広, 岡本秀輔, 鎌田 賢, 荒木俊郎: 「状態遷移図に基づくビジュアルWebブラウザ・プログラミングの提案」, 電子情報通信学会和文論文誌D, Vol. J89-D, No.10, pp.2246 - 2250, 2006.10

本論文では、状態遷移図の編集とその自動変換によるWebブラウザ自動生成ツールを提案する。具体的には、カスタマイズ可能なWebブラウザ「Mozilla Firefox」の拡張機能を利用した上記プロトタイプシステムを試作したので報告する。

新留和哉, 岡本秀輔, 新堀道信, 鎌田 賢, 米倉達広: 「BREW上のゲーム実行エンジン」, 電子情報通信学会2種研究会 サイバーワールド(CW)第6回研究会, pp.19-22, 2007. 3

auの携帯電話上で動作するBREWアプリケーションはEZアプリと呼ばれ、ゲームを中心に人気を得ている。KDDIから公式コンテンツプロバイダとして採用された会社だけがEZアプリを作成できる。一般ユーザでもゲームを開発できるように、BREW上で動作するゲーム実行仮想マシンを開発した。ゲームプログラミングのフロントエンドには、ユーザにやさしいインタフェースを持つIslayを利用する。Islayから出力されるゲーム定義ファイルをバイナリ形式ファイルに変換することによって、携帯電話上での計算量とメモリの節約を図る。

福嶋誠治・杉本直登・赤津祐史・界 義久・小口喜美夫: 「ノートPC用光LANカード」電気学会論文誌C, Vol. 126, No.10, pp.1200-1204, 2006.10

ファイバ・ツー・ザ・デスクトップ (F T T D) ネットワークの実現をめざして, P C M C I Aカードとコンパクトビリティを持つノートPC用光LANカード開発した。本論文ではその構造と特性を記述すると同時に, オフィスや家庭におけるネットワーク応用についても言及する。

S. Terada, K. Okada, Y. Okazaki, K.. Tojo, and K.. Oguchi: "Home gateway requirements in next gen-

eration home network", Proc. SPIE Vol. 6354, Network Architectures, Management, and Applications IV, pp. 63542J-1-63542J-11, 2006. 9

邦文題目: 次世代ホームネットワークにおけるホームゲートウェイの要求条件

This paper first outlines the service image of the next generation home network, and then clarifies the requirements regarding to the HGW (Home Gate Way) that is a key player in controlling all service traffic in the home. Finally, some experimental results already obtained are also described.

岡田耕平・小口喜美夫: 「波長伝達マトリクス法を用いたWDMネットワークにおける波長ルーティング機能の確認」成蹊大学理工学研究報告, Vol.43, No.2, pp.75-81, 2006.12

波長伝達マトリクス法は, WDMネットワークにおいて複雑な構造となる波長ルーティング機能の設計と機能確認のためにきわめて有効な手段である。本稿では, 波長伝達マトリクス法の基本とその拡張について記述する。次に, 光加入者端末 (ONU) 一局側終端装置 (OLT) 間を直接接続できるフルメッシュWDM受動光ネットワーク (PON) システムを新たに提案する。また, 提案システムにおける波長機能を波長伝達マトリクス法を用いて解析する。

櫻井康樹, 佐々木竜介, 甲斐宗徳: 「強マイグレーション化モバイルエージェントシステムの実装とそれによる自律分散処理システムの設計」, 成蹊大学理工学研究報告, Vol.43, No.1, pp.23-31, 2006. 6

本論文では, 強マイグレーションモビリティに基づくモバイルエージェントシステム, AgentSphereの設計と実装方法について述べる。強マイグレーション, すなわちプログラムの実行途中からの移動を実現するためには, そのプログラムの実行コード, プログラムカウンタ, ヒープエリアおよびスタックエリアの内容をすべて移動しなければならない。実行コードとヒープエリアの内容を移動するためには, Javaのシリアライズ機能がある。しかし, プログラムカウンタとスタックエリアの内容については, Javaのオリジナルの機能では移動することができない。そこで, Java Platform Debugger Architecture(JPDA)を用いてスタックエリアの内容をシ

リアライズ可能な変数に集めてヒープエリアに格納し、シリアライズ機能により移動する方法を提案する。また実行再開位置を特定するプログラムカウンタを移動する代わりに、ソースコード変換により、プログラムの任意の位置から実行再開を可能とする方法を提案する。この提案するソースコード変換では、強マイグレーションコードを記述したオリジナルのソースコードから、ステートメントコード、ランタイムコード、ステートメント情報の3つの情報ファイルを自動的に生成し、これらの変換されたコードを通常のJava仮想マシンで実行することにより、ユーザの記述した強マイグレーションコードを動作させることが可能となる。

藤本大地・伊東 拓・仲田 晋・北川高嗣・岡 将史・田中 覚：「MPU法に基づく色情報付き陰関数曲面の生成」電子情報通信学会論文誌, Vol. J89-D, No. 6, pp. 1391-1402, 2006.6

CG(Computer Graphics) や CAD(Computer Aided Design)では、三次元計測装置から得た離散点群から3Dオブジェクト曲面を再構成することがしばしば要求される。この表現法として、近年、陰関数曲面が注目されている。また、離散点群上の色情報を同時に取得できる計測装置も実用化されており、再構成した陰関数曲面上に色情報を付加することが問題となっている。本研究では、同問題の新たな表現法として、MPU(Multi-level Partition of Unity)法に基づく色関数の生成手法を提案する。本提案法では、小領域で定義される区分的な色関数を構成し、重み関数を介してそれらを滑らかに結合することで全領域で定義される色関数を構成する。また、小領域セル内の色情報の状態により色関数の構成法を適応的に変えることで色境界の表現も実現される。

呂 毅斌・伊東 拓・櫻井鉄也：「多重連結領域数値等角写像のPadé近似を用いた電荷点配置法」日本応用数理学会論文誌, Vol. 16, No. 3, pp. 149-164, 2006. 9

代用電荷法を用いた数値等角写像計算において、電荷点の配置は計算精度に影響を及ぼすが、通常それらは経験的に与えることが多い。本論文では、多重連結領域数値等角写像計算において、Padé近似を用いた電荷点配置法を提案する。本方法を用いることで、これまで単連結領域のみに適用されてきたPadé近似を用いた電荷点配置法が、多重連結領域にも拡張可能であることを示す。すなわち、本方法の

特徴は、代用電荷法によって得られた計算結果をもとに、多重連結領域において適切な電荷点配置を自動的に与えることである。

S. Kuribayashi, S. Tsumura and M. Tanabe : “Efficient ID transmission method in RFID networks”, APCC2006 1B-2, 2006.8

邦文題目：無線タグネットワークにおける効率的ID転送方式の提案

Radio Frequency IDentification (RFID) is a technology that identifies objects using radio frequency technology. In RFID networks, the means of transmitting and processing an identifier (ID) of each object is extremely important. This paper proposes a new method of transmitting IDs efficiently that uses the network address of the processing server as a part of the ID of an RF tag, so allowing direct forwarding to the processing server and thus greatly reducing the processing time and processing load. It is also proposed to adopt a virtual network address for use as a part of the ID, in order to allow flexible adaptation to a change in the location of the processing server. Moreover, this paper demonstrates how to implement the proposed method into a real network, assuming use of a widearea Ether network.

S. Tsumura and S. Kuribayashi : “Simultaneous allocation of multiple resources for computer communications networks”, APCC2006 2F-4, 2006. 8

邦文題目：コンピュータネットワークにおける複数種別資源同時割当て方式の提案

In computer communications networks, all services are provided using servers (computing resource and storage resource) distributed in various locations and network bandwidth which connects the selected server and the user terminal. Therefore, for each service request, it is necessary to assign multiple types of resource simultaneously and effectively. This paper proposes a new method of allocating multiple types of resource simultaneously in a computer communications network. The key idea of the proposed method is first to identify the resource type for

which the requested amount is the largest proportion of the maximum resource of that type, and then to select the center with the least available amount of the selected resource type. Moreover, this paper proposes another method of allocating multiple types of resource which takes account of the network delay time. It is demonstrated by simulation evaluations that the proposed method could reduce the amount of the resource of 20% in the maximum, compared with the existing method.

伊藤・渡辺・樽松・村上・他：“携帯電話用組み込みソフトウェア開発の実践的教育における産学連携の課題”，情報処理学会（2007年2月号）

現在、携帯電話の普及はめざましく、そのため新機種が年に数十種類市場にでてくる。新しい機能も、常に追加されている。そのため携帯電話本体に組み込まれるソフトウェア（組み込みソフト、という）の開発も極めて重要であるが、現在日本ではソフトウェア開発要員の確保が、質、量とも不足している。そこで、携帯電話サービスを行っているKDDIとソフトウェアの授業を行っている大学が共同し、具体的な目的をもったソフトウェア教育を行った。また、多様な授業法について、学生のレベルアップを評価基準として、授業法の比較をおこない、優れたソフトウェア技術者の育成法について、知見をえた。

H. Murakami: “ICT Business and Related Technologies in Japan -From wired BB to Mobile BB-”, IEEE ISCIR 2006, Oct.2006, Bangkok, Thailand.

日本はICT,特に携帯電話の分野で、世界で最も進んだ国である。とくに、多様なコンテンツを開発、商用化し

ている点で、世界的に極めてめずらしい。そこで、なぜこのようなコンテンツ先進国になったか、その技術的バックグラウンドはなにか、具体的に紹介。

H. Murakami : “Deployment of wired and Mobile Broadbands and Their Future Prospect in Japan”, IEEE GLOBECOM ACCESS'06, Nov.26, 2006, San Francisco California, USA.

日本での有線系と移動体のブロードバンド化の現状について報告。特に光の進展、ここを流れるコンテンツの多様化、について紹介。世界一のブロードバンド大国の詳細について紹介。光ファイバの普及は、世界で最も進んでおり、他国にとって非常に参考になる。

S. Nishiyama, H. Fukuoka, M. Ohashi, H. Murakami : “Combining RFID Tag Reader with Mobile Phone : An Approach to Realize Everyone's Ubiquitous Appliance”, IEEE International Symposium on Intelligent Signal Processing and Communication Systems, ISPACS'06, Tottori, Japan, Dec. 2006

ユビキタス時代の特徴の一つは、RFIDに代表される各種タグが、我々の周りに数多く埋め込まれ、このタグからの信号を携帯電話で介して、各種サーバーに送り、社会生活に役立てることである。このコンテンツの1つが、context awareness であり、携帯電話が必須な端末になる。このような背景から、RFIDにアクセスし情報を読み取る携帯電話を開発した。その仕様、目的、具体的な実験結果を報告した。

（以上4件 村上仁己 前職KDDI株式会社理事における実績）

## エレクトロメカニクス学科

Kazuaki Arai, Masaya Inabe, Hirohito Arai, Takeshi Ishigohka, et al. : “Test of Resonance-Type Superconducting Fault Current Limiter”, IEEE Trans. on Applied Superconductivity, Vol.16, No.2, pp.630-633, 2006.6

邦文題目：共振型超電導限流器の試験

The authors developed and tested a resonance-type superconducting fault current limiter (FCL) using Bi-2223 superconducting coils in

order to demonstrate actual operations. The short-current tests of a FCL were carried out for steady state 50 Hz current of up to 120 A with relevant combinations of a superconducting reactor, an arrester, a capacitance and a copper reactor of which the FCL consisted. It was shown by the results of over-current tests that the load-current during faults was controlled within limited much lower levels than the cases using no

FCL. And, the FCL could promptly recover to steady state after the faults were cleared.

H. Arai, M. Inaba, T. Ishigohka, et al. : “Fundamental Characteristics of Superconducting Fault Current Limiter Using LC Resonance Circuit”, IEEE Transactions on Applied Superconductivity, Vol.16, No.2, pp.642-645, 2006. 6

邦文題目 : LC共振回路を用いた超電導限流器の基本特性

The authors proposed a new type of fault current limiter (FCL) utilizing series LC resonance circuit composed of a superconducting coil and a capacitor. The superconducting coil is wound by Bi-2223/Ag HTS tape conductor. The new FCL can suppress the rapid increase of a fault current by its energy storing capacity. Both theoretical analysis and experiments are carried out. It is shown by the experimental result that the current limiting ability of this FCL. The obtained experimental result agrees well with the theoretical one.

Takeshi Ishigohka, Kenji Uno, and Sakio Nishimiya : “Experimental Study on Effect of In-Rush Current of Superconducting Transformer”, IEEE Transactions on Applied Superconductivity, Vol.16, No.2, pp.1473-1476, 2006.6

邦文題目 : 超電導変圧器の励磁突入電流に関する実験的研究

The problem of the in-rush current of a superconducting transformer using a small experimental model system with a Bi-2223 HTS winding was studied experimentally. The in-rush current with a ceiling current of more than 10 pu was applied. The experimental result shows the remaining of a finite resistive voltage even for a primary current smaller than its DC critical value after the decaying of the initial in-rush over current.

Ryo Kawanami and Takeshi Ishigohka : “Low Temperature Characteristics of MOSFET Targeting Low-Voltage High-Current Power Source for Superconducting Magnets”, IEEE Trans. on Applied Superconductivity, Vol.16, No.2, pp.1630-1633, 2006.6

邦文題目 : 超電導マグネット用低電圧大電流電源を目的とした低温におけるMOSFETの温度特性

A low-voltage/high-current DC power source using multi-parallel-connected MOSFETs for an excitation power source of superconducting magnets is proposed. The power source can operate at 77 K in liquid nitrogen bath. The fundamental idea and some preliminary experimental results are presented. The preliminary experiment using 100 MOSFETs connected in parallel are carried out. The forward-direction voltage drop both at room temperature and 77 K has been measured. The experimental results show good prospect for this type of DC power source in order to excite superconducting magnets.

N. Yanagi, K. Seo, S. Imagawa, H. Sekiguchi, K. Takahata, S. Yamada, T. Mito, T. Ishigohka, A. Ninomiya : “Pulse height analysis on the balance voltage and acoustic emission signals for the LHD superconducting coils”, Fusion Engineering and Design, Volume 81, Issues 20-22, pp.2559-2565, 2006.11

邦文題目 : LHD超電導コイルのバランス電圧およびAE信号のバルス高解析

The authors have observed in the superconducting helical coils of the Large Helical Device (LHD) that the balance voltage signals measured between the corresponding pairs of the coil blocks contain a number of spike signals during ramp-up and ramp-down processes of excitation. The spike signals might be generated by rapid changes of the self-inductances of the coil windings due to mechanical disturbances (conductor motions) caused by large electromagnetic forces. Pulse height analysis (PHA) has been successfully applied to analyze these signals in order to clarify the mechanical properties of the coil windings. In addition, four acoustic emission (AE) sensors attached to the helical coil cans are also used to detect mechanical disturbances, and PHA is applied also to analyze these signals.

T. Ishigohka, T. Mito, S. Imagawa, N. Yanagi, H. Sekiguchi and S. Yamada : “Protection of LHD coils by intelligent observation of voltage signals”, Fusion

As well known, the LHD is a typical large scale superconducting coil system with very large magnetic stored energy. Therefore, its protection at any operational condition is very important. In order to protect the large superconducting coils, a careful observation of voltage signal is essential. However, in general, the observed voltage signals have considerably large electromagnetic noises. Therefore, the authors cancelled the noise voltages by subtraction of a voltage of an adjacent coil from that of the target coil. Besides, the authors propose an intelligent data processing method using both integration and differentiation technique of the voltage signal. These techniques are applied for the LHD data. The obtained result well explains the normal-zone expansion phenomenon at LHD obtained in Oct. 1998.

大倉元宏・中川幸士・田内雅規:「視覚障害者用道路横断帯の敷設ガイドラインの提案」日本交通科学協議会誌, Vol.6, No.2, pp.12-19, 2006 (2007.3発行)

It is very difficult for vision impaired persons to cross an intersection independently. In an attempt to reduce the difficulty associated therewith, a tactile guiding indicator (TGI) paved on pedestrian crosswalk has been developed. In the article we reviewed our studies on the usability of TGIs, and propose the following installation guidelines:

- 1) The TGIs should be combined with Braille tiles (dot- and strip-patterned tiles) on sidewalks and audible traffic signals (ATS) employed as standard features at intersections for vision impaired pedestrians.
- 2) The TGI must be placed such that it forms a contiguous line with strip-patterned tactile tiles on opposite sides of the street to form a continuous traveling path.
- 3) The width of the TGIs should exceed 40cm to decrease the possibility of the user stepping off the path they form.
- 4) A tactile forewarning sign for informing users

of the position and direction of the TGI should be installed on the sidewalk quite near the TGI.

- 5) An ATS speaker should be positioned above the tactile forewarning sign to help users locate the sign more easily.

The bureaucratic nature of administrative system of the Japanese government is such that it has the potential to hinder the implementation of travel aids for vision impaired pedestrians. Travel aids for vision impaired pedestrians are administrated by different authorities; Braille tiles are administrated by the municipal roads authority, ATS devices are controlled by the police and TGIs by the police or the municipal roads authority. Since all of these aids are used by vision impaired pedestrians, guidelines for the installation of these devices should be discussed in an open forum with representatives from all relevant administrative sections.

小方博之・河合 岳・山本紗恵子:「人間の動作データを用いたスキルの自動評価」日本テスト学会誌, Vol. 3, No. 1, pp. 49-58, 2007.3

本論文では、もの作りやスポーツのように連続的な動作を伴う実技課題において、受験者のスキルを自動評価する方法について検討する。具体的には、モーションキャプチャ装置で取得した受験者の動作データを用いて評価を行う。一般に、受験者の動作はスキルレベルが同一でも同じにはならず、体の大きさや筋力、肉付きなどによって差が出る。同一受験者が複数回実技を行った場合の動作にも差が生じる。また、受験者が同じ姿勢をとる時点もデータによって異なる。このような特徴を有する動作データを扱うために、本研究では時点を一意に特定できるいくつかの姿勢をデータから抽出して多変量データとしたものを利用し、そこから分類問題に帰着させることでスキルレベルを推定した。ゴルフのパタースイングを例題として本手法の有効性を確認した。あらかじめスキルレベルの判っている30名の受験者から556データを取得し、leave-one-out法でスキルの評価を行ったところ、実際のスキルに近い値が得られ、本手法の有効性を確認できた。

Yuki Saito, Akinori Ezawa, Yusuke Fukumoto, Hiro-



yuki Ogata, Akira Torige : “Analyzing and Evaluating Robot Motion Algorithm for Sweeping Task”, *Mechanics for Safety, Security and Dependability in a New Era*, Elsevier, pp. 93-96, 2006. 9

邦文題目：掃引作業におけるロボット動作アルゴリズムの分析と評価

Recently, sweeping robots, such as cleaning robots for home use, have been actively developed. Most of these robots generate their motion by reactive algorithm with easy sensors mounted. However, with these algorithms, the sweeping task would be done uneven to the sweepable areas. So there are still rooms for developing a more efficient algorithm. To develop an effective algorithm, evaluation method is in need. However, the methodology to evaluate the efficiency of state informed algorithm has not yet been established. Cleaning robots do not always clean the same environment, so the difficulty of this research is that consideration of various kinds of environments is in need. We developed sweeping robot simulator to analyze the existing sweeping algorithms, and reveal their inefficient features to improve the existing algorithms. The algorithms that commercial robot cleaners install were analyzed and those efficiencies were estimated.

村松大吾・本郷保範・松本 隆：「ユーザ共通Fusionモデルを用いたオンライン署名認証」電子情報通信学会論文誌 D, Vol. J90-D No.2, pp.450-459, 2007. 2

署名は古くから個人認証を行う手法として利用されてきたこともあり、今後も個人認証の有力な一手法であると考えられる。本論文はオンライン署名を用いた認証手法に着目し、そのアルゴリズムの提案を行うものである。本論文ではオンライン署名から取得できる複数特徴量から複数の距離を計算し、これらを組合せ（Fusion）することでオンライン署名認証の精度を向上させる手法を提案する。複数の距離を組み合わせる手法としてユーザに依存しないユーザ共通のFusionモデルを構築し、モデルからの出力により判別を行う。本論文ではモデル学習にAdaBoostアルゴリズムを用いた。またオンライン署名認証での経時変化への対応手法としてリファレンス更新法も提案する。提案手法はオンライン署名の公開データベースを用いて精度評価実験を行い、有

効性を確認した。

（村松大吾 前職早稲田大学理工学術院助手における実績）

窪田 悟, 山川正樹, 中村芳知, 野本弘平, 城戸恵美子：「子供のテレビ視聴距離」, 映像情報メディア学会誌, 61巻, 2号, pp. 234-236, 2007. 2

本調査では、Webアンケートにより、大人と比較して、子供が相対的にどのくらいの視距離でテレビを観視しているかについて保護者からの観察結果を得た。その結果、低年齢になるほどテレビの視聴距離は近くなり、成人の平均視聴距離が約250cmであるのに対して、3歳以下の子供のテレビ視聴距離の平均は約170cmであった。これらの結果から、子供の視聴実態に配慮した映像表示条件の必要性を示した。

Kubota, S., Okada, S., Sakai, E., and Fujioka, T : “Measurement of light incident on mobile displays in various environments”, *Journal of the Society for Information Display*, Vol.14, No.11, pp.999-1002, 2006.11

Using a single lens digital camera with a 180° fisheye lens attached, we measured the incident light at the surface of a mobile display in 112 different environments, including outdoor and indoor environments, and inside a car. The data were analyzed the some typical environments in which mobile displays are used. The results of this research can be used to design the reflectivity of reflective and transfective LCDs, which make maximum use of outside light.

窪田 悟, 嶋田 淳, 岡田 想, 中村芳知, 城戸恵美子：「家庭におけるテレビの観視条件」, 映像情報メディア学会誌, 60巻, 4号, pp.597-603, 2006. 4

A field survey and a web questionnaire survey were conducted for obtaining data about television viewing conditions at home. In the field survey, measurements were made concerning the illuminance and luminance of television screens and television viewing distances and angles for 275 viewing locations at 50 homes. In the web questionnaire survey, 290 families were asked about room size, present television screen size, desired television screen size, and viewing condi-

tions. The results showed that the mean screen illuminance was 108 lx, and the mean luminance ratio of black and white was 72. The mean viewing distance was 266 cm, and the viewing-angle range was  $\pm 60$  degrees from the horizontal,  $\pm 30$  degrees from the vertical. Correlation analysis of screen sizes revealed that the best predictor of desired television screen size was the present television screen size.

N. Kawada, M. Ito and Y. Saito : "Thermal Stability of Lanthanum Oxynitride Ultrathin Films Deposited on Silicon Substrates", Jpn. J. Applied Physics vol. 45, No.12, pp. 9197-9199, 2006.12

邦文題目：シリコン基板上に堆積したランタン酸窒化膜の熱安定性

We prepared lanthanum oxynitride films on p-type Si(100) substrates by electron beam evaporation. The films were deposited by evaporating lanthanum at a substrate temperature of 300 °C, and introducing oxygen and nitrogen radicals into a chamber. After the thermal annealing of the films at 600 °C for 30 min, the composition and depth profile of the films were investigated by X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES), respectively. We found that lanthanum oxynitride films suppress Si diffusion from the substrate as compared with lanthanum oxide films.

山口 崇・柴田昌明：「予測シミュレーションを備えたベクトル場による二足歩行ロボットの歩行動作計画」, 電気学会論文誌D, Vol. 126, No. 6, pp.713-718, 2006.

This paper proposes a way of gait trajectory generation with artificial vector field for stable walking of a biped robot. The tip of the robot on walking can often deviate from the desired trajectory by the disturbances forced by unexpected outside factors. In our approach, though no prepared trajectory is specified a priori, the tip fol-

lows the artificial vectors designed in the workspace. Moreover, the prediction simulation is performed on-line. The simulator judges the stability under comparison with the present state and the prediction results, and then the gait parameters are adaptively improved in feedforward for the stable walk. The numerical and physical experimental results show the validity of the proposed method in the continuous walk.

市川麻理子・元木 聡・柴田昌明：「ハンドアイビジョンシステムによる3次元物体認識のための窺視動作制御法」, 電気学会論文誌D, Vol. 126, No. 6, pp. 726 - 731, 2006

This paper proposes a visual servo control method for exploring motion of eye-in-hand robot to recognize a three-dimensional object. The CCD camera attached at the manipulator tip captures the images of the target object, and then the robot varies its own posture with referring the position transitions in the images of the feature points on the object. Our approach for optimal motion is based on the strategy in which the position estimation precision of the feature points in the captured images gets improved when the feature points move widely, and the optimal robot motion provides the widest transitions of the feature points per unit robot motion, so that the robot should be controlled to pursue such motion. In the proposed method, the primary feature point is made located at the center of the image, while the other points are moved for achieving the optimal transition in the image. In addition, this paper describes the way to reduce calculation effort for the proposed method. The numerical and physical experiments have been executed with use of 3-DOF planar manipulator. The validity of our approach is confirmed in the several experimental results.

## 共 通 基 礎

K. Tanaka, K. Sano, T. Katoh, S. Iwata, K. Nemoto, and T. Kurushima : “Proton- and metal cation- enhanced excited state intramolecular proton transfers of 2-(2-hydroxyfluorophenyl)benzoxazole having imidazole moiety”, *J. Fluorine Chem.*, Vol. **127**, No 8, pp. 1073-1078, 2006. 8

邦文題目：イミダゾール部位を持つ2-(2-ヒドロキシフルオロフェニル)ベンゾオキサゾールのプロトンおよび金属カチオンにより増大する励起分子内プロトン転位

Protonation at the 3-imidazole nitrogen atom of 2-(2-hydroxyfluorophenyl)benzoxazole having an imidazole moiety (**1**) enhances the green emission around 500 nm, where the positive character caused by the protonation is inductively communicated to the hydroxy group, to recover its intramolecular hydrogen bonding, leading to the ESIPT process. Addition of  $\text{Al}^{3+}$  or  $\text{Zn}^{2+}$  to **1** enhances both the green emission and the blue emission around 450 nm in chloroform-acetonitrile.

I. Wakabayashi : “Number of solutions for cubic Thue equations with automorphisms”, *Ramanujan J.* Vol.14, pp.131-154, 2007. 3

邦文題目：自己同型をもつ3次トウーエ方程式の解の個数

Let  $F(X, Y)$  be an irreducible cubic form with integer coefficients and positive discriminant. We suppose that  $F$  has non-trivial automorphisms. We show that the Thue equation  $F(x, y)=1$  has at most three integer solutions except for a few known cases. For the proof, we solve an explicitly expressed cubic Thue equation

$$bx^3 - ax^2y - (a+3b)xy^2 - by^3 = 1$$

which is equivalent to  $F$ . To obtain an upper bound for the size of solutions, we use the Pade approximation method. To obtain a lower bound for the size of solutions, we use a result of R. Okazaki on gaps between solutions, which is obtained by geometric consideration.

I. Wakabayashi : “Cubic Thue equations with automorphisms”, *Diophantine Approximation and Related fields 2006*, Seminar on Math. Sciences No. 35, Keio Univ., pp.193-202, 2006. 8

邦文題目：自己同型をもつ3次トウーエ方程式

We report the following results, and give an outline of the proof. Let  $F(X, Y)$  be an irreducible cubic form with integer coefficients and positive discriminant, and we suppose  $F$  has non-trivial automorphisms. We show that the Thue equation  $F(x, y)=1$  has at most three integer solutions except for a few known cases. For the proof, we use an explicitly expressed cubic form  $F_{a,b}(X, Y)=bX^3 - aX^2Y - (a+3b)XY^2 - bY^3$ , which is equivalent to  $F$ . To obtain an upper bound for the size of solutions, we use the Pade approximation method developed in our former work. To obtain a lower bound for the size of solutions, we use a result of R. Okazaki on gaps between solutions, which is obtained by a geometric consideration. We also solve the Thue inequality  $|F_{a,b}(x, y)| \leq 2a+3b$  when  $a$  is sufficiently large compared with  $b$ . For the proof we use a continued fraction with fractional partial quotients, and a generalized Legendre theorem.