# Proceedings of International Forum on Research Promotion 2018

November 27-28 2018, Toyama, Japan

Organized by

**Center for Promotion and Advancement of Research**

**National Institute of Technology, Toyama College**

# Contents

Greeting from the president of Toyama College

Let me begin by welcoming you all the attendees of the International Forum on Research Promotion 2018 in Toyama. I hope that you all will enjoy this forum and I would like to take this opportunity to thank you for your ongoing support and understanding of this forum.

Looking into recent Toyama College activities, I am proud to say that they are expanding into a variety of international areas with our professors and students keen to vitalize the academical development. With regard to our social activities, this forum is an up-to-date and essential tool whereby the international attendees can exchange information about the sector. I can say with confidence that Toyama College is making an enormous contribution to academic and technical development in Japan's engineering industry and, on a broader scale, to overall growth of the national economy.

In order to inspire young generations, a keynote address and special presentations by international scientists, professors Péter SZOLGAY, Balázs RAKOS, Yueh CHIANG, and Frédéric MURZYN are proposed for this forum. Our college believes that these address and presentations will generate significant results for not only the young generations but also the all attendees. Meanwhile, I truly believe that the forum will contribute to passing on the skills of prominent scientists to younger generations through these lectures and continuous education for students which is becoming increasingly active, with the support from the attendees. I am positive the forum will play an active role in the scientific and academic development and will also create the mutual cooperation and technical exchanges. Let me once again extend a warm welcome to all attendees and express the wish that the presentations and discussions during the forum may be fruitful for all of us.

I want to thank Dr. Eiji TAKADA, and other staffs for their involvement in managing the forum. And, finally, I thank you again all the attendees for your support.

Tomoji TAKAMASA, PhD
President,
National Institute of Technology, Toyama College

# International Forum on Research Promotion 2018

## 1. Scope

The colleges of the National Institute of Technology in Japan are classified as institutions of higher education. To improve the education of our students, faculty members carry out advanced academic research. Toyama College strongly promotes research through a variety of activities, one of these being International Forum on Research Promotion 2018. This forum provides the opportunity for both faculty members and students to learn about advanced research by the invited speakers. Students will also share their research through poster presentations and gain valuable experience and feedback from discussions with foreign researchers, in order to enhance their motivation to study and to improve their global awareness.

## 2. Program（November 27-28, 2018）

Chairperson, Todd COOPER, NIT, Toyama

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|---|---|
| **13:00** | **Opening Remarks**<br>Dr. Tomoji TAKAMASA<br>President, National Institute of Technology, Toyama College |
| **13:05 -** | **Keynote Address**<br>Title：Overview on research activity on Faculty of Information Technology and Bionics PPCU<br>Dr. Péter SZOLGAY<br>Dean, Pázmány Péter Catholic University, Hungary |
| **13:35 -** | **Special Presentation 1**<br>Title : Protein-based Computing and Rectenna-based Infrared Energy Harvesting Devices<br>Dr. Balázs RAKOS<br>Associate Professor, Budapest University of Technology and Economics, Hungary |
| **13:55 -** | **Special Presentation 2**<br>Title : Microdosimetry and its application on semiconductor industry<br>Mr. Yueh CHIANG<br>Adjunct Research Fellow, Department of Radiation Oncology, Chang Gung Memorial Hospital. |
| **14:15 -** | **Special Presentation 3**<br>Title : Research at ESTACA in the field of transportation systems<br>Dr. Frédéric MURZYN<br>Associate Professor, Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile (ESTACA), France |
| **14:35 -** | **Special Presentation 4**<br>Title : Aging behaviour of ultra-fine grained Al alloys<br>Dr. Seungwon, LEE<br>Associate Professor, University of Toyama, Japan |
| **14:55 -** | **Closing Remarks for the Oral Session**<br>Dr. Eiji TAKADA<br>Director of the Center for Promotion and Advancement of Research, National Institute of Technology, Toyama College |
| **15:00 – 16:00** | **Poster Presentation by Advanced Course Students** |
| **16:00 – 17:30** | **Joint-CAST** |
| **Nov. 28** | |
| **9:30 – 12:00** | **Meeting on the Research Achievements in National Colleges** |

# *Lecture*

## *Overview on research activity on Faculty of Information Technology and Bionics PPCU*

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In 1635 Péter Pázmány, Archbishop of Esztergom established a University that is the oldest today in Hungary. The Faculty of Information Technology and Bionics was established in 1998. As a research oriented Faculty, teaching and doing research in electronic and computer engineering and later in bionic engineering. The Faculty has 700 students in BSc and MSc level.. Due to the intensive international co-operations all the course in MSc level are running in English. The Roska Tamás Multidisciplinary Doctoral School of Sciences and Technology is accredited to give doctoral degrees and habilitation in electrical engineering, information technology and biology. We have started in a Department system, without the classical continental chair system, and the research laboratories forming a unit called A Jedlik R&D laboratories. Each laboratory offers some experimental facilities, many of them with high-end technologies. In Jedlik Laboratories 60 doctoral students are working with 20 professor (supervisors) and with more than 20-30 MSc students. Some research directions are listed next: Virtual cellular machines, kilo-processor chips, cellular wave computers; Nano-photonics, nano-scale sensors and energy harvesting devices, modeling bio-nano phenomena; Bioinformatics, proteomics; Bio-inspired navigation and prostheses (substitutes for impaired abilities); Sensing - computing – and algorithms implementations and movement control; Deep submicron, MEMS and 3D integrated circuits; "Lab-on-a-chip" bionic interfaces, brain electrodes; Ultrasonic biomedical imaging, two- and multi-photon-microscopy; Medical text processing; Quantitative modeling in neuroscience etc.

We have strategic partnership with five National Research Laboratories of the Hungarian Academy of Sciences, as well as developing partnership with many companies.

## *Protein-based Computing and Rectenna-based Infrared Energy Harvesting Devices*

Balázs Rakos[1,*]

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Due to the continuously increasing energy and performance demand of our society, contemporary research aims for the development of electronic computing architectures with lower power consumption and dissipation, smaller size, and higher speed. Furthermore, our communities are in need of novel, more efficient, cheap and environment-friendly devices, suitable for clean energy harvesting. The present study discusses, why proteins may be excellent building blocks of nanoelectronic computing architectures in the future, due to their numerous advantageous properties. We introduce various methods by which binary, and multiple-valued logic circuits can be realized with the aid of electric field or light pulse-driven proteins. Furthermore, we present a novel device concept, based on integrated, nanometer-size antennas, metal-insulator-metal diodes and lenses, suited for the efficient conversion of environmental infrared radiation into electricity.

***Microdosimetry and its application on semiconductor industry***

Yueh Chiang , C. J. Tung, Chung-Chi Lee ,Tsi-Chian Chao*

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Proton Center at Chang Gung Memorial Hospital (CGMH) in Linkou is the first proton center in Taiwan and largest in Asia that officially accept patients in late 2015 and has treated more than 1,500 patients. Our proton center consisted of a cyclotron which can provide proton with 230 MeV and four full-gantries for patient treatment. In addition to therapy purpose, we also reserve an experimental room, named Particle Physics and Beam Delivery Core Laboratory (PPDBCL), with two fixed beam line for the particle physics study about radiation biology and semiconductor industry. Taiwan has the best wafer foundry in the world, who can provide 7nm process technology. Since wafer fabrication has been advanced into a nanometer century, microelectronic device is much more sensitivity to radiation such like high energy protons and neutrons come from cosmic ray. To test its reliability of a semiconductor unit, one can irradiate this sample under a high intensity fast neutron beam and measure the event counts. However, the facility which can provide neutron testing is quite limited and expensive. An alternative plan is using the high intensity proton beam produced by medical accelerators. The effect of radiation interaction with microelectronic device can be classified to two groups, single even effect (SEE) and total ionization dose effect (TID). The SEE is much critical for the device in nanometer scale because it has lower LET threshold. The testing of the radiation hardness of microelectronic devices is of supreme importance to understand, control, and reduce the radiation effects of microelectronic devices. Knowledge about the SEE on silicon is required to understand the radiation effects. This energy deposition can be measured using a silicon equivalent proportional counter (SEPC). The measurements using SEPC and related Monte Carlo simulations will help us characterize beam quality of the PPDBCL. This presentation will introduce our PPDBCL and its design philosophy, Monte Carlo simulations for determining irradiation parameters, and SEPC results

## *Research at ESTACA in the field of transportation systems*

Frédéric Murzyn

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In this talk, research at ESTACA (School of Engineering based in Paris and Laval) will be introduced. After a brief description of the school in terms of academic programs, students, their professional insertion and industrial partners, ESTACALAB (the research laboratory) will be presented with special emphasis on his two main departments: Systems and Mechanical Engineering. An overview of the research topics dedicated to transportation systems (cars, trains, rockets and planes) will be given including some PhD and research projects in both departments. A special interest will be focused on activities dealing with air quality and depollution in automotive and railway engineering (fluid mechanics approach). In particular, some experimental facilities and instrumentation will be shown allowing CFD simulations, laboratory and embedded measurements using techniques like LDV (for velocity and turbulence measurements), PALAS and ELPI (for ultrafine particles generation and counting in wind tunnels) and DustTrack and PTrack (for on road measurements). As examples, two ongoing research projects will be presented. The first one is called CAPTIHV. It is funded by ADEME (French Agency for Environment and Energy) and ESTACA is leader. It aims at characterizing pollutant (NO, $NO_2$ and particles) infiltration in car cabins from field measurements in Paris area and suburbs. Three major results indicate that i) tunnels and the ring around Paris contribute to higher pollutant concentrations with car cabin levels that may be larger than outside of the car ; ii) different dynamics for NO, $NO_2$ and particles are exhibited and iii) ventilation settings have strong influence on the rate of infiltration of these pollutants. The second one is the PhD of Romain Rodriguez. This is an experimental study undertaken in our wind tunnel. Particle dispersion in the wake of classical car models has been studied showing the correlation between the flow topology (downstream of the car) and particle concentration fields. Interaction between recirculation region and particles is highlighted. In the last part of the talk, we will discuss about existing relationships between Toyama Institute of Technology and ESTACA and possible future research collaborations will be suggested.

## *Aging behaviour of ultra-fine grained Al alloys*

Seungwon Lee[1,*], Kenji Matsuda[1] and Zenji Horita[2]

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Age-hardenable Al alloys traditionally have been strengthened by dispersion of fine precipitates through heat treatment. About 3 decades ago, severe plastic deformation (SPD) processes are started by many scientists and engineers. Several SPD methods including high-pressure torsion (HPT), equal channel angular pressing (ECAP), and accumulative roll-bonding (ARB) have been developed and studied, and among them high-pressure torsion (HPT) process can produce finer grains than the other processes. In HPT process, a thin disc sample is compressed between two anvils under a high pressure and shear strain is concurrently introduced by rotating the anvils with respect to each other. Since the earliest work by Bridgman in 1935, it has been shown that the hardness and strength of materials evolve into saturation levels with straining, where hardness, strength, grainsize and dislocation density remain unchanged with further increase in the shear strain. Here, it is interesting to combine the two different hardening methods, grain refinement and precipitation hardening. However, it is generally not easy to achieve the combined supersaturated conditions using conventional thermomechanical treatment. Provided that such a precipitation within the fine grains by subsequent aging while keeping the grain size small. The aim of this research is to investigate a possibility of achieving the simultaneous hardening by the effects of grain refinement and fine precipitation. Age-hardenable Al alloys i.e. 2000, 6000, 7000 series alloys, show different aging behavior because of their different alloying elements and the amounts. And, the main strengthening precipitate are different. For this research, various Al alloys were fabricated using high purity alloying element by casting. The ingot was homogenized in an air atmosphere and slowly cooled down in the furnace. Discs of 1mm thickness and 10mm diameter were cut from the homogenized ingot. The discs were solution-treated in air atmosphere and immediately quenched into ice water. Each disc was processed by HPT at room temperature under an applied pressure of 6 GPa for number of rotations of 5 at a rotation speed of 1 rpm. The thicknesses of discs were reduced from 1mm to 0.8 mm during the HPT processing. Samples after HPT process were subjected to aging treatments. Microstructure observation was carried out using transmission electron microscopy (TEM) and mechanical properties were estimated using Vicker`s microhardness measurement and tensile test using age-hardenable Al alloys.

# *Poster Presentation by Advanced Course Students*

| Number | Affiliation | Authors Name | Paper Title |
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| 01 | National Institute of Technology, Toyama College | Kaito Aoki<br>Fumihiko Ishida | Device control system using the image recognition |
| 02 | National Institute of Technology, Toyama College | Tomohiro Imai<br>Masahiko Takahiro<br>Yasutaka Mori<br>Tomohiro Fukuda | Atmospheric pressure decomposition process of Epoxy resin for CFRP by applying Low frequency oscillatory stress |
| 03 | National Institute of Technology, Toyama College | Aoi Iwaori<br>Masamoto Tafu<br>Takeshi Toshima<br>Saori Takamatsu | Adsorption of ammonia gas by fluorapatite (FAp) derived from calcium phosphate (DCPD)and fluoride |
| 04 | National Institute of Technology, Toyama College | Hiroya Uyama<br>Tatsuei Yamazaki<br>Toyohisa Asaji | Development of Wien filter for desktop-sized ECR ion source |
| 05 | National Institute of Technology, Toyama College | Yuki Ejiri<br>Hiroshi Shibata | Evaluation of boundary nonlinearity using ultrasound |
| 06 | National Institute of Technology, Toyama College | Mikiya Kato<br>Tokichika Maruyama<br>Masakazu Yamagishi | New electron withdrawing materials to improve the contact resistance of OFETs |
| 07 | National Institute of Technology, Toyama College | Yuki Kitazaki | Study of hydrogen evolution from formic acid using metal nanoparticle catalysts |
| 08 | National Institute of Technology, Toyama College | Toyoaki KINOSHITA<br>Tatsuya SHIMIZU<br>Hisashi YAMAMOTO<br>Hitoshi NISHIDA<br>Noboru MOMOSE | Prediction of Material Removal Distribution on Surface Polishing Utilizing Magnetic Compound Fluid |
| 09 | National Institute of Technology, Toyama College | Toshiya Kurosaki<br>Shin-ichiro Kaneko | Development of an Intuitively Intelligible User Interface for a Remote Control Mobile Robot |
| 10 | National Institute of Technology, Toyama College | Aito Sugimura<br>Fumihiko Ishida | A Gaze Estimation Method based on Voltage-Ratio of EOGs |
| 11 | National Institute of Technology, Toyama College | Takahiro Daimon<br>Masao Kita | Fabrication of $Cu_2O$ thin films by Mist CVD method |
| 12 | National Institute of Technology, Toyama College | Yuki Takagi<br>Makoto Inoue<br>Tetsuo Aida<br>Kazuo Matsuzawa<br>Naritoshi Aoyagi | Production of High Purity Mg-Zn Alloy Sheet by Vacuum Distillation and Extrusion |
| 13 | National Institute of Technology, Toyama College | Kazuhiro Takei<br>Makoto Inoue<br>Kenji Nakamizo<br>Misato Fujii<br>Kenji Uruma | Production of High Purity Magnesium by Vacuum Distillation |
| 14 | National Institute of Technology, Toyama College | Akihiro Doike<br>Kazuto Mizoguchi<br>Hiroyuki Kawafuchi | Dechlorination reaction of chlorine-substituted aromatic compounds by electroorganic method |
| 15 | National Institute of Technology, Toyama College | Kotaro Fujihira<br>Hitoshi Nishida<br>Hisashi Yamamoto<br>Shinji Ikeda | Numerical analysis of polishing pressure distribution on surface polishing with a magnetic compound fluid |
| 16 | National Institute of Technology, Toyama College | Atsuki Matsumoto<br>Yutaka Sakurai | Soft Magnetic Characteristics and Exchage-coupled Dual Layered film |
| 17 | National Institute of Technology, Toyama College | K. Yamagishi<br>E. Takada<br>Y. Sato<br>T. Torii | Possibility study of a shape variable type gamma camera with umbrella-like configuration |
| 18 | National Institute of Technology, Toyama College | S.Ogasawara<br>T.Aso<br>T.Chao<br>H.Chang<br>C.Lee | Tetrahedral Organ model in Geant4 Based Particle Therapy Simulation Framework |
| 19 | National Institute of Technology, Toyama College | Megumi Takenouchi | On a predicting system of swells in Toyama Wan |
| 20 | National Institute of Technology, Toyama College | Yuya Yamazaki<br>Tomoaki Kyoden | Analysis on optical path of Doppler signal from circular pipe in case to use multipoint laser Doppler velocimetry |

| Number | Affiliation | Authors Name | Paper Title |
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| 21 | National Institute of Technology, Toyama College | Kairi Tajima<br>Kiichiro Mukose | Application of Virtual Reality Technology in Maritime Education |
| 22 | National Institute of Technology, Toyama College | Rei Kawai<br>Hiroshi Oguma<br>Takeshi Asai<br>Mizuki Motoyoshi<br>Suguru Kameda<br>Noriharu Suematsu | Transmitting Timing Calculation Unit with CPU on FPGA<br>for QZSS Short Message SS-CDMA Communication |
| 23 | National Institute of Technology, Toyama College | Ryo Kawajiri<br>Akira Tsukada<br>Cooper Todd | 2D/3D facial recognition system using Xtion |
| 24 | National Institute of Technology, Toyama College | Sho TATSUGUCHI<br>Soshi TAKEWAKI<br>Hiroshi OGUMA | Construction of Hazard-Map Utilization Support System by Using Open-Data |
| 25 | National Institute of Technology, Toyama College | Asuka Hashimoto<br>Kyo Takata<br>Nao Ito<br>Ryuichi Matoba<br>Kentaro Tani<br>Yoshinobu Maeda | Study of the Influence of an Obstacle on the Evacuation Behavior<br>by Multi-Agent Simulation Considering Intimate Space |
| 26 | National Institute of Technology, Toyama College | Masaki Fujishima<br>Shoichi Furuyama | Development of estimation system for COD concentration in water |
| 27 | National Institute of Technology, Toyama College | Kota Makino<br>Toru Shiina | Construction of a Precipitation Classification System using Vertical Doppler Radar |
| 28 | National Institute of Technology, Toyama College | Ryuta Makino<br>Tsukasa Aso<br>Yoshimune Ogata<br>Hidesuke Itadzu | Peak efficiency calculation of the high purity Ge detector by Monte Carlo simulation |
| 29 | National Institute of Technology, Toyama College | Daisuke Ito<br>Ikuhiro Nasuno | Recommendation for compact city policy of Takaoka city, Toyama prefecture |
| 30 | National Institute of Technology, Toyama College | Aoi Sakaguchi<br>Tetsuya Miyashige | Effectiveness of personnel management that fulfill the instinct of understanding. |
| 31 | National Institute of Technology, Toyama College | Akari Miya<br>Tetsuya Miyashige | A survey of process of creating foreign repeat visitor<br>-Focus On Snow Resort- |
| 32 | National Institute of Technology, Toyama College | Masatake YOSHIKAWA<br>Takeharu KIYOSHI | Marketing Strategy of BOP Business |
| 33 | National Institute of Technology, Ishikawa College | Kaoru Teranishi<br>Naoki Shimada<br>Kiminao Kogiso | Encrypted Control System: Theory and Applications |
| 34 | National Institute of Technology, Akashi College | Shuji Tamura<br>Moriyoshi Watanabe<br>Keiichi Kanda | Study on Acute Toxicity Test for soil spraying agent using Eisenia fetida |
| 35 | National Institute of Technology, Akashi College | Kengo Maruya<br>Moriyoshi Watanabe<br>Keiichi Kanda | Study on the performance of bamboo charcoal as water purification material |
| 36 | National Institute of Technology, Akashi College | Junta Nishio<br>Yoshihiro Okamoto<br>Keiichi Kanda | Study on Bed Variation Management by groin at the Confluence of Kako and Mino River |

01

## *Device control system using the image recognition*

Kaito Aoki*, Fumihiko Ishida

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Our life is surrounded by many information systems because of the recent improvements in Information Technology. However, we must train to adapt to each system and its interaction to use it. The purpose of this study is to remove the digital divide which arises in the above process by creating system between human and information system which don't need special training. The proposed system is as follows. The system recognizes an object such as an information device from a webcam and display information related to the object. And then, we can control the object by a motion of the wrist. In our prototype system, we used the algorithm YOLO (J Redmon) for recognizing an object and the armband form sensor Myo (Thalmiclabs Inc.) for detecting user's wrist motion. We could control the TV and room light from this system by combining infrared communication with Arduino. We plan to integrate web information and voice control system into our system for more flexible controllability and operability.

02

## *Atmospheric pressure decomposition process of Epoxy resin for CFRP by applying Low frequency oscillatory stress*

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Carbon Fiber Reinforced Plastics has been widely used as structural materials because of its relatively high strength, high tenacity and thermal and chemical resistances. On the other hand, it has been thought to be difficult to recycle CFRP by using chemical decomposition process of epoxy resin because of high stability against chemical agents of the epoxy resin and its high adhesion ability with Carbon fibers. Therefore, in this study, chemical decomposition reaction of epoxy resin has been carried out under atmosphere pressure by applying relatively low frequency oscillatory stress to the sample in order to increase inertial energy of the resin and accelerate the decomposition reaction speed.

As a result, it is shown that the efficiency of chemical decomposition tends to be slightly increased in comparison to the reaction condition without applying oscillatory stress.

03

## *Adsorption of ammonia gas by fluorapatite (FAp) derived from calcium phosphate (DCPD) and fluoride*

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Hydroxyapatite (HAp, $Ca_{10}(PO_4)_6(OH)_2$) adsorbs various gaseous chemicals, and widely used adsorbent for improvement of the indoor environments. We have investigated utilize DCPD ($CaHPO_4 \cdot 2H_2O$) for precursor of FAp ($Ca_{10}(PO_4)_6F_2$). DCPD is obtained as bi-product from gelatine production from caw bone. Utilize of DCPD from various industries seems to be useful for waste management.

In this presentation, adsorption property of FAp derived from DCPD was investigated. DCPD was used bi-product from gelatin industries in this study. FAp was prepared by reaction of the DCPD in an aqueous solution containing 20 mg/dm$^3$ of fluoride for 24 hours. Fifty milligrams of the FAp powder set into sampling bag and insert 3 dm$^3$ of 10 ppm ammonia gas. As comparison, HA prepared by conventional solution method was also used. HAp indicated adsorption property for ammonia, however FAp derived from DCPD indicated extremely remove rate and capacity.

From these results, FAp derived from DCPD and fluoride ions indicate extremely removal property against gaseous ammonia. Reaction of DCPD is utilize for waste water treatment. By using this result, fluoride in waste water is able to utilize as raw material for production of FAp and applicable to removal of malodorous substance.

04

## *Development of Wien filter for desktop-sized ECR ion source*

Hiroya Uyama*, Tatsuei Yamazaki and Toyohisa Asaji

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Demand of the power semiconductor devices is increasing rapidly in the automobile industry. Aluminum ion implantation has been used for its manufacture. However, the conventional ion implanter is difficult to install in the automobile factory because it is large and expensive. Our purpose is to develop a desktop-sized ECR (Electron Cyclotron Resonance) ion source using multiply charged ions. This study shows the mass separation and improved resolution of multiply charged ions by the Wien filter attached to desktop-sized ECR ion source. The Wien filter is called an $E \times B$ mass separator. The device separates multiply charged ions with mass-to-charge ratio by cross electromagnetic fields. Only the expective multiply charged ions pass through the device by keeping the magnetic field constant and changing the electric field. The electric field intensity of the Wien filter was set at 0 to 31 kV / m. As a result, we were able to mass separate monovalent ions. However, since we have found ions other than argon, we will use QMS (quadrupole mass spectrometer) to identify ion species. In the future, we aim to improve the resolution by weakening the magnetic field used for Wien filter.

05

## *Evaluation of boundary nonlinearity using ultrasound*

Yuki Ejiri and Hiroshi Shibata

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In recent years, research using nonlinearity of ultrasonic wave has been conducted for nondestructive evaluation. The nonlinear phenomenon is generated by a large amplitude ultrasonic wave in a defect or damaged part, to evaluate defects and damage from the characteristics of nonlinear ultrasonic wave reflected and scattered.
The purpose of this research is to evaluate internal defects using sinusoidal and chirp ultrasound.
The actual structure in the real world behaves nonlinearly as increasing the external load. If the load was large, linear analysis alone may make an erroneous decision. In this way, there is a phenomenon that can never be obtained by linear analysis alone, so nonlinear analysis becomes necessary. Meanwhile, as a remarkable nonlinear characteristic of a solid material detected by ultrasonic measurement, there is boundary nonlinearity due to cracks and contacts such as interfaces. It has been experimentally shown that a particularly large nonlinear phenomenon appears at the boundary nonlinear solid contact interface.
Therefore, in this study, FFT analysis is performed on ultrasonic waves passing through double contact interfaces sandwiching a thin film between metal blocks. The harmonic generation of frequency components of the incident wave is analyzed.

06

## *New electron withdrawing materials to improve the contact resistance of OFETs*

Mikiya Kato*, Tokichika Maruyama and Masakazu Yamagishi

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An organic field-effect transistor (OFET) is one of the important devices in industrial field because of its switching functionality. Carrier traps at the interface between an organic semiconductor and an amorphous insulator and contact resistance at the interface between an organic semiconductor and contacts interfere with the carrier conduction and degrade the performance of OFET. In this study, we developed two new electron withdrawing materials, 2,5-dialkyl-7,7,8,8-tetracyanoquinodimethane (alkyl-TCNQ), which should dope hole into organic semiconductors by charge transfer to fill the carrier traps. Decyl- and hexyl-substituted TCNQs, C10-TCNQ and C6-TCNQ, were synthesized via the same procedure. C10-TCNQ and C6-TCNQ had higher solubility in toluene than unsubstituted TCNQ. As a result of their application to rubrene OFETs, these TCNQ deposition layers between metals and organic semiconductor shift threshold voltage to the low voltage driving side. There was no significant difference in the shift amount of threshold voltage between them. The amount of charge transfer was not affected by alkyl chain length. Furthermore, both molecules improved the contact resistance of rubrene OFETs. These results suggest that alkyl-TCNQs serves as a useful hole doping material for OFETs and that they are able to be used in the solution process.

07

## *Study of hydrogen evolution from formic acid using metal nanoparticle catalysts*

Yuki Kitazaki*

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The securing of safe hydrogen source is one of the problems fuel cell development that is expected to be a future mobile battery. Formic acid is promising from the point of carbon offset as a hydrogen source. However there are two types of decomposition reactions in formic acid as follow equations (1) and (2).

$$HCOOH \rightarrow H_2 + CO_2 \qquad (1)$$
$$HCOOH \rightarrow H_2O + CO \qquad (2)$$

It has been reported that using palladium nanoparticle catalyst, the reaction of equation (1) proceeds selectively.[1)] In order to prepare a high active catalysts even used little amount of palladium, we have attempted that the optimum catalyst conditions for hydrogen evolution reaction from formic acid by changing the conditions such as metal amount, temperature and formic acid and sodium formate ratio. To alloy with other metals has been also tried.

1) F.-Z. Song, Q.-L. Zhu, N. Tsumori, Q. Xu, *ACS Catalysis*, 1509 (2015) 5141-5144.

08

## *Prediction of Material Removal Distribution on Surface Polishing Utilizing Magnetic Compound Fluid*

Toyoaki KINOSHITA[1], Tatsuya SHIMIZU[1],

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In this study, in plane surface polishing utilizing magnetic compound fluid, the purpose is to predict material removal distribution when applying DC magnetic field and pulsed magnetic field. The material removal distribution was obtained by applying measurement data of pressure distribution and velocity distribution of the machined surface to Preston's rule of thumb. In the DC magnetic field, the trends of the profile curve and its predictive curve were greatly different. On the other hand, in the pulsed magnetic field, two curves were showed a similar tendency and material removal distribution was found to be predictable.

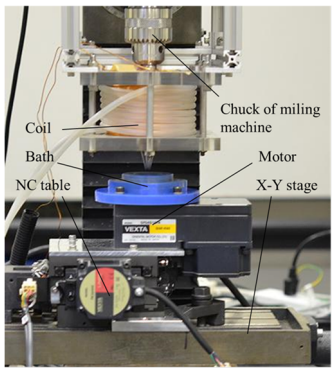


Fig.1 External view of Experimental Setup

09

## *Development of an Intuitively Intelligible User Interface for a Remote Control Mobile Robot*

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It is so difficult for unskilled operators to operate a remote placed mobile robot while looking only robot's camera images. That is caused by not enough situation information which the operator can grasp from robot's camera images. Therefore, the operator has to grasp the robot's status and its around environment, as much as possible for operating the robot in safety. The target mobile robot in this study has main crawlers and sub crawler arms, and an omnidirectional camera and an IMU sensor. I developed a UI (User Interface) that enables the operator to grasp the robot's posture, arm angles, and its around environment intuitively. The developed UI displays the robot's posture and arm angles status via not only numerical values but CG figures because the operator can't grasp enough the status by the camera images. In addition, for a purpose to help the operator grasping a positional relation between the robot and environment, the UI can show a bird-eye's view robot image looking it down from right overhead by camera image processing. The results of evaluation test have shown the developed UI gave operating performance gains for unskilled operators.

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## *A Gaze Estimation Method based on Voltage-Ratio of EOGs*

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Electrooculography, an electrooculogram (EOG)-based technique for estimating gaze direction, is a simple technique based on the principle that the difference in electrical potential between two points around the eyeball and direction of gaze can be linearly approximated. However, because the electrical potential of the eye changes over time, independently of eye movement, a phenomenon called 'drift' occurs, where the relationship between the electrical potential and gaze direction changes, compromising the accuracy of electrooculography in estimating gaze direction. In order to reduce the effect of drift and improve the accuracy of electrooculography, we use a method for estimating gaze direction from the voltages from more than three electrodes, which is based on the linear approximation of the voltage ratio, an index independent of any changes in the electrical potential of the eye without movement. Now, we plan to conduct an experiment with human participants to validate the effectiveness of this method of gaze direction estimation for practical use.

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## *Fabrication of $Cu_2O$ thin films by Mist CVD method*

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Compound semiconductors have been widely used in variety of optoelectronic devices. At present, phosphide and nitride are used to luminescent material such as photoelectric transducers, light emitting diode (LED) and thin film solar cells. On the other hand, oxide exhibit relatively high stability in the atmosphere, the advantage of abundant resources and lower costs. Therefore, using oxide semiconductors are environmentally friendly.

However, most oxide semiconductors have wide energy band gap, oxide semiconductors were hardly used in the visible region. Among oxide semiconductors, $Cu_2O$ is p-type semiconductor and narrow band gap. In this research, we fabricated a $Cu_2O$ thin film by using ultrasonic spray-assisted mist chemical vapor deposition (mist CVD) method, which is simple apparatus and can be applied under atmospheric pressure.

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## *Production of High Purity Mg-Zn Alloy Sheet by Vacuum Distillation and Extrusion*

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Recently, magnesium alloys are increasing mainly in products molded by die casting method. This is because it is light weight, so it can be used for many purposes. Since magnesium is bioabsorbable, it is expected to be applied to biomaterials. However, commercial magnesium has poor corrosion resistance and low strength, so magnesium alloy of high purity and high strength is required. By using vacuum distillation and extrusion with AZ91D magnesium alloy (Mg-9.1%Al-0.68%Zn) as raw material of vacuum distillation, strength can be improved. Therefore, in this study, production of magnesium sheet by vacuum distillation and extrusion was studied. Extrusion was carried out at 325℃,350℃,375℃,and mechanical properties were investigated.

High purity Mg-Zn alloy sheet was made by vacuum distillation and extrusion from ZK60 magnesium alloy (Mg-5.1%Zn-0.57%Zr). The ultimate tensile strength of extruded material shows about 250MPa. The Vickers hardness of the extruded material was 60HV. The corrosion resistance of the extruded material was worse than that of the raw AZ91D magnesium alloy.

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## *Production of High Purity Magnesium by Vacuum Distillation*

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Magnesium is expected to be utilized in the medical field because of the characteristic that it is excellent in bio absorbability. The purity of commercial available magnesium is about 99.9%, and impurities such as iron are contained, and corrosion resistance become bad. High purity magnesium is required for long period use in the body.It is considered that high purity magnesium can be produced by vacuum distillation . Pure magnesium causes a sublimation phenomenon when heated at a vacuum of 333 Pa or less. Therefore, there is a method of covering aluminum foil in pure magnesium of raw material for and vacuum distilling. Thereby, sublimation phenomenon can be prevented.Further, by making the raw material into a granular form, the evaporation rate and recovery rate can be greatly improved. However, the obtained magnesium deposit had variability in purity. Therefore, in this study, the purification of magnesium by vacuum distillation was investigated using granular magnesium as a raw material. By increasing the aluminum foil, it did not contaminate other than zinc. The evaporation rate was 98% on average. The recovery rate was 85%.

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## *Dechlorination reaction of chlorine-substituted aromatic compounds by electroorganic method*

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Because some dioxins are known to have strong toxicity, there have problem that it is dangerous to the human body. Hence, degradation methods of dioxin are needed for the society. However, dioxins have chemical stability and flame retardant. There are known that those cause are dioxin's chlorine. Now the major dioxin degradation methods involve the use of high temperature processes or risky reagents such as supercritical water. Dioxin have another problem that high temperature is required for decomposition. If we can remove chlorine atoms in advance, the problems can solve. Our study's objective is industrialization of electrochemical dechlorination reaction process which is an environmentally conscious method. In this study, we examined the dechlorination reaction of *p*-*tert*-butylchlorobenzene as a model compound of dioxins under the condition of NMP-$H_2O$(5-0.07 mL), zinc electrodes, 10V, electrolyte *n*-$Bu_4NClO_4$ and 40℃(87% yield). The reaction proceeds even if a carbon electrodes are used. For the purpose of industrialization of electrochemical dechlorination reaction process, we report here the result of a variety of reaction conditions and trying the scale-up.

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## *Numerical analysis of polishing pressure distribution on surface polishing with a magnetic compound fluid*

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The micro polishing method for small and complicated mold is required in various industrial fields. It is considered that polishing utilizing the magnetic compound fluid would be able to apply those molds. In this method, estimation of the material removal distribution from tool shape is an important issue. The material removal distribution is expected to be calculated by the product of the polishing pressure and the speed of the abrasive grain on the workpiece surface. Therefore in this study, the main purpose is to clarify the relation between polishing pressure distribution analyzed by FEM magnetic field analysis using virtual displacement method and profile curve obtained by polishing experiment. Consequently, it is concluded that the profile curve would be predicted by polishing pressure using FEM magnetic fields analysis.

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## *Soft Magnetic Characteristics and Exchage-coupled Dual Layered film*

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The exchange magnetic anisotropy is a phenomenon in which the magnetic hysteresis curve shifts asymmetrically in the exchange-coupled magnetic dual-layered film. In order to clearly express and investigate this phenomenon, it is necessary to have sufficient soft magnetic characteristics for the ferromagnetic thin film constituting the dual layered film. In this study, thin films were fabricated by using an RF-magnetron sputtering apparatus with a NiFe alloy target having almost soft magnetic characteristics. The sputtering conditions of the sample and the magnetic characteristics measured using VSM (vibrating sample magnetometer) were compared to obtain soft magnetic characteristics. Then, by combining the prepared soft magnetic thin film with an antiferromagnetic thin film which was separately studied, we aimed to fabricate exchange-coupled magnetic film. As a result, by controlling the composition of the NiFe alloy at the time of sputtering, corresponding to the direction of the applied magnetic field was confirmed and good soft magnetic characteristics could be obtained. However, although the antiferromagnetic film and the soft magnetic film prepared respectively were combined, it did not exibit the shift of the magnetic hysteresis curve.

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## *Possibility study of a shape variable type gamma camera with umbrella-like configuration*

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Due to the accident after the Great East Japan earthquake (March 11, 2011), radioactive substances are distributed inside and outside the Fukushima Daiichi Nuclear Power Station. In order to smoothly remove them, it is necessary to identify contaminated point. For that purpose, gamma camera is required which has a compact shape when it moves through narrow areas and changes its shape into that satisfying the performance at the time of measurement. In this research, we study the possibility of compact, lightweight Compton camera with umbrella-like configuration.

To evaluate its possibility, simulations and measurements have been carried out. Scintillation detectors composed with 1 cubic centimeter of GAGG($Gd_3Al_2Ga_3O_{12}$) were set on two umbrella-like structures. From the calculations with the radiation simulation code: EGS5, it has been shown that the system can work as a gamma camera. However, from the preliminary experiments, the measured angular resolution was worse than the simulated results. By carrying out further studies to explain the discrepancy, we will optimize its design to meet the requirements to be used at the reactor site.

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## *Tetrahedral Organ model in Geant4 Based Particle Therapy Simulation Framework*

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In order to ensure patient's safety and effectiveness of treatment plan, reliable Monte-Carlo simulation is essential for dose calculation in radiation therapy. The simulation needs a computational model of human body for practical studies of patient dose. Because of easy implementation and tolerable computational efficiency, voxel model has been so far employed for this purpose. However, tetrahedral model is more suitable for representing conformal structure of patient organs. In this presentation, we report on the implementation of tetrahedral organ model in Geant4 based particle therapy system simulation framework (PTSIM). The implementation has successfully demonstrated to construct several types of organs. The performance in the tetrahedral model was evaluated by comparing with that in the voxel model. We report the performance on the computational efficiency and memory usage.

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## *On a predicting system of swells in Toyama Wan*

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The large swells invade Toyama Wan from October to April every year, and it cause wave disasters around Toyama Wan. The swells have troubled the people since long ago, and therefore the people around Toyama Wan named the swells "Yorimawarinami" more than 150 years ago, in order to warn of them.

After 1970, the large wave disasters have occurred on the coast of Toyama Wan with a period of about 10 years, for example, ship dragging anchor and grounding. Therefore, it is very important to predict the swells exactly in order to prevent wave disasters. Currently Toyama Local Meteorological Office predict them in Toyama Wan using numerical wave prediction model, but it is difficult to predict them with high reliability.

It was proposed of a system to predict the swells till a few hours before surging on the coast of Toyama Wan by catching them off the apex of Noto Hanto with a wave meter and a radar. It was suggested in this paper that an observation system combined of a wave meter and a radar is available to catch swells in a coastal water.

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## *Analysis on optical path of Doppler signal from circular pipe in case to use multipoint laser Doppler velocimetry*

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The purpose of this study is to develop the device for measuring the flow rate in a circular pipe by using multipoint laser Doppler velocimetry (MLDV). As the basic principle of laser Doppler velocimetry (LDV), the laser beam is divided into two beams, and intersected using a combination of lenses. Interference fringe patterns are formed in this intersection point, and can be operated as measurement region. When the particles are passing through this interference fringe patterns, the scattered lights are emitted. The scattered light is receiving by the optical fiber via two-convex lenses. When the interference fringes are set in the flow field, the movement velocity of the particle following the flow can be measured from scattered light.

In this poster presentation, we reported the results of analysis on optical path of Doppler signal from circular acrylic-pipe in case to use MLDV. In the results of analysis, the relationship between receiving position of scattered light and emitted position in circular pipe was clarified by Snell's law. This result will be useful to develop the flow-meter in circular pipe using MLDV.

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## *Application of Virtual Reality Technology in Maritime Education*

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A new personal training system for maritime education using VR (virtual reality) technology are being developed in this research. This personal training can be supplementary of onboard trainings of maritime colleges. The first step in this development is to record scenes of group work on the training ship "Wakashio-Maru", from each person's point of view, by using omnidirectional cameras fixed to the helmets. The second step is to provide information for learning about the roles and the procedures of each person in the group work, by using superimposed annotations, notes, illustrations and animations. The third step is to build a system that enables one to observe the recorded scene and read the provided information freely and flexibly, by using head mounted displays. The educational effect of this new system is going to be verified by questionnaire survey.

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## *Transmitting Timing Calculation Unit with CPU on FPGA for QZSS Short Message SS-CDMA Communication*

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We have proposed synchronized Spread-Spectrum Code-Division Multiple-Access (SS-CDMA) communication for location and short message communication system using Quasi-Zenith Satellite System (QZSS) as a safety confirmation system at the time of grade disaster. In the previous research, we have constructed a transmission timing control system for realizing synchronous Spread-Spectrum Code-Division Multiple-Access (SS-CDMA) communication used in this communication system. Although the system was constructed using the Micro Control Unit (MCU) and Field Programmable Gate Array (FPGA), it is necessary to consider SoC implementation of the system for improving the operating frequency and downsizing. Therefore, we construct transmitting timing calculation unit by FPGA which is implemented Central Processing Unit (CPU) core. The constructed CPU core can be handled almost in the same way as a normal microcomputer. As a result of the evaluation, it is found that the constructed CPU core as a foothold in SoC implementation of the transmission timing control system.

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## *2D/3D facial recognition system using Xtion*

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Our laboratory is developing a virtual interview system (VIS). In VIS, using a motion capture device to evaluate the students' gestures and facial expressions. VIS needs teachers to take attendance and help students to login. Therefore, we are developing facial recognition system. This system uses Xtion PRO LIVE in consideration of the capability, affordability and ease of use. In this system, recognition accuracy is improved by using 2D facial recognition and 3D facial recognition together. For matching, we employ a facial edge from the facial image for 2D recognition, and a facial mask from the depth information for 3D recognition respectively. Index in matching facial mask is a mean distance per pixel. Index in matching facial edge is an area (pixel) of overlap. In the evaluation of accuracy, we prepared 200 images of respectively taken from 40 subjects with 5 shots each. A set of pairs existing in the overlapped distribution in each result (distance of facial mask and area of facial edge) is independent. Therefore, when used in combination, mask matching and edge matching is very effective to improve the recognition rate.

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## *Construction of Hazard-Map Utilization Support System by Using Open-Data*

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Recently, large-scale disaster such as the Great East Japan Earthquake, Western Japan heavy rain and Hokkaido Eastern Iburi earthquake have occurred. Confirmation of hazard-map is recommended for disaster prevention although it is not used much. Therefore, we propose hazard-map utilization system by using open-data and position information. This system is registered by linking position information and hazard information such as inundation depth during flooding, sediment disaster, and evacuation facilities. Users can get hazard information in the neighborhood by sending position information from the mobile terminal to the server. The hazard information to be registered uses open data released by the Geographical Survey Institute. It is constructed as a web application so that users can easily access it. In conclusion, we constructed hazard-map utilization support system and confirmed that users can get hazard information based on position information in field experiments.

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## *Study of the Influence of an Obstacle on the Evacuation Behavior by Multi-Agent Simulation Considering Intimate Space*

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In this study, we constructed a continuous space simulation model for an evacuation in which the evacuees are represented by agents. The agents are designed to be self-driven and have intimate spaces around their bodies. An agent recognizes an exit and drives itself towards it while maintaining its distance from other agents. When a bottleneck occurs around an exit, the intimate space around the agent is reduced into its body and the agent can drive itself through the bottleneck to the exit. Using this model, we examined the influence of the placement of an obstacle on the outflow of the evacuees. The results suggest that the best position of an obstacle depends on the size of the exit.

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## *Development of estimation system for COD concentration in water*

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An estimation system for a COD concentration in water was developed by colorimetric method. COD is the amount of oxygen required for decomposition of organic matter in water, and it is used as an indicator of water contamination. A method for mechanical color judging is required in the system because the measurement using the colorimetric method is simple but generally differs sight of color depending on the person. External lights and shadows also affect the judging, that's why the estimation results will include large errors. The system were classificated a concentration and achieved 96% validity for accuracy with a neural network system. The validity of learning was confirmed by visualization of feature quantities. Estimate the concentration with the Android application connected to neural network and collect it along with the location information. By analyzing visualization result of incorrect answer image in outdoor, further accuracy improvement can be expected.

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## *Construction of a Precipitation Classification System using Vertical Doppler Radar*

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Due to recent climate change, natural disasters involving torrential rain and heavy snowfall are steadily increasing; therefore, it is becoming increasingly important to accurately estimate precipitation intensity using weather radars. The scattering properties of particles drastically vary depending on precipitation particle type. A means by which precipitation classification can be conducted through observation data measured by weather radars is needed. In this study, we constructed a system based on neural networks that classifies precipitation particle types. The system handles Doppler spectra observed by a vertical pointing Doppler radar as input data and the type of precipitated particle that includes both liquid (Drizzle, Drizzle with Rain, and Rain) and solid (Snow and Graupel), based on ground observations, as a teacher signal. We indicate the F-measure measured by the classification system can be 0.915.

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## *Peak efficiency calculation of the high purity Ge detector by Monte Carlo simulation*

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High purity Ge detector is used to measure gamma rays' energy spectra. Each count rate of full energy peaks is used to determine the radioactivity. There are two methods in activity measurement. The relative measurement requires standard sources, whilst the absolute measurement can determine the activity only from the count rates of a sample. The modified sum-peak method[1] is an absolute measurement and applicable to the sample containing multiple nuclide. Our research aims to verify the modified sum-peak method by Monte Carlo simulation. To confirm the reliability of our simulation, the counting efficiency by our simulation was compared with that by the measurement. The preliminary result shows that the counting efficiency of our simulation is consistent with the measurement within 10 %.

[1] Y. Ogata, et al., Nuclear Inst. Meth. Phys. Res. A, 775: 34-40; (2015)

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## *Recommendation for compact city policy of Takaoka city, Toyama prefecture*

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In recent years, local cities in Japan have various problems such as the arrival of super aged society, disorderly expansion of urban areas and suburbs, decline of central urban areas, environmental problems and so on.

There is "compact city policy" as a measure against these problems. It is a policy that keeps the town compact, develops public transportation, and creates bustle. It is promoted in 384 cities in Japan. Takaoka city of Toyama prefecture is one of them. Takaoka city has three problems. ① Lack of young people in industry ②Decline of central city area ③Declining convenience of residents in the suburbs

I think that policies focusing on "young people", "travelers" and "residents in the suburbs" are necessary to solve these problems.

As examples of compact city's advanced examples, I picked up Toyama City in Japan, Utsunomiya City in Japan, Strasbourg in France and Freiburg in Germany. In each area, unique policies such as youth migration project, transit mall, park and ride were seen.

These policies are key to the compact city that will attract young people and tourists, residents in the suburbs. That is the Recommendation for compact city policy of Takaoka city.

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## *Effectiveness of personnel management that fulfill the instinct of understanding.* *

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Recently, the number of the job application of a private enterprise is showing a tendency to rise. In short, both new graduate student and people who change jobs can find a job application of company that fit themselves. According to a survey conducted by Mynavi, the purpose of working and motivation divided into two, salary or work worth doing. So, company have to give employee suitable incentive, and personnel management may be divided into two.

This research will examine existing two ways of personnel management in company, one of way that fulfill the instinct of understanding is effective.

In more detail, there are two types. One is the personnel management that give incentive such as ostensible reward for the employee who strongly has the instinct of acquisition. The other is the personnel management that give incentive such as internal reward for the employee who strongly has the instinct of understanding.

I will examine the hypothesis from a case study. In the case of the company that gives the employee the internal incentive, for example; philosophy incentive and self-actualization incentive have many employees who strongly have the instinct of understanding. Then, they can satisfy a desire of motivation factor.

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## *A survey of process of creating foreign repeat visitor*
## *-Focus On Snow Resort-*

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The paper describes the process that is creating repeat visitor in snow resorts by customer satisfaction.
Recently, foreign visitors have been increasing in Japan. In tourist site, Promotion for repeat customers is cost-effective, so tourist site need to get repeat tourists. When customers are satisfied, they repeat.

Also, especially, some snow resorts get a lot of foreign repeat visitors and customer satisfaction level is very high. By deriving a consumer satisfaction factor of a foreigner tourist at a snow resort, it's also possible to utilize for other local tourist sites.

The purpose of this study is to describe process that is creating repeat visitor in snow resorts by customer satisfaction. This research uses the expectation disconfirmation theory by Richard L. Oliver.
In snow resorts, when three factors that are "lodging" "sightseening" "eating and drinking" are better than customers expectation, customers are satisfied with the tourist site and they become repeat visitor.

From now on, survey the opinions of foreign visitors, and deepen this research.

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## *Marketing Strategy of BOP Business* *

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The purpose of this research is to clarify what type of business is needed in the BOP (Base of the Economic Pyramid) market. Since the Japanese economy is shrinking as a result of the aging population, it is reasonable for businesses to target the market, which is often found in the emerging economies in developing countries, in an effort to expand their business globally.

The method of this research is through referring to related papers, articles, books, and field studies in Thailand. The reason why I choose the country is that it has been one of the most industrialized economies in the South East Asia and has attracted a number of Japanese companies, which therefore leads to an assumption that more BOP business activities can be found there.

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## *Encrypted Control System: Theory and Applications*

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Cybersecurity of control systems has recently attracted attention in the industrial sector as well as other business areas because an attacked control system results in a heavy incident in physical space. However, many control systems have no sufficient security measures compared with information equipment. Meanwhile, a security enhancement method for the control systems which is based on controller encryption using homomorphic encryption scheme has been proposed. The encrypted controller calculates inputs into a plant from encrypted signals and encrypted gains without decryption. Therefore, the attackers cannot eavesdrop the controller parameters and the signals even if they invade a computer conducting control operation. Additionally, the controller encryption method is implemented easily because this method is specialized for control systems. In the presentation, we will present an introduction to the theory of controller encryption and some applications.

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## *Study on Acute Toxicity Test for Soil Spraying Agent using Eisenia fetida*

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Humans are using various chemical agents in nature to improve the safety and convenience. To clarify toxicity is important to avoid the risk to humans. On the other hands, Literature of investigated the impact and risk to the soil organisms are less.So, We conduct investigation followed OECD test guidelines of acute toxicity using earthworm ( Eisenia fetida) . The subject agents in this study are two types, snow melting agent (calcium chloride) and anti-freezing agent (sodium chloride). Our lab performs acute toxicity test on chemicals in soil spray materials. The number of survivors and weight loss after 7 days and 14 days were measured, and the half lethal concentration LC50 was calculated based on the survival number after 14 days. In addition, the soil pH transition was also measured to verify the influence by pH. As a result, the LC50 of calcium chloride was found to be 9.01 (g / kg). Also, the soil pH transition was minute, it could be considered that agent action by calcium chloride was the main cause of death. In the future, we will conduct the same trials on sodium chloride. Also, we will compare actual usage to experimental results and examine safety.

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***Study on the Performance of Bamboo Charcoal as Water Purification Material***

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At the waterway in the park of Kakogawa City, Hyogo prefecture, local residents and Akashi National College of Technology have installed water purification materials of bamboo charcoal. Until now, we have conducted field observation in this waterway and laboratory experiment in order to reveal the removal performance of bamboo charcoal. Field observation is conducted monthly and water quality improvement effect could not be confirmed, but in the laboratory experiment, removal of organic matter (BOD) could be confirmed. In this study, we purpose to estimate the water purification effect of bamboo charcoal installed in the waterway and clarify the removal performance against inorganic matter (nitrogen, phosphorus) and turbidity of bamboo charcoal. In the experiment, 2 kilograms of bamboo charcoal packed in a cylindrical acrylic pipe is passed through the water of the river, then nitrogen and phosphorus of the inorganic matter after passing are measured. As a result of this experiment, when water passed through bamboo charcoal, the nitrogen concentration increased or decreased, and the phosphorus concentration increased. This is thought to be caused by organic substances being decomposed into inorganic substances. Therefore, we will conduct the experiment using water free from organic matter in the future.

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***Study on Bed Variation Management by groin at the Confluence of Kako and Mino River***

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The Kako River flows through Hyogo Prefecture in Japan. At the confluence of Kako and Mino River, due to the meander in the river upstream, barrage water from the large barrage on the Kako River (Kakogawa Barrage) and the Mino River tributary, has promoted the development of a sandbar on the right bank. The sandbar, which has enlarged and become fixed, currently deflects the passage of water back to the left bank and has decreased the usable water surface area.To wash away the sandbar, the groin was installed in 2015. The purpose of this study was to survey the river topography near the Mino River confluence and identify the factors responsible for sandbar development by using model experiments and numerical analysis. In addition, the function of the groin was verified. Movable-bed modeling of the channels at the tributary junction was performed to assess the influence of the barrage water and the river meander upstream on river flow, and to observe the flow and the change of elevation characteristics at the junction and their influence on river topography. The numerical calculations were analyzed using Nays2DH (iRIC, 2014) to verify the experimental results and to investigate how they can be applied.

# *Meeting on the Research Achievements in National Colleges*

発表タイトル*：2 cm 以下の電気伝導度センサを複数用いた土壌肥料拡散係数の推定

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発表概要 ：

現在、高付加価値な作物を生産できる施設園芸が盛んに行われている。施設園芸の課題として、過剰施肥による地下水の汚染などがある。過剰施肥を防ぐため、肥料の効率的な供給が研究されている。効率的な肥料の供給のためには、土壌中の肥料移動を連続測定することが不可欠であるとされている。土壌中の肥料移動および作物の養分吸収において、土壌の養分拡散が重要である。拡散の大きさを示す指標として拡散係数がある。拡散係数の算出は 2 cm 以下の肥料分布変化を測定する必要があるが、従来の土壌を採取して拡散係数を算出する方法では、現場で非破壊的に連続測定することができない。本発表では、土壌肥料の拡散係数を、施設園芸の現場でリアルタイム算出することを目的として提案した、電機伝導度 (EC) センサを複数用いて測定した土壌の EC 分布と、フィックの法則から算出した EC 分布を比較することで、土壌肥料の拡散係数を推定できる方法について紹介する。

発表タイトル*：在宅 COPD 患者の QOL 向上を目指す遠隔支援システムの構築

発表者所属・職・氏名：富山高等専門学校一般教養科・准教授・大橋千里

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発表概要 ：

慢性閉塞性肺疾患（以下 COPD）患者は、呼吸困難や急性増悪等の症状により日常生活において身体的な制約が起こる。それにより抑うつ傾向などの心理的障害や社会的不利などの QOL の低下を引き起こす。そこで本研究では、在宅 COPD 患者の運動耐容能と QOL の向上を支援することを目的とした遠隔身体活動支援システムを構築する。このシステムは、患者の日常の身体活動状況をスマートフォンで測定し、その経過を医師や訪問看護師等がモニタリング、フィードバックを継続的に行うことで在宅による包括的リハビリテーションを可能にする。そして将来的には遠隔医療支援により患者の病態の進展を抑制し、積極的な社会参加を促すことで QOL の向上やフレイルの予防を目指している。

ここでは、1 名の在宅高齢 COPD 患者を対象に遠隔による身体活動支援介入実験を行い、患者の身体活動状況と QOL 指数の側面からの実用性評価について事例報告する。

発表タイトル*：ナノ電荷分離構造を持つ半導体光触媒粒子による水分解および二酸化炭素還元反応

発表者所属・職・氏名：長岡技術科学大学 物質材料工学専攻(分析計測センター)・准教授・齊藤 信雄

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発表概要 ：

半導体光触媒を用いた水分解や二酸化炭素の還元は、光エネルギーを化学エネルギーに変換できる人工光合成技術として近年、数多くの研究がなされている。しかしながら、それらのエネルギー変換効率は低く、その原因として一つとして光励起電子とホールの再結合が挙げられる。本研究では再結合を抑制できるナノ構造を粒子表面に付与し、光触媒活性を向上させることを目的にした。数百ナノ nm の半導体粒子表面に数十 nm の金属酸化物を高分散担持した後、焼成あるいは液中レーザーアブレーション処理により固相反応を進行させ、表面にナノ構造を作製した。粒子表面を FESEM/EDS/EBSD および STEM/EDS で観察し、それらの組成およびモルフォロジーが光触媒活性に及ぼす効果を調べ、表面に形成した異なる半導体の界面が光励起電子とホールを分離するサイトとして働き、再結合を抑制することにより高い光触媒活性をもたらすことを見出した。

発表タイトル*：近接気化型 CVD 法による薄膜の合成

発表者所属・職・氏名： 福井工業高等専門学校 物質工学科・准教授・西野純一

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発表概要 ：

近接気化型化学気相析出（NV-CVD）法は，酸化亜鉛を低温で作製することが可能で，その構造は，非常に単純で基板加熱の放射熱を利用して原料の金属錯体を気化させるため一般の CVD 法で用いられるキャリヤーガスを加熱する必要がなく省エネルギーであるという特徴を持つ．本研究では ZnO 膜の作製における原料気化の影響を調べるため，大気雰囲気下でファイヤーロッド・カートリッジヒーターを加熱源とする NV-CVD 装置を用い，Si(100) 単結晶を基板とし原料のビスアセチルアセトナト亜鉛[bis(2,4-pentane-dionato) zinc, $Zn(C_5H_7O_2)_2$]を析出途中で継ぎ足すことにより ZnO 膜の析出を試みた．XRD の結果, 大気雰囲気下で合成した薄膜は，ZnO と Zn の混相よりなっていることがわかった．このことは，真空を用いない大気雰囲気下で金属 Zn 膜合成の可能性があることを示唆する．

発表タイトル*：マグネシウム合金の応力腐食割れ

発表者所属・職・氏名：高知工業高等専門学校ソーシャルデザイン工学科・准教授・奥村勇人

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発表概要 ：

マグネシウムは、実用金属材料中最も軽量で、高い比強度および比剛性を有することから、輸送機器の軽量化を促進させる材料として注目されている。輸送機器の軽量化は、燃料(ガソリン，電気および水素)に関わらずその消費量を削減し、充填時の航続距離を延ばし、$CO_2$排出量を抑制する。しかしながら、マグネシウム合金は、塩素イオンおよび酸の存在する雰囲気では耐食性が悪いという欠点があり、室内空間で使用する構造材料への適用が多い。そこで、応力が生じる部材でかつ自然環境でのマグネシウム合金の適用を拡大できるよう、応力腐食割れについて実験を行った。現在までに様々な研究者らによって応力腐食割れの研究が行われているが、ごく一般的に利用されている AZ91D，AM60B および AZ31 合金から行った。これらの結果から、応力が負荷されない条件では、最も耐食性の良い AZ91D 合金が応力腐食割れし易いことがわかった。

発表タイトル*：超高純度マグネシウムの開発に関する研究

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発表概要　：

マグネシウムは資源が豊富で、軽量で、リサイクル性に優れていることからさまざまな用途への展開が期待され、特に医療材料への展開が期待されている。しかしながら、燃えやすい、腐食しやすい等の問題により、限られた用途になっている。マグネシウムは蒸気圧が高く、元素間の蒸気圧差を利用した真空蒸留法によりマグネシウムの高純度化を行い、耐食性を高めることができ、得られたマグネシウム凝縮物で塑性加工を行うことにより、燃焼の恐れがなく、機械的特性に優れた高純度マグネシウム板材の作製が可能である。

そこで本研究では、真空蒸留・塑性加工法により純度 99.999%以上の超高純度マグネシウム板材を作製し、特性の検討を行っている。

発表タイトル*：生分解性キレート剤による水溶液内化学反応に基づく土壌洗浄技術の開発

発表者所属・職・氏名： 茨城工業高等専門学校国際創造工学科(化学・生物・環境系)・助教・澤井光

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発表概要：

エチレンジアミン四酢酸（EDTA）に代表されるアミノポリカルボン酸系キレート剤は，水溶液中で金属イオンと安定な水溶性錯体を形成し，難溶性の金属塩を溶存態へと強力に変換する。一方でキレート剤は腐食性や毒性を持たないため，鉛やヒ素などの重金属に汚染された固体廃棄物の浄化剤としての応用が期待される。特にアミノ酸骨格などを有する生分解性キレート剤は，環境残留性が少なく薬剤による二次汚染を防ぐことができる。本研究では，生分解性キレート剤を活用する固体廃棄物の化学的湿式洗浄（キレート洗浄）の開発を行っている。たとえば琥珀酸系の骨格をもつ生分解性キレート剤は，汚染土壌中の鉛やヒ素の除去に効果を示し，特に溶出可能性の高い化学形態（炭酸塩吸着態）の汚染物質を選択的に除去可能であった。このことから本法は，溶出量基準のみを超過するような自然由来の低レベル汚染土壌に適している。

## *スマートフォン、タブレットによる環境測定技術*

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色の濃淡で濃度を判定できる比色法は、測定装置を必要としないことからコストパフォーマンスが高く、その場で結果が得られることから、有効な環境分析法の一つとして広く利用されている。しかしながら、この手法は求められる感度を有しておらず、測定結果が測定者の色覚の強弱に依存することから測定結果の信頼性が低い。近年では色の濃淡から濃度を測定する装置が開発、市販されているが、計測コストを大幅に上がることが問題となる。本発表では、高性能かつ簡易な環境分析技術の構築を目的に、これまで取組んできたスマートフォンやタブレットを用いる環境測定技術について紹介する。