Monday, November 19, 2012, Auditorium Room, Centre for Life Science (CeLS), NUS	
08:45	**1. Opening Speech:** **Toward Application of Engineering to Medicine, and Food Manufacturing** Prof. Renshi Sawada Kyushu University, Japan
09:00 to 10:45	**2. Invited Talk:** **Introduction of MEMS activities at AIST - MEMS for Green and Life Innovation** Prof./Dr. Ryutaro Maeda Advanced Institute of Science and Technology (AIST), Tsukuba, Japan **3. Talk:** **Research on a Biological Condition Analysis Based on The MEMS Blood Flow Signal** Terukazu Akiyama, and Renshi Sawada Kyushu University, Japan **4. Talk:** **Characteristics and Applications of Microsensor Measuring Linear Movement and Inclination Around Two Axes** Toshihiro Takeshita[1], Takuma Iwasaki[2], Hideyuki Ando[3], and Renshi Sawada[1] [1]Graduate School of Systems Life Science, Kyushu University, Japan [2]Department of Mechanical and Aerospace Engineering, Kyushu University [3]Fuzzy Logic Systems Institute, Japan **5. Talk:** **Skin Blood Flow During Running in Different Running Speed** Wataru Iwasaki[1], Masaki Nakamura[1], Takeshi Gotanda[1], Eiji Higurashi[2] and Renshi Sawada[1] [1]Kyushu University, Japan; [2]The University of Tokyo, Japan **6. Invited Talk:** **Low-temperature Bonding Technology for Optical Microsystems Applications** Eiji Higurashi, Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Japan **7. Talk:** **Low-temperature Bonding of Laser diode Chips Using Atmospheric-pressure Plasma activation and Its Application to Micro Laser Doppler Velocimeter** Michitaka Yamamoto[1], Takeshi Sato[1], Eiji Higurashi[2], Tadatomo Suga[1], and Renshi Sawada[3] [1]School of Engineering, The University of Tokyo [2]Research Center for Advanced Science and Technology, The University of Tokyo [3]Department of Intelligent Machinery and Systems, Kyushu University **8. Invited Talk:** **Chemical Reaction in Microspace: Control of Chemical Reactivity by**

	Microfluidics Kenichi Yamashita Advanced Institute of Science and Technology (AIST), Japan
10:45 to 11:00	Break
11:00 to 13:00	**9. Invited Talk:** **Interaction Between Physiological Environment and Surface of Joint Prothesis – Effect on Friction and Wear** Yoshinori Sawae[1,2], Kazuhiro Nakashima[1,2], Seido Yarimitsu[2] and Teruo Murakami[2] [1]Department of Mechanical Engineering, Kyushu University, Japan [2]Research Center for Advanced Biomechanics, Kyushu University, Japan **10. Talk:** **Microscopic Structure Formation in Regenerated Cartilage Tissue Cultured Under Traction Loading** Keisuke Fukuda[1] and Yoshinori Sawae[1,2] [1]Graduate school of System Life Science, Kyushu university, Fukuoka, Japan [1,2]Department of Mechanical Engineering, Kyushu University, Japan **11. Invited Talk:** **Impulse-driven capsule for medical treatments** Prof. Takahiro Ito Kyushu Institute of Technology, Japan **12. Talk:** **Capsule Robot with Flexible Micro Arm for Intestinal Surgery** Phunopas Amornphun and Takahiro Ito Kyushu Institute of Technology, Japan **13. Invited Talk:** **Development of Ambient MEMS Devices ~ Networked MEMS and Large Area MEMS** Dr. Toshihiro Itoh Advanced Institute of Science and Technology, Tsukuba, Japan **14. Talk:** **Development of a Wearable Body Temperature Sensor for an Early Diagnosis System of Pneumonia in Cows** Hirofumi Nogami, Hironao Okada, Toru Miyamoto, Ryutaro Maeda, and Toshihiro Itoh, Advanced Institute of Science and Technology (AIST), Tsukuba, Japan **15. Invited Talk:** **Introduction of A MEMS Sensor for Healthcare Application** Noritomo Hirayama Fuji Electric Co., Japan **16. Talk:** **Application of ICT to Agriculture: Internet Control of Cattle Grazing in Mountain and Foothill Areas of Japan**

	Takafumi Gotoh[1], Tetsuji Etoh[1], Yuji Shiotsuka[1], Ryosuke Fujimura[1], Osamu Hirano[2], Makoto Maeda[2], Hiroyuki Terauchi[3], Hideyuki Otsuka[4], Yuji Maeda[5], Takeshi Nishidoi[6], Kaoru Yoko-o[6], Kazuhiro Suzuki[6], Shinji Sawane[6], Akira Muranishi[6] [1]Kuju Agricultural Research Center, Faculty of Agriculture, Kyushu University, Kuju, Japan [2]Intellectual Property Management Center, project Support Department, Kyushu University, Fukuoka, Japan [3]Panasonic Communications Co., Ltd., Fukuoka, Japan [4]MSK Agricultural Machine Co. Ltd., Kumamoto , Japan [5]NTT departments III, (R&D Strategy Department), Tokyo, Japan [6]Network Innovation Center, Fujitsu Co., Ltd., Japan **17. Poster Paper:** **Human Position Sensing with Meter-Scale Fabric Touch Sensors** Hiroko Tanaka1, Seiichi Takamatsu1,2, Takahiro Imai1, Takahiro Yamashita1, and Toshihiro Itoh1,2 Macro BEANS Center, BEANS Laboratory, Japan National Institute of Industrial Science and Technology, Japan **18. Poster Paper:** **Heterogeneously Integrated Bio MEMS Devices in the FIRST Project "Integrated Microsystem"** Yuri Kitajima, Toshihiro Kamei, and Ryutaro Maeda, National Institute of Industrial Science and Technology, Japan
13:00	**End of Workshop**

1. Opening Speech:

Toward Application of Engineering to Medicine, and Food Manufacturing

Speaker:

Prof. Renshi Sawada
Kyushu University, Japan

Abstract

This project has two targets:

1) Development of all-around MEMS blood flow sensor (BFS)
2) formation of Asian bio-industrial infrastructure centered at Singapore and Japan.

By combining optical MEMS and ultrasonic MEMS, a novel integrated micro BFS will be developed with capability of measuring blood flow in wide range of skin depth. The ultrasonic-micro BFS deploys piezoelectric suspended membrane and photonic-crystals-based acoustic lens to generate focused ultrasonic wave propagating to much deeper region. Meanwhile, this micro BFS can also detect the contact pressure in order to make sure the tight contact between skin and micro BFS in vitro animal testing and can make the livestock insensible to the existence of the sensor and reduce the mental stress in mounting.

It is expected that the world's population is growing rapidly, and only senior citizens (elderly people over the age of 65), have increased significantly in Japan. We have to accelerate the development of medical devices, healthcare equipment, and high-quality agricultural and livestock products, and develop into global market for them.

This project is expected to contribute to the foundation of industrial base for developing into global market by using the bio-electronic devices.

Renshi Sawada

Professor
Life Science Institute
Department of Mechanical Engineering,
Kyushu University, Japan

Biography

Renshi Sawada received the B.E., M.E., and Ph.D. degrees from Kyushu University, Fukuoka, Japan, in 1976, 1978, and 1995, respectively. In 1978, he joined the Electrical Communication Laboratories, Nippon Telegraph and Telephone, Tokyo, Japan, where he was engaged in the research on the polishing of Si substrates, gettering of Si crystalline defects, fabrication of dielectrically isolated Si substrates (silicon on insulator substrate process), and optical microelectromechanical systems, such as micromirror array, integrated optical displacement sensors, integrated optical blood flow sensor, integrated scanning microscope, and sensors attachable to animals and humans for network. Since January 2004, he has been at Kyushu University, Fukuoka, Japan. He is an Editor of the *Journal of Micromechanics and Microengineering* and have served as members of the board of trustees including JIEP in 2008-2010, the Society of Instrument and Control Engineers in 2006-2007, and Kyushu branch of Japanese Society for Medical and Biological engineering since 2009. He received the Japan Society of Precision Engineering awards in 1981 and 1991, the Okawa press prize in 2001, the ninth Microoptics Conference (MOC) paper prize in 2003, and the Japan Institute of Electronic Packaging Awards in 2010, and Best Paper Award in Sensordevices of International Academy, Research, and Industry Association (IARIA). He also served as conference chair for a number of international conferences, including IEEE International Optical MEMS Conference 2000 and 2001, was also involved in Program Committees of many conferences, and is a Fellow of Institute of Physics.

2. Invited Talk:

Introduction of MEMS activities at AIST - MEMS for Green and Life Innovation

Ryutaro Maeda
Advanced Institute of Science and Technology (AIST), Tsukuba, Japan

Biography of Presenting Author: Prof./Dr. Ryutaro Maeda

Ryutaro Maeda received Ph.D. degree in engineering in 2006 from Toyohashi University of Technology, Aichi, Japan. He was a post doctoral researcher from 2006 to 2007, and joined the faculty of Toyohashi University of Technology from 2008 as an assistant professor. Since 2009, he has been an assistant professor in Nara Institute of Science and Technology. His current research interests focus on retinal prosthesis devices and bio-imaging with CMOS image sensors.

Abstract

Not available at time of press

3. Talk:

Research on a Biological Condition Analysis Based on the MEMS Blood Flow Signal

Terukazu Akiyama, and Renshi Sawada
Kyushu University, Japan

Biography of Presenting Author: Mr. Terukazu Akiyama

Terukazu Akiyama was born in Japan, in September 1987. He received the B.E. degree from Nishinippon Institute of Technology, Fukuoka, Japan, in 2010 and M.E. degree from Kyushu University, Fukuoka, Japan, in 2012. He is a student of doctorate program of Kyushu University.

Abstract

We have developed a ultra-compact high-precision MEMS blood flow sensor with minimum component, simple structure and MEMS technology. Because high sensitive blood flow signal provide the pulse wave data simultaneously have been detected in the ECG and pulse wave meter. It is useful in respect of a multivariate analysis. In this paper, we have analyzed the blood flow signal of a cow at the time of usual and estrus.

4. Talk:

Characteristics and Applications of Micro Sensor Measuring Linear Movement and Inclination around Two Axes

Toshihiro. Takeshita[1], Takuma. Iwasaki[2], Hideyuki. Ando[3], Renshi Sawada[1]
[1]Graduate School of Systems Life Science, Kyushu University, Japan
[2]Department of Mechanical and Aerospace Engineering, Kyushu University, Japan
[3]Fuzzy Logic Systems Institute, Japan

Biography of Presenting Author: Mr. Toshihiro. Takeshita

Toshihiro Takeshita was born in Japan, in October 1988. He received the B.E. degree from Kyushu University, Fukuoka, Japan, in 2011 and is a student of Master's program of Kyushu University.

Abstract

The authors report on the development of an optical ultra-micro-displacement sensor with a surface area of 3.0 × 3.0 mm in area and a thickness of 0.8 mm. The sensor structure is simple, consisting only of a vertical cavity surface emitting laser (VCSEL), eight two-dimensional monolithically integrated photodiodes, a frame and cover glass. This sensor can measure linear displacement with a resolution of 0.856% F.S. of 200 μm, and 1.11% F.S. of 500 μm. In addition, the device can measure inclination within resolution of 2.07% F.S. of ±1.5°. Therefore, the sensor can be utilized as a very small and highly accurate positioning mechanism and actuator, making it particularly suitable for incorporation into moving devices such as moving MEMS micro-mirrors and piezo-actuators.

5. Talk:

Skin Blood Flow During Running in Different Running Speed

Wataru Iwasaki[1], Masaki Nakamura[1], Takeshi Gotanda[2], Eiji Higurashi2, and Renshi Sawada[1]
[1]Kyushu University, Japan
[2]The University of Tokyo, Japan

Biography of Presenting Author: Mr. Wataru Iwasaki

Wataru Iwasaki was born in Japan, in October 1985. He received the B.E. degree and M.E. degree from Kyushu University, Fukuoka, Japan, in 2008 and 2010, respectively. He is a student of the doctorate program of Kyusyu University. He has received 2010 JIEP Academic Plaza Award in 2010 and SENSORDEVICES 2010 Best Paper Award in 2010.

Abstract

Skin blood flow during running has not been studied before, because blood flow meter couldn't measure blood flow in moving condition. We have previously developed a micro integrated laser Doppler blood flowmeter using microelectromechanical systems (MEMS) technology. The micro blood flowmeter is wearable and can measure signal stably even in a moving condition. We monitored skin blood flow during running at velocities of 6 km/h, 8 km/h, and 10 km/h, and were successful in measuring a stable signal under these conditions. We found that at the forehead the skin blood flow increases and, in contrast, at the fingertip it initially decreases during running. We also found that the level of these increases and decreases correlated with the running velocity.

6. Invited Talk:

Low-temperature Bonding Technology for Optical Microsystems Applications

Eiji Higurashi
Research Center for Advanced Science and Technology (RCAST),The University of Tokyo, Japan

Biography of Presenting Author: Prof. Eiji Higurashi

Eiji Higurashi is an associate professor of Research Center for Advanced Science and Technology (RCAST) in the University of Tokyo. He received the M.E. degree from Tohoku University in 1991. In 1991, he joined the Applied Electronics Laboratories of Nippon Telegraph and Telephone Corporation (NTT). He received the Ph.D. degree from Tohoku University in 1999. He has been an associate professor of Department of Precision Engineering in the University of Tokyo since 2003 and an associate professor of RCAST in the University of Tokyo since 2004. He has been engaged in the research on integration and packaging of optical micro-systems. He received several awards, including the Igarashi Award in 2002, the Okawa Publications Prize in 2003, and the Ichimura Academic Award in 2008.

Abstract

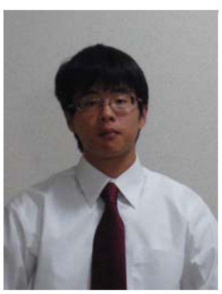
Heterogeneous integration of multiple optical chips in three dimensions is an important technology for realizing highly functional, compact optoelectronic microsystems. In a conventional method using AuSn solder, however, the chips tended to be thermally damaged during the several repeated high-temperature bonding steps (300°C). In this study, three-dimensional integration of optical chips was successfully performed using Au-Au surface-activated bonding (bonding temperature: room temperature - 150°C) in ambient air. This bonding method was also suitable for chip-size packaging of microsystems. Compact and thin optical microsensors (2.8 mm × 2.8 mm × 1 mm thick) were fabricated. The feasibility of measuring velocity was demonstrated using prototype microsensors. The results show that this technique is very promising for producing various optical microsystems in use in many industrial applications.

7. Talk:

Low-temperature Bonding of Laser Diode Chips Using Atmospheric-pressure Plasma Activation and Its Application to Micro Laser Doppler Velocimeter

Michitaka Yamamoto[1], Takeshi Sato[1], Eiji Higurashi[2], Tadatomo Suga[1], and Renshi Sawada[3]
The University of Tokyo, Japan
[2] Research Center for Advanced Science and Technology, The University of Tokyo, Japan
[3] Department of Intelligent Machinery and Systems, Kyushu University

Biography of Presenting Author: Mr. Michitaka Yamamoto



Michitaka Yamamoto received B.E. degree from Tokyo University, Tokyo, Japan, in 2012. He is currently working toward the M.E. degree at the Department of Precision Engineering, School of Engineering, The University of Tokyo, Tokyo, Japan. His current research interests include Au-Au Surface Activated Bonding and integration of optical components.

Abstract

We present simple Au-Au low-temperature bonding (150 ºC) method using atmospheric-presser plasma for future highly-functional optical devices. The LD chips with Au electrodes were bonded on flat topped Au stud bumps with smooth surfaces. This technology was applied to the fabrication of micro laser Doppler velocimeter (LDV).

Thick Au stud bumps (15.3 μm) with smooth surfaces (Ra: 1.3 nm) were fabricated by coining the stud bumps using the flat surface (Ra: 0.2 nm) of Si chips. Whole Au-Au surface-activated bonding process including surface activation by atmospheric-pressure plasma was carried out in ambient air. Under a bonding temperature of 150 ºC and a contact load of more than 680 gf, die-shear strength exceeded the failure criteria of MIL-STD-883F, method 2019 (×2). Using this technique, compact and thin micro LDV (2.8 mm × 2.8 mm × 1 mm thick) was developed. The feasibility of measuring velocity was demonstrated for a moving Au wire (φ: 22 μm). The micro LDV detected relative speeds as low as 1 μm/s.

8. Invited Talk:

Chemical Reaction in Microspace: Control of Chemical Reactivity by Microfluidics

Kenichi Yamashita
National Institute of Advanced Industrial Science and Technology (AIST), Japan

Biography of Presenting Author: Dr. Kenichi Yamashita

Senior Research Scientist
Measurement Solution Research Center,
National Institute of Advanced Industrial Science and Technology (AIST), Japan

Kenichi Yamashita received the M. E. and Ph.D. degree from Kyushu University, Fukuoka, Japan, in 2000 and 2002, respectively. Since 2002, he has worked in AIST as a research scientist.

Abstract

I herein introduce the capability of the microreactor as a chemical reactor. Especially my research addressed the fundamental behavior of the solute in microchannel laminar flow, in contrast to most previous studies of the practical applications of microreactors. In contrast to a batchwise system, interaction of the solute with solvent in a microchannel laminar flow is non-isotropic, suggesting that such a behavior is characteristic of solutes in a laminar condition. Henceforth, I believe that such a fundamental study of the behavior of molecules in a microchannel laminar flow can elucidate microchannel-enhanced chemical reactions and simultaneously enable exploration of controlling chemical reactions using a microreactor. In some experiments, I chose DNA strands as the subject of our study and investigated their duplex formation and behavior in microchannels based on the fact that DNA is directly visible and that exact measurement of duplex formation of DNA can be done using physicochemical analysis. The use of DNA also enables theoretical discussions of such reactions.

Based on thermodynamic analysis, the change in conformational entropy caused by microfluidic stretching and orientation of DNA strands is an important factor in the microfluidic thermal stability shift. Moreover, kinetic analysis shows that the microchannel laminar flow enables change of reaction rate by inducing a change in activation energy. It is suggested that a microfluidic system is useful for performing fast reactions by influencing the activation energy and producing an enhancement effect, even without the presence of catalysts.

9. Invited Talk:

Interaction Between Physiological Environment and Surface of Joint Prosthesis - Effects on Friction and Wear

Yoshinori Sawae[1,2], Kazuhiro Nakashima[1,2], Seido Yarimitsu[2] and Teruo Murakami[2]
[1]Department of Mechanical Engineering, Kyushu University, Japan
[2]Research Center for Advanced Biomechanics, Kyushu University, Japan

Biography of Presenting Author: Prof. Yoshinori Sawae

Yoshinori Sawae received the degree of B.S. in 1991, M.S. in 1993 and Dr.Eng in 1996 in Mechanical Engineering from Kyushu University, Fukuoka, Japan. He joined Department of Mechanical Engineering, Kyushu University as a lecturer in 1996 and became a Professor of Machine Elements and Design Engineering Laboratory in 2011. Current research interests are primarily friction, wear and lubrication in artificial joints and natural synovial joints.

Abstract

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are popular surgical treatments whereby the diseased hip and knee joints are replaced with joint prostheses to reconstruct joint functions. Although joint capsule and synovial membrane are resected during the operation, they are soon regenerated around implanted artificial joint and internal space of the capsule is filled with periprosthetic fluid secreted from the synovial membrane. The periprosthetic fluid contains many kinds of electrolytes, radicals, nutrients and biological macromolecules, such as proteins, lipids and hyaluronic acid. These constituents should be entrained into the contact area between articulating surfaces during joint movements and possibly have some chemical and mechanical interactions with the surface of joint prosthesis. Consequently, friction and wear characteristics of prosthetic joint *in vivo* are inevitably subjected to the influence of physiological environment.
In this study, static and dynamic behavior of protein adsorption on the surface of prosthetic joint materials was examined in the simulated synovial joint environment by using atomic force microscopy and fluorescent microscopy. Subsequently, effects of the physiological environment on the friction and wear behavior of implanted joint prostheses were discussed.

10. Talk:

Microscopic Structure Formation in Regenerated Cartilage Tissue Cultured Under Traction Loading

Keisuke Fukuda[1] and Yoshinori Sawae[2]
[1]Graduate school of System Life Science, Kyushu University, Japan
[2]Department of Mechanical Engineering, Kyushu University, Japan

Biography of Presenting Author: Mr. Keisuke Fukuda

March, 2011 Received B.S. in mechanical engineering from Kyushu University, Fukuoka, Japan.
April, 2011 Admitted to Graduate School of Systems Life Sciences, Kyushu University
March, 2013 Expected to receive M.S. in Systems Life Sciences from Kyushu University

Abstract

In this study, chondrocytes isolated from bovine cartilage tissue were seeded in agarose gel and resultant chondrocyte-agarose constructs, a well-established experimental model to examine the effect of mechanical loadings on the chondrocyte metabolism, were cultured with a traction loading on the construct surface to examine its effect on the regeneration of the cartilaginous tissue by chondrocytes. Custom-designed mechanical loading equipment was developed to apply the traction loading on the upper surface of constructs being cultured in the CO_2 incubator. After 2 to 3 weeks culture, immunofluorescent staining of keratin sulfate, a type of glycosaminoglycan (GAG) chain consisting proteoglycan molecules, and type II collagen was performed to verify the chondrocyte biosynthesis of extra cellular matrix (ECM) and characterize the structure of elaborated cartilaginous tissue by confocal laser scanning microscopy (CLSM). Viscoelastic properties of cultured construct were also evaluated by using a rotational rheometer. Results indicated that the traction loading enhance ECM biosynthesis in the surface region of constructs and collagen rich layer covered with GAG rich superficial layer was formed in the articulating surface. Storage modulus and loss tangent of the elaborated tissue were also enhanced by the traction loading.

11. Invited Talk:

Impulse-driven Capsule for Medical Treatment

Takahiro Ito
Dept. of Computer Science and Systems, Kyushu Institute of Technology, Japan

Biography of Presenting Author: Prof. Takahiro Ito

Takahiro Ito received the B.E. and M.E. degree in mechanical engineering from the University of Tokyo, Japan in 1983 and 1985 respectively and the M.S. degree in computer science from the University of Illinois at Urbana-Champaign in 1992. He received Ph.D. degree from the University of Tokyo in 2002.
In 1985, he joined the NTT Electrical Communication Laboratories, Tokyo, Japan. Since March 2008, he has been a professor at Kyushu Institute of Technology, Japan. He is also the general manager of the center for microelectronic systems. His research interests are micro-mechanism, sensor, and MEMS devices for medical application.

Abstract

We have developed a traveling small capsule, which has smooth outer surface and is driven by the inertia force and friction force. It is small enough, only 7 mm in diameter and 12 mm long, it can be put in the human gullet or intestines. The capsule contains a small magnet and a coil, and electric pulse drives the magnet to move the capsule. To investigate the feasibility of our traveling capsule, we did the theoretical analysis and computer simulation using a simple model. We did the experimental investigation that our capsule can travel on a plastic plate and it can also travel on pig intestine surface. Our capsule is supposed to be useful for medical treatment such as inspection, drug delivery or operation.

12. Talk:

Capsule Robot with Flexible Micro Arm for Intestinal Surgery

Phunopas Amornphun, and Takahiro Ito
Kyushu Institute of Technology, Japan

Biography of Presenting Author: Dr. Phunopas Amornphun

Phunopas Amornphun received the B.S. degree in Electronics Physics from Thammasat University, Thailand in 2004, M.S. degree in Robotics and Automation from King Mongkut's University of Technology Thonburi, Thailand in 2009, and Ph.D. degree in Mechanical Information System from Kyushu Institute of Technology, Japan in 2012.

Abstract

The use of micro fiber for the transmission of the forces and the movements in robotic micro arms has been investigated from several researchers. The interest in this kind of actuation modality is based on the possibility of optimizing the position of the actuators with respect to the moving part of the robot, in the reduced weight, reliability, simplicity in the mechanic design and flexibility with many DOF. This paper proposes a novel flexible micro arm that uses BioMetal Fiber (BMF) actuator. The BMF has very high durability and exhibits stable operating characteristics. It is being thin but capable of producing a powerful force. This platform can enable new medical devices for a capsule robot and for minimally invasive surgeries. This paper presents kinematics of the flexible micro arm and bending properties. An experiment has been developed with the impulse driven capsule robot. The flexible micro arm is manually controlled using a camera guide for manipulating to desired position.

13. Invited Talk:

Development of Ambient MEMS Devices, Networked MEMS and Large Area MEMS

Toshihiro Itoh
Advanced Institute of Science and Technology (AIST), Tsukuba, Japan

Biography of Presenting Author: Dr. Toshihiro Itoh

Toshihiro Itoh received the BE, ME, and Ph.D. degrees in precision engineering from the University of Tokyo, Japan, in 1988, 1990 and 1994, respectively. He is currently a leader of Collaborative Research Team of Macro BEANS (Bio Electromechanical Autonomous Nano Systems), and a deputy director of Research Center for Ubiquitous MEMS and Micro Engineering (UMEMSME) in National Institute of Advanced Industrial Science and Technology (AIST), Japan. Also he has been a director of Macro BEANS Center, METI/NEDO BEANS project and a director of Tsukuba Research Center, NEDO “Green Sensor Network System Technology Development” project since 2008 and 2011, respectively. He had joined the faculty of the University of Tokyo in 1995 and was an associate professor at the Research Center for Advanced Science and Technology (RCAST) and the Department of Precision Engineering from 1999 to 2007. His research interests are in MEMS and wireless sensor nodes for sensor networks as well as large area MEMS.

Abstract

Two examples of “ambient” MEMS devices, MEMS sensors integrated with wireless communication function (wireless sensor node) and large area MEMS fabricated by continuous micro/nano-manufacturing and integration process for fibers, will be introduced. One of the important technological issues to realize maintenance-free sensor network systems is power reduction of each wireless sensor node. By developing novel ultra-low power (ULP) MEMS sensors and custom LSI with event-driven mode, we have successfully developed an ULP sensor node with the power consumption around 1 μW. As large area MEMS, fabric devices fabricated by weaving integration of micro/nano-machined fibers, such as a 1 m x 1 m touch sensor, will be presented. The fabrication process of our large area devices consists of continuously high-speed coating for functional film materials, 3-D micro/nano-machining of the films on fibers, and weaving the functional fibers into large-area integration.

14. Talk:

Development of a Wearable Body Temperature Sensor for an Early Diagnosis System of Pneumonia in Cows

Hirofumi Nogami, Hironao Okada, Toru Miyamoto, Ryutaro Maeda, and Toshihiro Itoh
Advanced Institute of Science and Technology (AIST), Tsukuba, Japan

Biography of Presenting Author: Dr. Hirofumi Nogami

Hirofumi Nogami received the B.E (2005) degree in Faculty of Engineering from Kyushu University, M.E (2008) and Ph.D. (2011) degrees in graduate school of Systems Life Sciences from Kyushu University. He has worked at Advanced Institute of Science and Technology (AIST) since April, 2011. His research works are potentially in commercial development in animal health monitoring system and the wireless sensor node.

Abstract

Calves have a high rate of attrition from pneumonia and calf scours. To decrease attrition rate, automatic monitoring system for early diagnosis has been required. We developed wearable wireless sensor nodes for the system. This sensor node is 12 millimeters in length and width, 5 millimeters thick and weighs 5 grams. It uses 300MHz transmission. The measurement items are temperature and acceleration. We attached this wireless sensor node to a calf tail close to an anus, and measured skin temperature and acceleration for two weeks. We could confirm circadian change measured by skin temperature and distinguish between a standing position and a sitting position measured by acceleration.

15. Invited Talk:

Introduction of A MEMS Sensor for Healthcare Application

Noritomo Hirayama
Measurement of Instrument Development Dept.
Measurement Technology Development Center,
Product Technology Laboratory, Corporate R&D Headquarters
Fuji Electric Co.,Ltd, Japan

Biography of Presenting Author: Mr. Noritomo Hirayama

Noritomo Hirayama received the B.E. degree in Mechanical Engineering from the Kogakuin University in 1991. In 1991, he joined the Fuji Electric Corporate Research and Development, Ltd. He works as a research engineer at Fuji Electric Co., Ltd. Currently he is a senior manager at Measurement of Instrument Development Dept., Measurement Technology Development Center in the Product Technology Laboratory, Corporate R&D Headquarters, Fuji Electric Co.,Ltd, Japan

He has been engaged in the research on the optical measurement and various sensing technologies such as tunable diode laser absorption spectroscopy for gas concentration, ultrasonic Doppler Velocity profiler for Fluid flow and non-invasive biosensor. He received the prize for an excellent work in the Japan Electrical Manufactures' Association in 2008.

Abstract

In Fuji Electric, various MEMS sensors have been manufactured for industrial use. A MEMS sensor has the feature of small size, integration, and low power consumption, and can expect the low cost by mass production. With these features, we consider the vital sensing for health care application. In this paper, a micromachined gas sensor based on a catalytic thick film/SnO_2 thin film bilayer and other sensors are presented.

16. Invited Talk:

Application of ICT to Agriculture: Internet Control of Cattle Grazing in Mountain and Foothill Areas of Japan

Takafumi Gotoh[1], Tetsuji Etoh[1], Yuji Shiotsuka[1], Ryosuke Fujimura[1], Osamu Hirano[2], Makoto Maeda[2], Hiroyuki Terauchi[3], Hideyuki Otsuka[4], Yuji Maeda[5], Takeshi Nishidoi[6], Kaoru Yoko-o[6], Kazuhiro Suzuki[6], Shinji Sawane[6], Akira Muranishi[6]

[1]Kuju Agricultural Research Center, Faculty of Agriculture, Kyushu University 8780201, Kuju, Japan
[2]Intellectual Property Management Center, project Support Department, Kyushu University, 8128581, Fukuoka, Japan
[3]Panasonic Communications Co., Ltd., 8128531, Fukuoka, Japan
[4]MSK Agricultural Machine Co. Ltd., 8691235, Kumamoto , Japan
[5]NTT departments III, (R&D Strategy Department), 1008116, Tokyo, Japan
[6]Network Innovation Center, Fujitsu Co., Ltd., 2118588, Japan

Biography of Presenting Author: Prof. Takaufmi Gotoh

Takafumi Gotoh is an associate professor who belongs to graduate school of agriculture, at Kuju Agricultural Research Center, Kyushu University. He received his B.Sc, M.Sc. and Ph.D. degrees in Department of Animal Science from Kyushu University, Japan in 1988, 1990 and 1997, respectively. He is basically an animal scientist, especially he is studying cattle. His research topics are creation of beef production system, metabolic imprinting. Because he works in university farm, he has started ICT farm project. Now he is doing joint researched with ICT scientists and private companies in Japan. He was awarded by Japanese Society of Animal Science for a thesis entitled “Histochemical Properties of Skeletal Muscles in Japanese Cattle and Their Meat Production Ability” in 2001.

Abstract

In recent times the Japanese government has recommended that farmers graze cattle on abandoned agricultural fields. However, it is not so easy to control and carry out daily checks on cattle grazing in mountain and foothill areas. To help resolve this burdensome farming task, we are creating an internet based ICT control system intended to provide not only feed concentrate but also to monitor cattle grazing abandoned agricultural fields in mountain and foothill areas. We will present current results regarding this system.

17. JSPS Poster Paper (1):

Human Position Sensing with Meter-Scale Fabric Touch Sensors

Hiroko Tanaka[1], Seiichi Takamatsu[1,2], Takahiro Imai[1], Takahiro Yamashita[1], and Toshihiro Itoh[1,2]
[1] Macro BEANS Center, BEANS Laboratory, Japan
[2] National Institute of Industrial Science and Technology (AIST), Japan

Biography of Presenting Author: Ms. Hiroko Tanaka

Hiroko Tanaka has been a researcher of Macro BEANS (Bio Electromechanical Autonomous Nano Systems) Center, BEANS Laboratory that established under NEDO/METI BEANS project, since 2007. She joined the secretary of Nanoimprint Process Solution Consortium (NIPS), Japan, from 2005 to 2006.

Abstract

Recently, human position sensing devices have attracted great deal of attention for the applications to elders or nursing cares. Electronic textiles that integrate sensors into fabrics are ideal because they have the advantage of instantly obtaining information from humans. Textiles can cover extremely large-area (> 1 m2) because meter-scale fabric is woven by automatic looming machines. In this paper, human position sensing device which consists of highly conductive polymer-coated fibers are reported. Meter-scale long fibers with a conductive PEDOT:PSS layer were used as an enough large electrode to detect human foot or hands. Using the 1 meter-long fibers, a touch with about 5 cm wide human hand can produce capacitance change of more than 1 pF, which is large enough to detect with the capacitance meter integrated in standard MCUs.

18. JSPS Poster Paper (2):

Heterogeneously Integrated Bio MEMS Devices in the FIRST Project "Integrated Microsystem"

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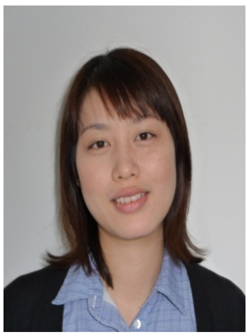

Yuri Kitajima has been a member of research team for the "Integrated Microsystem" Project of Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) in AIST, Japan, since 2010.

Abstract

In the "Integrated Microsystem" project of Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST),, the AIST research team has been trying to develop MEMS integration process for prototyping for hetero integration on 8- or 12-inch Si wafers and high efficiency production. For instance, a fabrication process of heterogeneously integrated fluorescence detector for microfluidic biochemical analysis has been developed. We have proposed an annular fluorescence detector in which an optical interference filter is monolithically integrated on an a-Si:H pin photodiode. This allows laser light to pass through the detector and to irradiate a microchannel, enabling coaxial configuration of excitation source and detector. In this paper, the "Integrated Microsystem" project and examples of developed integrated MEMS devices including Bio MEMS will be introduced.