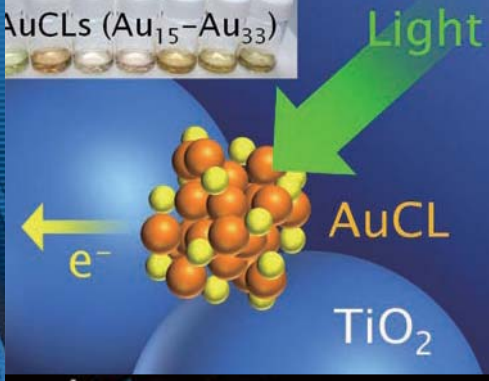
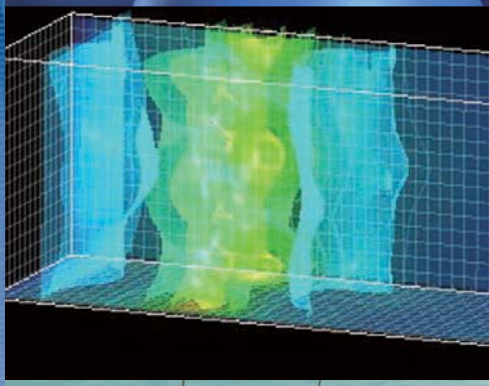
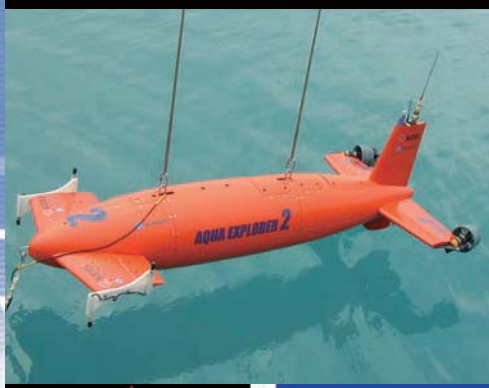
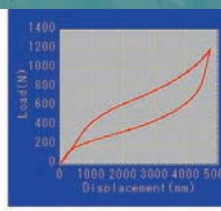
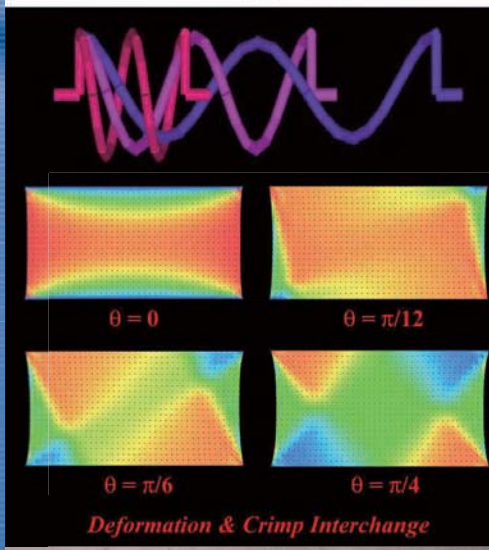










Institute of Industrial Science
The University of Tokyo

2013 ▸ 2014

CONTENTS

IIS

Scope

Director General
Professor **YOSHIAKI NAKANO**

Institute of Industrial Science (IIS), the University of Tokyo, was established in 1949 on the foundations of the Second Faculty of Engineering of the University of Tokyo. In the years that have followed, IIS has undertaken research and education activities encompassing almost the entire spectrum of engineering—ranging from the micro-world at a quantum level to the macro-world on a global and cosmic scale. IIS has continuously generated outstanding research results in these fields and shared its findings with the global academic community, while producing generations of excellent researchers. About 300 permanent staff and 700 graduate students belong to 5 research departments, 1 extraordinary research department and 13 centers, making IIS the largest research institute in Japan that is attached to a university.

The mission of IIS is to generate and accumulate academic knowledge and to develop technologies based on such knowledge. We then deploy and apply the resulting industrial technologies for the benefit of society as a whole. To this end, it is important to have free flows of ideas and to develop systems that actively encourage those flows. At IIS, all faculty members above the rank of lecturer head independent laboratories where they pursue autonomous research activities. However, activities are not confined to individual research areas. Working under one roof, researchers enjoy the benefits of information exchanges and working across disciplines, which promote the continued creation and delivery of a stream of new ideas. Through collaborations with society and industry, in which IIS has taken a leadership role since its establishment, the results have evolved from basic research to applied research and functional technologies, which have been highly praised at home and abroad.

Meanwhile, IIS carries great expectations of society, which is searching for solutions to today's pressing problems; therefore, we must continue to respond to these challenges. In the aftermath of the Great East Japan Earthquake, many faculty members have reacted rapidly to academic and social needs, demonstrating the flexible and agile management ethos of the Institute. Our goal is to deliver a new engineering paradigm by developing a research structure and environment that can respond to major changes in the attitudes and values of society that have occurred since the disaster, and manage the social problems that are expected to emerge in the future.

These social problems are diverse, with some requiring urgent solutions and others medium- to long-term commitments. And, there are also many common global issues. As members of IIS, we are dedicated to identifying possible contributions to society as a whole, and to delivering solutions. I should be grateful for your continuous support for our activities.

Organization

The University of Tokyo currently comprises 10 faculties, 11 institutes, 15 graduate schools, and a number of shared facilities. Institute of Industrial Science (IIS) is the largest of these institutes; currently, IIS comprises five research departments, one extraordinary research department, one guest chair, three Corporate sponsored research programs, three social cooperation chairs, nine research centers, four collaborative research centers, one international collaborative research center, Chiba experiment station, common facilities, and administrative offices. In addition to pursuing research in their respective fields, the faculty members of the Institute play an active role in the Graduate School by conducting courses, experiments, exercises, and research meetings, as well as supervising graduate students for their master's and doctoral theses in the divisions of engineering and science.
As of 2004, IIS has been managing five research departments in which fundamental research activities are conducted in the individual research laboratories, and thereafter, on the basis of the results of these activities, collaborative research, extensive research, general research, and project research activities are promoted with the close cooperation of researchers from different disciplines. In particular, project research activities are conducted at research centers, as is the case with research strategy facilities, and the entire research organization is supported by the common facilities and administrative offices.

The University of Tokyo

10 Faculties

- Faculty of Law
- Faculty of Medicine
- Faculty of Engineering
- Faculty of Letters
- Faculty of Science
- Faculty of Agriculture
- Faculty of Economics
- College of Arts and Sciences
- Faculty of Education
- Faculty of Pharmaceutical Sciences

15 Graduate Schools

- Graduate School of Humanities and Sociology
- Graduate School of Education
- Graduate Schools for Law and Politics
- Graduate School of Economics
- Graduate School of Arts and Sciences
- Graduate School of Science
- Graduate School of Engineering
- Graduate School of Agricultural and Life Sciences
- Graduate School of Medicine
- Graduate School of Pharmaceutical Sciences
- Graduate School of Mathematical Science
- Graduate School of Frontier Sciences
- Graduate School of Information Science and Technology
- Graduate School of Interdisciplinary Information Studies
- Graduate School of Public Policy

11 Institutes

- Institute of Medical Science
- Earthquake Research Institute
- Institute for Advanced Studies on Asia
- Institute of Social Science
- **Institute of Industrial Science**
- Historiographical Institute
- Institute of Molecular and Cellular Biosciences
- Institute for Cosmic Ray Research
- Institute for Solid State Physics
- Atmosphere and Ocean Research Institute
- Research Center for Advanced Science and Technology

13 University-wide Centers

- University Museum
- Cryogenic Research Center
- Radioisotope Center
- Environmental Science Center
- Research into Artifacts, Center for Engineering
- Biotechnology Research Center
- Asian Natural Environmental Science Center
- Center for Research and Development of Higher Education
- Center for Spatial Information Science
- Information Technology Center
- International Center for Elementary Particle Physics
- VLSI Design and Education Center
- Todai Policy Alternatives Research Institute

16 Committee for Presidential Initiatives

- Organization for Interdisciplinary Research Projects
- Earth Observation Data Integration and Fusion Research Initiative
- Organization for Synchrotron Radiation Research
- Open Innovation Center for Drug Discovery
- Institute for Nano Quantum Information Electronics
- Center for Knowledge Structuring
- Ocean Alliance
- Translational Research Initiative
- Information and Robot Technology Research Initiative
- Consortium for Renovating Education of the Future
- Institute of Gerontology
- Life Science Network
- Future Center Initiative
- Center for Marine Biology
- Micro-Nano Multi-Functional Devices Research Network
- Network for Education and Research on Asia

Todai Institutes for Advanced Study (TODIAS)

- Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU)
- Integrated Research System for Sustainability Science

Administration Bureau

Education and Research Related Affairs

Corporate General Affairs

Internal Audit Group

University Library

Institute of Industrial Science

Research Departments

- Department of Fundamental Engineering
- Department of Mechanical and Biofunctional Systems
- Department of Informatics and Electronics
- Department of Materials and Environmental Science
- Department of Human and Social Systems

Extraordinary Research Department

- Department of Management of Large Scale Complex System

Guest Chair

- Guest Chair for Advanced Interdisciplinary Modeling

Corporate Sponsored Research Program

- Advanced Energy Conversion Engineering
- Non-Ferrous Metal Resource Recovery Engineering
- Nikon Imaging Science

Social Cooperation Programs

- Proactive & Holistic Energy Demand Management for Construction Sector
- Mobility and Field Science
- Immunology

Research Centers

- Collaborative Research Center for Energy Engineering (CEE)
- Underwater Technology Research Center
- Advanced Mobility Research Center (ITS Center)
- Center for International Research on Micronano Mechatronics (CIRMM)
- International Research Center for Sustainable Materials
- International Center for Urban Safety Engineering (ICUS)
- Center for Photonics Electronics Convergence
- Center for Socio-Global Informatics
- Center for Research on Innovative Simulation Software (CISS)

Chiba Experiment Station

Collaborative Research Centers

- Nanoelectronics Collaborative Research Center
- Collaborative Research Center for Bio Nano Hybrid Process
- Collaborative Research Center for Innovative Mathematical Modelling
- Collaborative Research Center for Manufacturing Innovation (CMI)

International Collaborative Research Center

- LIMMS/CNRS-IIS (UMI 2820)

Common Facilities, Administration

- Central Workshop
- Computer Center
- Image Technology Room
- Cryogenic Service Room
- Library
- Environmental Safety Center
- Research Management Office
- Office for the Next Generation
- Administration

Komaba Research Campus

Chiba Experiment Station

Personnel and Students (as of Jan. 1, 2013)

Professors	57	Project Research Associates	40	Postdoctoral Fellows	8
Associate Professors	34	Project Researchers	62	Technical Support Staff	64
Lecturers	3	Research Managers	38	Administrative Staff	59
Coappointed Professors	18	Research Fellows	327	Project Academic Support Specialists	12
Visiting Professors	24	Research Advisors	54	Project Academic Support Staff	18
Project Professors	7	Visiting Research Fellows	18	Project Specialist	1
Project Associate Professors	17	Cooperative Research Fellows	184	Graduate Students	702
Project Lecturers	3	Commissioned Researchers	10	Visiting Research Students of Graduate School	10
Research Associates	65	Private Sector Collaborative Researchers	102	Research Students	6

Budget (Fiscal year 2012) (in thousand Yen)

Salaries and Wages	4,514,630
Research, Equipment, and Others	6,491,237
(Management Expenses, Grants for National University Corporations	1,209,050
Funds for Commissioned Research	4,551,022
Funds for Collaborative Research with Private Sector)	731,165
Endowments	295,180
Grants-in-Aid for Scientific Research	913,850
Total	12,214,897

Research

At Institute of Industrial Science (IIS), extensive research ranging from basic to applied in a wide variety of engineering fields is conducted across approximately 160 laboratories, which are primarily led by professors, associate professors, and lecturers. Each of the laboratories is affiliated to one of the five departments, one extraordinary research department or thirteen research centers.
Research activities include both innovative research based on the original ideas of researchers and the dissemination of the obtained results throughout the society.

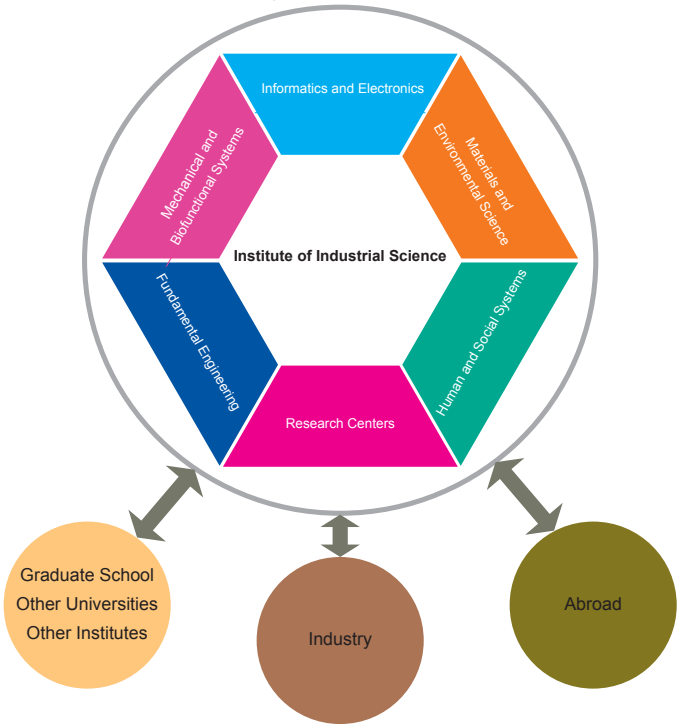
Laboratory System

Research in IIS is conducted by each laboratory as a basic unit headed by an individual professor, associate professor, or lecturer. These faculty members choose their own research topics and conduct research with their original methods. This laboratory system plays an important role in the promotion and development of creative research. Each of the laboratories is affiliated to one of the five departments, one extraordinary research department or nine research centers (ref. pp. 14-59).

Organization of Research

Group Research, in which multiple laboratories work together voluntarily, is actively organized in IIS. These studies are conducted on various levels - from Research Unit comprising researchers in similar fields to large-scale projects involving cooperation among researchers from different fields in accordance with pre-determined plans and purposes.
Research centers and collaborative research centers are the major outcomes of the activities of the Research Units. The flexible organization of the research groups facilitates faster and more dynamic expansion and development of research.

Five Research Departments and Research Centers



Cooperation with Industry

The research of IIS ranges widely from basic engineering to applied technology; therefore, it is essential to promote research and development in cooperation with industry.
For this purpose, cooperative research with private sector and funded research are conducted, and further contacts and exchanges with researchers in private sectors are promoted. Furthermore, endowments from the private sectors have enabled us to establish and maintain endowed chairs, to which project professors and project associate professors from outside are appointed. Thus, as a university-affiliated research institute open to society, IIS makes every effort to promote engineering research and to make use of research results to contribute to society (ref. pp. 12-13).

Research Management Office (RMO)

The Research Management Office (RMO) was established to promote the planning, coordination, and management of research at IIS. The RMO supports the education and research activities of the faculty, such as planning research strategies, procuring external funds, and promoting government–industry–academia collaboration.
Simultaneously, to improve the management of the Institute, the RMO acts as internal liaison and coordinator between faculty and administrators for activity evaluations, education and research publicity, intellectual property strategy, promoting international cooperation, etc.

Research Funds

Research costs in IIS are covered by the Operational Expenses Subsidy provided by Ministry of Education, Culture, Sports, Science and Technology (MEXT), various competition-based subsidies awarded on the basis of applications such as Grants-in-Aid for Scientific Research, collaborative research with private sectors, and endowments from industry (ref. pp. 3 & 5). A fixed portion of these funds is kept by the Institute and is distributed to early-stage but promising research activities based on internal competition and the discretion of IIS director general.

Cooperation with Graduate Schools, Other Departments and Organizations

IIS cooperates with the University of Tokyo's Graduate Schools including Engineering, Science, Arts and Sciences, Frontier Science, Information Science and Technology, Interfaculty Initiative in Information Studies, and related Undergraduate Schools, and has strong link with Research Center for Advanced Science and Technology located on the same campus. Cooperative activities are conducted in IIS not just with these schools and institutes, but also with other organizations, both within and outside Japan. For domestic, IIS has agreements with Tokyo City University, National Institute of Infomatics, Public Works Research Institute. For International, the Laboratory for Integrated Micro-Mechatronic Systems (LIMMS) is managed in cooperation with Centre National de la Recherche Scientifique (CNRS) (ref. pp. 8-11).

Technology Licensing Organization (TLO)

The objective of this organization is to transfer new knowledge and skills gained through research to the development of new industrial applications. A government-recognized technology licensing organization (TLO) is established in the Foundation for the Promotion of Industrial Science and is operated as a platform for making academic research visible (ref. p. 12).

◆ External Funding

	FY2008		FY2009		FY2010		FY2011		FY2012	
	Number	Amount (in thousand Yen)	Number	Amount (in thousand Yen)	Number	Amount (in thousand Yen)	Number	Amount (in thousand Yen)	Number	Amount (in thousand Yen)
Endowments	137	237,848	132	264,593	112	340,382	103	295,643	139	295,180
Commissioned Research	109	3,009,216	124	3,539,480	131	4,252,181	135	3,445,369	135	4,551,022
Collaborative Research with Private Sector	165	814,497	140	641,448	179	546,080	155	510,955	148	731,165
Total	411	4,061,561	396	4,445,521	422	5,138,643	393	4,251,967	422	5,577,367
Grants-in-Aid for Scientific Research	147	702,394	160	832,598	150	754,476	187	886,620	206	913,850

◆ Number of Research Themes and Published Papers

	FY2008	FY2009	FY2010	FY2011	FY2012
Number of Research Themes	603	632	619	596	573
Number of Published Papers	4,591	4,490	4,547	4,604	4,702

◆ Number of Awards

	FY2008	FY2009	FY2010	FY2011	FY2012
Number of Awards	124	121	126	125	133

Education & Philanthropy

Educational activities of Institute of Industrial Science are basically grouped under three categories; education for students, that for industrial researchers, and that for younger generation. It also contributes to international exchanges of knowledge by accepting overseas students and researchers. The following courses and seminars conducted at IIS provide opportunities for sharing research findings.

Graduate Education

Faculty members of IIS conduct regular courses and exercises at the Engineering and Science divisions of the Graduate Schools of the University of Tokyo and supervise research activities of graduate students assigned to IIS. Because IIS runs laboratories for various fields, it provides excellent opportunities to promote interdisciplinary studies as well as single-field studies, and thus gives excellent training to junior researchers.

Educational Programs for the Undergraduate School

Ever since IIS transferred to a location close to the College of Arts and Sciences (Kyoyo Gakubu) Campus, it has been actively involved in undergraduate education through lectures and seminars. Most of the faculty members teach on a part-time basis at the Faculty of Engineering in the University of Tokyo and at other universities.

International Education

In addition to international exchanges of research findings, IIS contributes to international education by actively accepting overseas students and researchers.

Independent Research Seminars · Experiment-oriented Seminars

The student curriculum for the Junior Division of the Undergraduate Program at the University of Tokyo offers Independent Research Seminars and Experiment-oriented Seminars.

The Independent Research Seminars are held for small groups of students who are given independent research subjects by dedicated teaching staff (above lecturer's level) at each faculty and institute. The seminars are designed to offer students opportunities to get insights into the specialized research undertaken at the university and to meet teaching staff working across the university.

The Experiment-oriented Seminars aim to provide a wide-ranging education through experiments, and are organized by dedicated teaching staff at each faculty and institute to assist students to undertake experiment-oriented studies in a variety of subjects available inside and outside the university. The seminars have been listed in the Topical Courses of the Junior Division since the 2006 Curriculum, and are offered in each semester (summer and winter semester).

IIS acts positively to support initiatives through the Seminars.

UROP (Undergraduate Research Opportunity Program)

UROP is designed to experience the practices required for research. It is offered to undergraduate students, particularly freshmen and sophomores, at the College of Arts and Sciences (Kyoyo Gakubu) Campus. Unlike the conventional programs, UROP students draft their individual research plans according to the program objectives, carry out the research, and finally make a presentation. Students can choose any research topic from the various topics investigated at IIS, and each student is assigned a research group on the basis of his/her choice.

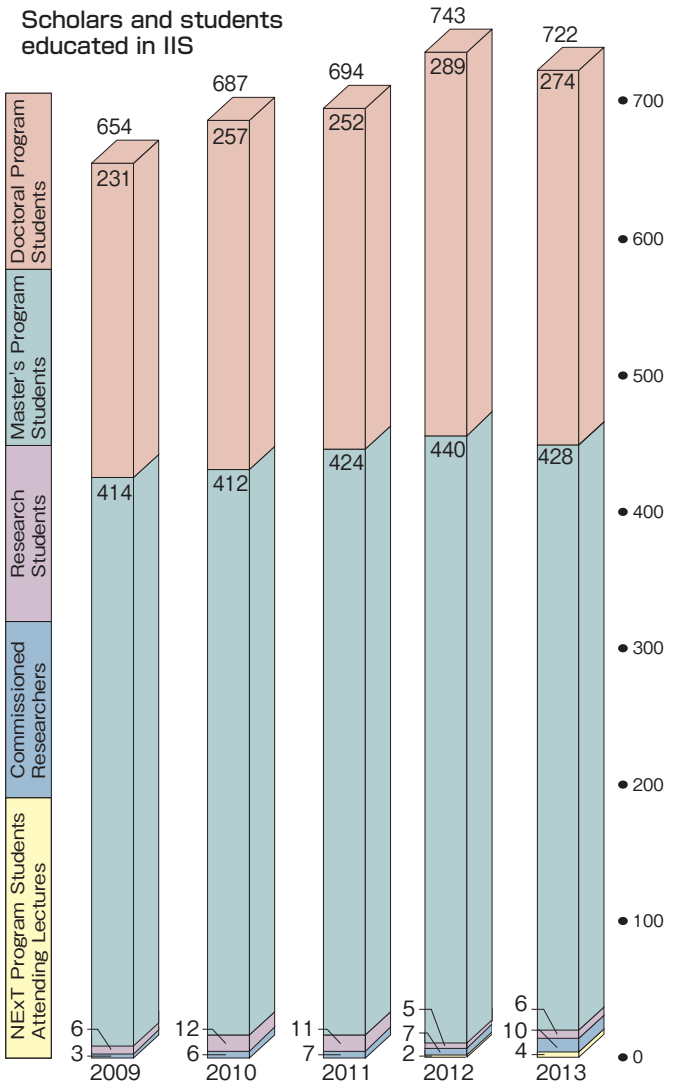
IIS PhD. Student Live

IIS PhD. Student Live is held annually for 2nd grade PhD. stimuli students to obtain mutual understanding about each research and give stimuli each other.

Open House at Institute of Industrial Science

The Open House at IIS is an annual event held in May or June for two days. During the period, the Institute is open to visitiors whatever the age group. We have hosted around 5,000 visitors, including around a thousand from high-school and below.

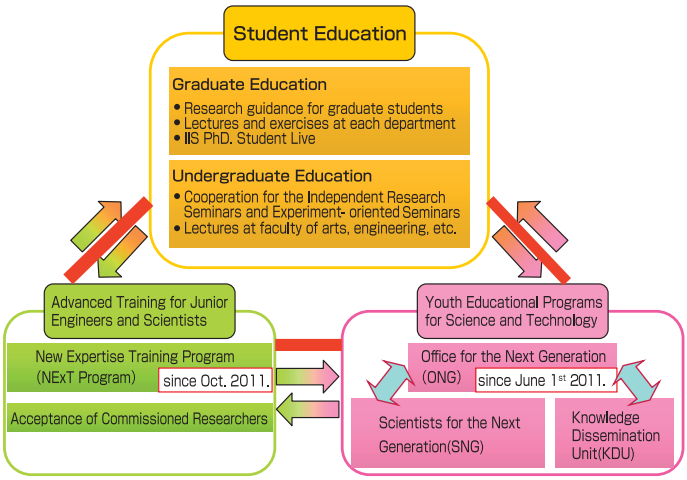
Chiba Experiment Station is also open to visitors in November every year.



As of January 1 every year

Advanced Training for Junior Engineers and Scientists

IIS is also concerned with the continuing education of junior engineers and scientists from industry and governmental institution. A person who has scholastic qualifications that are equivalent or superior to a Bachelor's degree may be admitted as a research student. In addition, a program for entrusted researchers accepts engineers and scientists from industrial and other organizations. Through these two programs, many research students are entrusted researchers pursue studies on cutting-edge subjects in the area of engineering and science every year.

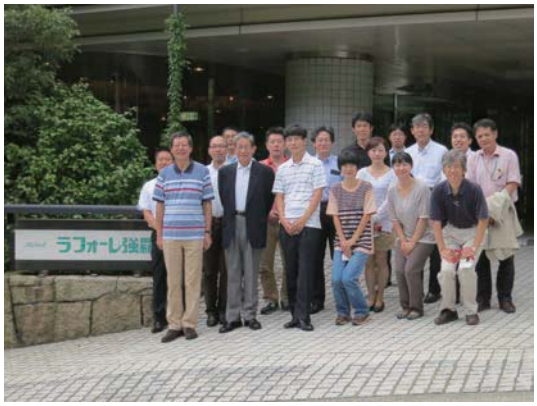


NAMIS AUTUMN SCHOOL

The NAMIS AUTUMN SCHOOL is held by the NAMIS(=Nano and Micro Systems) research group which is a collaboration among various institutes the world over. Schools are organized every autumn with an attendance of over 60 graduate school students and post doctoral researchers. The duration is one week, including experiments, poster sessions and scientific visits.

New Expertise Training Program (NExT Program)

Rapid changes in the industrial structure and business models require human resources that are capable of integrating a variety of technologies and creating new businesses. IIS is a research institute that is engaged in the whole spectrum of engineering and multidisciplinary collaborative research. Exploiting these characteristics, IIS operates a career development support program for corporate engineers (New Expertise Training Program: NExT Program hereafter). Under the NExT Program, IIS offers educational support to corporate engineers to help them develop new expertise by, for instance, welcoming them to join seminars and discussions at laboratories where they can study new technologies, conduct research on the seeds of new technologies, and foster insights into technologies in diverse fields.



NExT Seminar

Youth Educational Programs for Science and Technology

IIS continues to explore new ways to contribute to society through education. In recent years, IIS has placed great emphasis on the Youth Educational Program for Science and Technology.

The Scientists for the Next Generation (SNG) at IIS was formed by IIS members in 1997. SNG is a program to promote interest in and awareness of science and technology among individuals of the younger generation in order to increase the number of next-generation scientists and engineers.

The SNG project involves the following activities:

1) Open House at IIS in which special programs are held for junior and high school students
2) School outreach program in which IIS faculty and staff members visit several schools and interact with the students

The Knowledge Dissemination Unit (KDU) at IIS which is Interdisciplinary Group Research was established by IIS faculty members in 2005. Then, the outreach activities which the researcher of IIS was performing individually unified, and we have been performing the effective outreach activities by sharing of our knowledge.

Youth Educational Programs for Science and Technology based on research in IIS is vigorously promoted through these activities.

ONG (Office for the Next Generation)

In 2011, the Office for the Next Generation (ONG) has been set up at IIS in order to introduce the latest science and technology in university into elementary and secondary education by cooperating with industries. The purpose of ONG is to make new models of the education and outreach, which raises next-generation researchers and engineers, by cooperating with the industries.

NAMIS AUTUMN SCHOOL

International Exchange Activities

Because it is necessary to consider the future of science and technology on a global scale, IIS promotes international academic exchanges by conducting joint studies with foreign researchers and educational activities for international students. Programs are held with research organizations of various countries through international academic agreements, exchanges of academic information at IIS symposia, inviting foreign researchers, organizing colloquiums for the delivery of lectures by foreign scholars, and providing opportunities for the promotion of personal communication among individual researchers from other countries. The idea of appointing foreign members to the faculty and sending young Japanese researchers to other countries is encouraged.

Foreign Organizations with Research Cooperation Agreements

1987	Dalian University of Technology	P.R.China
1994	Centre National de la Recherche Scientifique	France
2006	College of Engineering, National Tsing Hua University	Taiwan
2007	University of Glasgow	U.K
2007	Kunming University of Science and Technology	P.R.China
2008	Ecole Normale Supérieure de Cachan	France
2009	Tsinghua University	P.R.China
2009	School of Naval Architecture, Ocean and Civil Engineering, Shanghai Jiao Tong University	P.R.China
2010	University of Würzburg	Germany
2010	School of Electrical Engineering, College of Engineering, Seoul National University	Korea
2011	College of Engineering, Sungkyunkwan University	Korea
2011	Department of Instrumentation and Applied Physics, Indian Institute of Science	India
2012	Tongji University	P.R.China
2012	University of Lyon	France

Institute of Industrial Science (SEIKEN) Symposia (after 2010)

2010	The 12th International Scanning Probe Microscopy Conference
2010	2nd Hydrology Delivers Earth System Science to Society
2010	The Third International Symposium on Dynamic Traffic Assignment
2010	The 10th International Conference on Motion and Vibration Control
2011	3rd International Symposium on Winter Lightning
2011	International Symposium on Underwater Technology 2011 & International Workshop on Scientific Use of Submarine Cables and Related Technologies 2011
2011	International Conference on Microtechnologies in Medicine and Biology
2011	Asian Symposium on Multibody Dynamics Researches
2011	International Symposium on Atomistic Modelling for Mechanics and Multiphysics of Materials
2012	The 16th International Conference on Miniaturized Systems for Chemistry and Life Sciences (MicroTAS2012)
2012	CHAMPS2012: The 9th International Forum and Workshop on Combined Heat, Air, Moisture and Pollutant Simulation
2012	11th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA2012)

All the symposia above have been held in cooperation with the Foundation for the Promotion of Industrial Science.

Programs for Inviting Foreign Researchers and Sending Researchers to Other Countries

Programs for inviting foreign researchers and sending Japanese researchers to other countries are conducted. A short-term program of one- to three-months duration is offered to researchers from abroad. Programs for sending researchers to other countries, granted by the Foundation for the Promotion of Industrial Science, are arranged to assist faculty members, members of technical support staff, graduate students, and others to attend international conferences or reside on a short-term basis for academic exchange activities.

Foreign Members of the Faculty and International Students

Appointing foreigners to the faculty, whether to research departments or visiting chairs, is encouraged. Further, a number of international students are admitted to receive education and training as graduate and research students. International exchange meetings for both foreign researchers and students, and Japanese members of the faculty are conducted annually.

Komaba Research Campus International Garden Party 2012

Scholars Visiting Overseas and International Students at Instutute of Industrial Science (IIS)

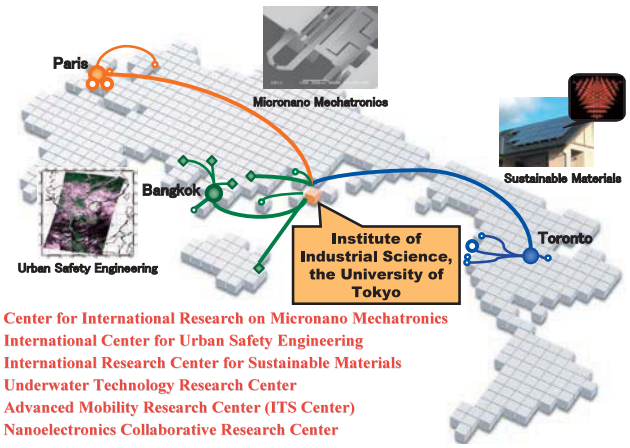
	2009	2010	2011	2012	2013
Visiting Research Fellows	13	15	6	7	6
Visiting Research Associates	3	5	12	7	7
Postdoctoral Fellows	12	13	5	7	13
Predoctoral Fellows	5	9	2	5	16
Todai Postdoctoral Research Fellows	13	16	15	7	16
Doctoral Program Students	98	113	93	130	131
Master's Program Students	71	58	72	97	92
Graduate School Research Students	21	17	22	12	10
Research Students	4	10	8	3	6

As of January 1 every year

Global Collaborative Research Initiative

The global collaborative research initiative at IIS, the University of Tokyo, is a project set up to promote the multifaceted strategic integration of national and international research networks. Through this initiative, IIS hopes to create novel academic fields by undertaking international research initiatives, and consequently address new global challenges raised by academic development and social paradigm shifts. Within IIS, individual laboratories with similar research interests independently pursue many research activities. As a result, several research centers have been established to promote collaborative research.
Such research centers play a central role in collaborations with overseas research organizations in a project initiated by IIS in 2005 to achieve its goal of becoming an international center of research excellence. Currently, the following six centers are engaged in this type of activity:
- Center for International Research on Micronano Mechatronics
- International Center for Urban Safety Engineering
- International Research Center for Sustainable Materials
- Underwater Technology Research Center
- Advanced Mobility Research Center (ITS Center)
- Nanoelectronics Collaborative Research Center

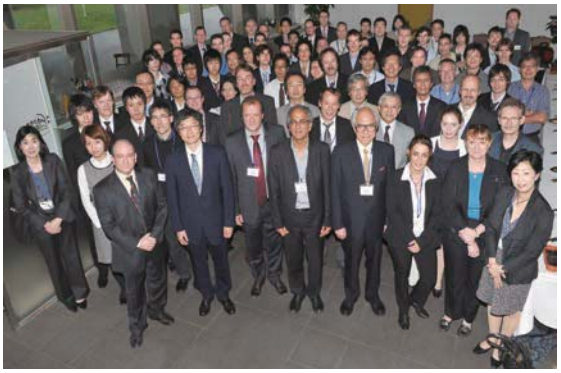
Overseas offices for collaborative research have already been set up in Paris, Bangkok, and Toronto.



Joint Research Laboratory for Integrated Micro-Mechatronic Systems (LIMMS) with Centre National de la Recherche Scientifique (CNRS), France

Laboratory for Integrated Micro-Mechatronic Systems (LIMMS), located at IIS, was established in 1995 in coordination with Centre National de la Recherche Scientifique (CNRS) to conduct cooperative research programs on Micro- and Nano- Electro-Mechanical Systems (MEMS/NEMS) by inviting French researchers for a period of two–three years each. Three institutes with CNRS, namely, Laboratoire d'Analyse et d'Architecture des Systèmes (LAAS) in Toulouse, Franche-Comté Electronique, Mécanique, Thermique et Optique-Sciences et Technologies (FEMTO-ST) in Besançon, and L'Institut d'Électronique, de Microélectronique et de Nanotechnologies (IEMN) in Lille have been the parent organizations of visiting researchers; at present, more than 10 CNRS institutes are enrolled in this program. In total, 16 faculty members of the University of Tokyo have joined as host professors, and more than 110 French researchers have been welcomed.
After nine years of successful operation, LIMMS has been upgraded to the first UMI (Unité Mixte Internationale) status of CNRS in Asia in 2004, thereby obtaining an official eligibility to apply to the EU funding including the FP7. Since December 2011, LIMMS and its EUJO-LIMMS extention became the European Commission's first international laboratory in Japan.
Recent research topics of LIMMS include micromachined tools for atom/molecule handling and observation, semiconductor opto- and electronic devices, bioengineering devices, and fundamental micro/nano fabrication technologies.

EUJO-LIMMS Kick-Off meeting in May 2012


LIMMS Steering Committee in September 2011

International Activities of the International Center for Urban Safety Engineering (ICUS)

The International Center for Urban Safety Engineering (ICUS), was established in April 2001 with the goal of developing new systems and methods for protecting people from the accidents and disasters that may occur in everyday life in urban areas around the world. The Center's research includes infrastructure design and maintenance, development of monitoring methods to prevent and guide people in the case of accidents and disasters, and safety analysis and evaluation of important facilities – not only in Japan but also in other Asian mega cities. As such, ICUS works in cooperation with researchers and engineers throughout the world. Since its inception, ICUS has been actively involved in establishing international collaborations. In 2002, ICUS established the Regional Network Office for Urban Safety (RNUS) at the Asian Institute of Technology (AIT) in Bangkok, Thailand, followed by the establishment of the Bangladesh Network Office for Urban Safety (BNUS) at the Bangladesh University of Engineering and Technology (BUET) in Dhaka, Bangladesh, in 2006. These offices continue to be actively involved in promoting research, networking and dissemination of results through seminars and workshops. To further promote international collaboration between academic institutions, ICUS has signed memorandums of understanding (MOU) with many institutions around the world. In addition, every year ICUS organizes the International Symposium on New Technologies for Urban Safety of Mega Cities in Asia (USMCA). In 2012, the 11th USMCA was held in Ulaanbaatar, Mongolia, with the cooperation of the President of Mongolia, the Mayor of Ulaanbaatar city and Mongolian University of Science and Technology (MUST), Mongolia. More than 150 people from 14 countries participated in this two-day symposium, which helped to strength international ties and build social networks between people from different backgrounds and perspectives. The 12th USMCA will be held in Hanoi, Vietnam on October 9-11, 2013.


Participants of the 11th USMCA in Ulaanbaatar, Mongolia in October, 2012.

International Collaboration Research Program with Ho Chi Minh City University of Technology

IIS and Faculty of Chemical Engineering, Ho Chi Minh City University of Technology (FD/HCMUT), signed an agreement to cooperate and enhance research and education for sustainable utilization of biomass resources in February, 2006. Under this agreement, IIS established the Branch Office of IIS/UT in HCMUT and international collaboration works have been conducted. Based on this partnership, JST-JICA SATREPS "Sustainable Integration of Local Agriculture and Biomass Industries" was started from October 2009 to September 2014.

Opening ceremony of the biomass utilization demonstration plant for SATREPS project, located in a near-urban agriculture area, Thai My Village, Cu Chi District, Ho Chi Minh City (January, 2013)

Collaborative Research in Urban Safety at Chula Unisearch, Chulalongkorn University, Thailand

IIS opened the Chula Unisearch office at Chulalongkorn University in July 2006. Located in the heart of Bangkok, this office has been serving as a platform for collaborative research among universities and research centers in both IIS and Chula. All IIS faculty members are allowed to use the IIS office room as well as meeting rooms at Chula Unisearch free of charge. A seminar room (210m^2) is also available for a free. IIS and Chula have jointly organized various symposia and seminars on environmental and disaster management along with IIS Thai alumni parties. Recently the 5th International Joint Student Seminar on Civil Infrastructures in 2012 and 5th IIS Thai alumni party in 2013 were organized by this office. In order to promote further collaboration between IIS and Chula in wider research fields including Japanese industries in Thailand, periodical discussion with the Dean and researchers of Faculty of Engineering are being held.

Participants of 5th student seminar at Sasa International House, Chulalongkorn University

Activities of the Branch Office of Institute of Industrial Science/the University of Tokyo established in the University of Toronto

Since the branch office of IIS, the University of Tokyo (IIS/UT) was opened in the Faculty of Applied Science and Engineering, University of Toronto (FASE/UT) in 2006. collaborative research on sustainable materials, such as sustainable iron- and steelmaking, recycling of precious metals, solar grade silicon production, etc., have been conducted through "Consortium on Sustainable Materials (COSM)".
Also, workshops of COSM were held beginning in 2007. They are conducted every year, alternately at FASE/UT and IIS/UT. The third and the fifth workshops were held at FASE/UT in 2009 and 2011, respectively. This office has been mostly used for the management of COSM and also serves as a temporary office for visitors from IIS/UT.

The 5th COSM workshop at FASE/UT in 2011

Visit of the President, Prof. Hamada, and the Executive Vice President, Prof. Maeda, to the branch office of IIS/UT in FASE/UT

Activities of the Branch Office of Institute of Industrial Science, Established through Collaboration between the University of Tokyo and Kunming University of Science and Technology

An agreement to conduct collaborative research program between Institute of Industrial Science, the University of Tokyo (IIS/UT), and Kunming University of Science and Technology (KUST), P. R. China, was established in February, 2008. The office was opened in the Department of Vacuum Metallurgy, KUST, on 19 May, 2008. Collaborative studies on sustainable research have been conducted through the "Consortium on Energy Materials." Collaborative research was initiated by Prof. Kazuki Morita of IIS, also serving as a guest professor at KUST since 2006, and Prof. Wenhui Ma of KUST; the main focus of the research was the development of solar-grade silicon refining technology. The office and laboratories are used conducting the collaborative research, and can serve as a temporary office for visitors from IIS.

China-Japan Joint Forum on Energy and Environmental Issues for Metallurgical and Material Processes at KUST in 2009

International Collaboration by Advanced Mobility Research Center (ITS Center)

The Advanced Mobility Research Center (ITS Center) was established in April 2009, taking over the ideals of its predecessor, the Collaborative Research Center for Advanced Mobility (CRCAM). Established in March 2005, CRCAM was the first research base in Japan that specialized in intelligent transport systems (ITS) and consisted of researchers from various fields such as transport engineering, vehicle engineering, information technology, as well as acoustics. ITS is expected to contribute to improved and safer mobility of people and goods as well as offer solutions to environmental problems caused by transport-issues which are being addressed by researchers throughout the world. The ITS Center conducts research activities on these issues by international collaboration, exchange knowledge, and promote its technology all over the world.

To achieve its goals, the ITS Center deployed overseas collaboration bases to the Federal Institutes of Technology, Lausanne (École Polytechnique Fédérale de Lausanne, EPFL) in Switzerland in 2005 and the Queensland University of Technology (QUT) in Australia in 2009. The ITS Center also holds international joint research activities and seminars in collaboration with universities and organizations abroad based on memorandums of understanding for research exchange. For example, it invited professionals from various countries and held several international joint symposia on ITS research: with Asian Institute of Technology in Bangkok, Thailand (2009); with National Taiwan University in Taipei, Taiwan (2011); and with the Institution of Engineers Malaysia in Kuala Lumpur, Malaysia (2012).

To this day, the ITS Center continues to promote agreements with research institutions around the world, expand its research network, and contribute to the advancement of ITS throughout the world.

Presenters at the International Symposium on ITS Research held in Taipei, Taiwan in 2011

Activities of the Collaborative Research Office at WWF-India

Based on the MOU between WWF-India and IIS at the University of Tokyo, Underwater Technology Research Center (UTRC) has been carrying out collaborative research projects for observation and conservation of endangered animal species in India using advanced acoustic and information technologies. One of the leading projects is "INCASTS" (Indo-Nippon Collaboration on Acoustic Surveillance Technology for Susu), a collaborative program with WWF-India and Indian Institute of Technology Delhi for the Ganges River Dolphin's long-term in-situ monitoring at a stationary observatory in Narora, where successful monitoring for 4-6 months in the dry season has been conducted for 4 consecutive seasons since November 2008.

To enhance the on-going project and to develop more advanced projects, collaborative research offices between WWF-India and UTRC have been established at WWF-India's head office at New Delhi and at the filed office at Narora in February 2009. Since then, the offices have been working as a key platform for the international research activities for freshwater dolphins' monitoring in Asian waters such as the Irrawaddy dolphin's long-term in-situ monitoring in Borneo.

The Ganges river dolphin's phase 5 monitoring has been started from 26 November 2012 at Narora where the WWF-India's filed office is located (November 2012).

Cooperation with Industry

With the specialization and evolution of science and technology currently ongoing, there is an increasing need for universities to cooperate with industry and the government. IIS plays an active role in bridging the gap between industry and academia in the area of engineering by actively utilizing the following programs. For example, on the basis of the rules of one of the national university corporations, IIS accepts collaborative research programs and research contracts from industry and government-affiliated special corporations, and educates researchers and research students from industry. Further, Corporate Sponsored Research Program and associated research promotion funds are available to encourage research activities in IIS.
Please feel free to contact Planning Section, the Research Grant Office, for details on these programs (Phone: +81-3-5452-6015; Fax: +81-3-5452-6080, E-mail: rk@iis.u-tokyo.ac.jp). For information on the past achievements of IIS, please visit the website. (http://www.iis.u-tokyo.ac.jp/industry_e/industry_e.html)

Collaborative Research with Industry

This program accepts researchers and research funds from industrial organizations and allows IIS faculty members to conduct joint research activities with them. The use of various facilities and research equipment in IIS is permitted for this purpose, and some of the direct expenses required for performing research activities can be met by IIS. Further, project research programs are being conducted via collaborations with multiple universities and industrial organizations.

Entrusted Research

This program allows IIS faculty members to study specific research subjects entrusted by industry, etc. It is characterized by the fact that specialists from various fields of science covered in IIS participate in the projects and conduct consistent studies ranging from basic research to application technology.

Entrusted Researchers and Research Students

This program accepts engineers and researchers from industrial organizations as entrusted researchers and research students of IIS and educates them on specific research subjects.

Research Promotion Fund

This program accepts research funds to encourage studies conducted by IIS faculty members. These funds financially support facility management and studies in the field of industrial science.

Corporate Sponsored Research Program

This program allows endowed chairs to be established on the basis of funds contributed by industrial organizations to promote activities in the area of research and education of national university corporations, etc. As with other research departments, the contents of research and education conducted by endowed chairs are negotiated and decided independently by IIS. The present established endowed chairs are those at the Advanced Energy Conversion Engineering in 2008, Non-Ferrous Metal Resource Recovery Engineering (JX Nippon Mining & Metals) in 2012, and Nikon Imaging Science in 2012.

Social Cooperation Programs

Social cooperation programs were established in 2011 to carry out researches on subjects with hugh social benefits. This program is based on collaborative research program with industry. Chairs for the above subjects are founded with the aid of the fund from industry under this program and those researches are activated.

The Foundation for the Promotion of Industrial Science

The Foundation for the Promotion of Industrial Science (FPIS) serves as a foundational juridical institution established to support research on production technologies. The objectives of the foundation are to promote the smooth functioning of IIS activities by conducting seminars for industrial engineers on current themes, assisting in promoting research activities, sending Japanese researchers to other nations, conducting international exchange meetings, helping special research groups, and conducting technology transition projects.
Phone and Fax: +81-3-5452-6094
E-mail: fpis@interlink.or.jp

Industry-University Collaboration

The Industrial Liaison Planning Committee of IIS and the Industrial Liaison Office of the Foundation for the Promotion of Industrial Science are working in collaboration to promote industry–university collaboration. Targeting high-level industry–university collaboration and new relationships among industries, these institutes are:

(1) reinforcing coordination for industry–university collaboration and planning,

(2) establishing the Special Research Group aiming at industry–university collaboration from the pre-research and development stage, and

(3) establishing the Technology Licensing Organization (TLO) to enable collaborative research with industry.

Advancing Industry-University Collaboration and Pioneering New Links

＊Cooperation between IIS and industry at the planning stage: Planning for the Special Research Group

Planning and promoting the Special Research Group, which has a special system that targets industry–university collaboration from the pre-research and development stage considering the importance of organic connections between IIS and industry

＊Planning and management of technology licensing: Establishing the FPIS-TLO

TLO has been established at the Foundation for the Promotion of Industrial Science and is introducing the reports on inventions of the faculty.

＊Mediation for industry-university collaboration and assistance with contracts: Introduction of the Liaison producer system

In addition to the role of research cooperation, a Liaison producer has been introduced by FPIS-TLO, thus reinforcing relationships between IIS and industry.

Opening Ceremony of Komaba Research Campus Open House

Since 2008, the Forum for Industry–University Collaboration has changed the form to the Opening Ceremony at Komaba Research Campus Open House. The Ceremony is organized to introduce the latest major activities of the Institute and to discuss topics of interest at that time.

ARAKAWA Lab.

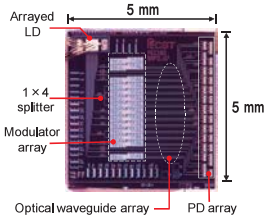
Research on Photonics-Electronics Convergent System Technology

The PECST (Photonics-Electronics Convergent System Technology) project led by Prof. Yasuhiko Arakawa is one of the thirty FIRST (the Funding program for world-leading Innovative R&D on Science and Technology) programs. The aim of the project is to exceed the limitation of current LSI by converging photonics and electronics.

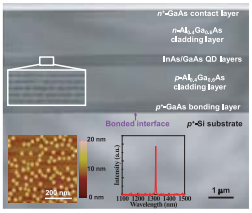
In this project, we are developing the innovative technologies for photonics-electronics convergence in order to realize an on-chip data center –a data center integrated into a single chip- under the strong collaborations among government, industry and academia. Major electronics companies including Fujitsu, Hitachi, NEC, NTT, and OKI and universities (Kyoto University, Tokyo Institute of Technology, and Yokohama National University) are involved in the project. AIST (National Institute of Advanced Industrial Science and Technology) is also playing a role as another research hub in Tsukuba.

We are leading the world in this field by demonstrating significant achievements. Particularly, our demonstration of an optical interconnect with a transmission bandwidth density up to 6.6 Tbps/cm^2 (as of 2012) on a single silicon chip has received tremendous attention. We have also demonstrated a quantum-dot laser, which is a promising light source for use in the future electron-photon convergence systems, on a silicon substrate with a threshold current density of 205A/cm^2 by using wafer bonding technique.

Since 2012, we are collaborating with Photonics Electronics Convergence Technology for Power-Reducing Jisso System also led by Prof. Arakawa, one of Future Pioneering Projects by Ministry of Economy, Trade and Industry.



High-density optical interconnection chip



Quantum dot laser on silicon substrate

OKABE, T. H. Lab.

Rare Metal Workshop

For over 20 years now, Dr. Toru H. Okabe has been consistently pursuing research on refining/recycling of "rare metals," variously called "specialty metals" or "less-common metals." He has expended considerable effort in developing new and environment-friendly recycling technologies for precious metals and for rare metals such as niobium, tantalum, tungsten, and rare-earth metals. He has also been keen on developing new technologies for processing future (or advanced) materials such as titanium, with the ultimate goal of realizing a processing technology that will transform rare metals into commonly available metals.

In 2002, Dr. Okabe established the "Rare Metal Workshop" (or Workshop on Rare Metals) as a part of the Special Research Group organized by the Foundation for the Promotion of Industrial Science (FPIS), with the objective of facilitating collaboration between industry, government, and academia. Since its establishment, more than 55 workshops have been organized and conducted at Institute of Industrial Science. The number of participants in each of this workshop in the recent years has been about 100 to 180, and a cumulative total of over 5000 people have participated over the span of 11 years, with most of the participants coming from industrial sectors.

The activities of the "Rare Metal Workshop" act as an effective bridge between the industry and academia working in the field of non-ferrous metal production, and they also facilitate networking with the government and media. In addition, the workshop acts as one of the central body of information on rare metals and a fruitful meeting ground for industrial collaboration.

OOKA Lab.

Research Committee on Realization of Zero Energy Buildings (ZEBs)

The idea of zero energy building, that fossil fuel energy consumption in a building is compensated by generation of renewable energy in its' site, is getting to be popular concept in various countries all over the world. In European Union, it was declared that all new constructions must be zero energy after December 31, 2020. Japanese government also declared that all new building must be zero energy by 2030. However, the way how to realize zero energy building has not been established clearly yet.

On the other hand, many of Japanese energy saving technologies in buildings (for design, control and facility) are leading the world. Therefore, it is very important to integrate these technologies and show the way to realize zero energy building.

For such purpose, Research Committee on Realization of Zero Energy Buildings was organized in Institute of Industrial Science, the University of Tokyo, with cooperation of 17 companies and some associations.

In this committee, the information about latest technologies has been exchanged among member companies, many domestic and international lecturers have been invited to provide the valuable information. Furthermore, proto-type of zero energy building was designed and proposed.

Proposal of Zero Energy Building (Exterior View)

(Interior View) Designed by Kawazoe Lab.

Department of Fundamental Engineering

The department covers a wide range of fundamental research pertaining to the field of engineering and strongly promotes multidisciplinary cooperation between different areas. Activities include experimental and theoretical physics of soft and nanostructured materials, mechanics, and earthquake engineering.

Field Earthquake Engineering

- Long-lasting landform changes caused by earthqaukes
- Seismic fault-induced failures and remedial measures
- Soil-structure interaction
- Seismic design of underground facilities

KONAGAI Lab.

Field Physics of Complex Fluids

- Phase transition and phase separation in complex fluids
- Liquid-glass transition, liquid-liquid transition, and thermodynamic anomaly of water
- Numerical simulations of soft matter dynamics
- Developments of the instruments studying physical properties of complex fluids

TANAKA, H. Lab.

Field Earthquake Engineering

- Development of seismic evaluation and retrofit of RC buildings
- Estimation method of seismic performance and performance based seismic design of sustainable buildings
- Seismic test of RC buildings
- Field investigations of earthquake-damaged areas

NAKANO, Y. Lab.

Field Surface and Interface Physics

- Diffusion, reaction and phase transition of adsorbates
- Functional nano-structures
- Spin conversion and internal-state relaxation
- Adsorption structure and photo-excited dynamics of molecules at surfaces

FUKUTANI Lab.

Field Nano-Rheology Science

- Physics and measurement techniques of surface phenomena and elementary molecular process on surface
- Phase transition and critical phenomena of two dimensional materials
- Structure and dynamics of micro multi-phases
- Photonics of liquid crystal

SAKAI, K. Lab.

Field Fluid Physics

- Hybrid turbulence model
- Statistical theory of inhomogeneous turbulence
- Analysis and modeling of rotating turbulent flows
- Dynamo mechanism in magnetohydrodynamic turbulence

HAMBA Lab.

Field Many-Body Physics

- Quantum mechanics of open systems
- Thermally driven nano-devices
- A new definition of the tunneling Time
- Quasi-bound state in continuum

HATANO Lab.

Field Nanoscale Surface Physical Chemistry

- Hydrogen absorption in metallic nanocrystals
- Surface/subsurface hydrogen exchange at metal surfaces
- Oxide surface hydroxylation

WILDE Lab.

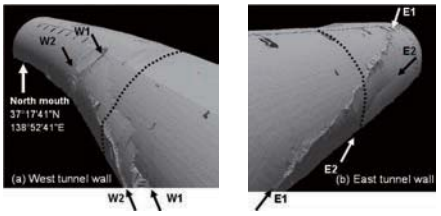
Field Geo-disaster Mitigation Engineering

- Slope failure caused by rock weathering
- Liquefaction-induced large ground deformation
- Stability of geo-cell earth structures
- Damage survey of natural disaster

KIYOTA Lab.

KONAGAI Lab. Long-lasting landform changes caused by earthqaukes

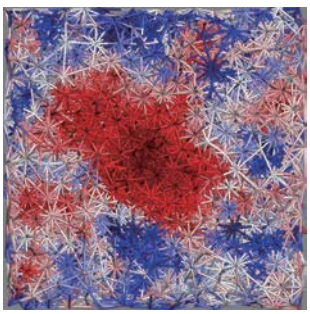
The Wenchuan Earthquake of 2008 has left a huge amount of debris in mountains. At later date, on September 24th, a two-days heavy rain at Beichuan triggered debris flow, and the southern half of the city was buried. All these examples show that large earthquakes can trigger long-lasting geotechnical problems. Traces that an earthquake has left in terrains and civil infrastructures are an early sign of long-lasting landform changes. They are to be analyzed to deduce the causes of the problems.



Laser-scanned Kizawa tunnel lining damaged in the 2004 Chuetsu Earthquake

TANAKA, H. Lab. A new perspective on crystallization

Understanding the crystallization process is of fundamental physical importance. With computer simulations and colloidal experiments, we show that the crystallization pathway involves the interplay of two kinds of order, translational and orientational order, the latter determining the formation and symmetry of the solid phase.



Bond orientational order field during the crystallization of hard spheres. Red (blue) links have high (low) order.

NAKANO, Y. Lab. Seismic performance evaluation of RC frames with unreinforced masonry wall

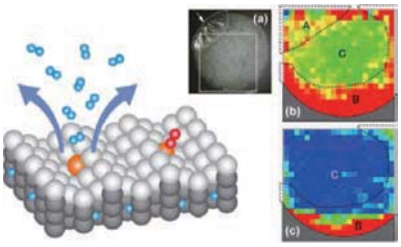
This study is to evaluate seismic capacity of RC frame with URM wall using 1/4 scale specimens under in-plain loading. From the test result, failure mechanism and lateral strength are investigated based on curvature distribution of RC columns and principal compressive strains of URM wall.

Test setup (left), 1/4 scaled concrete block (top-right), URM wall with 3-axis strain gauges (bottom-right)

FUKUTANI Lab.

Hydrogen dynamics at surfaces

Dynamics of hydrogen at solid surfaces and interfaces is of particular importance in view of the fuel cell and hydrogen storage application. We have developed hydrogen microscope capable of visualizing hydrogen distribution in solids. Figures (b) and (c) show the hydrogen distribution in a Pd-based alloy at the surface and 8nm below the surface.

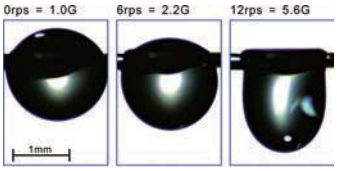


(a) Optical microscope image and hydrogen distributions at (b) 2 nm and (c) 8 nm from the surface

SAKAI, K. Lab.

ReD surface tensiometer

We developed a new method to measure the surface properties of liquids with high surface tension and high viscosity and high temperature. In this method, we only have to set a small droplet of the sample in the rotating cylinder and to generate a large distortion of the droplet with the centrifugal force. The shape of the deformed droplet gives the accurate value of the surface tension. By controlling the centrifugal force, this method can obtain a wide measurable range of the surface tension.

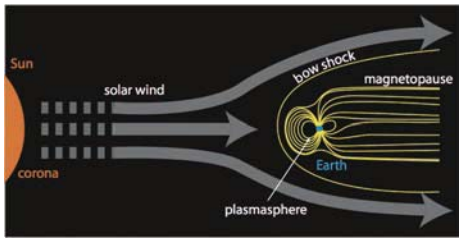


Drop shape shift in ReD surface tensiometer

HAMBA Lab.

Application of MHD turbulence model to solar wind

Magnetohydrodynamic (MHD) turbulence such as solar wind exhibits complicated behavior due to the interactions between an electrically conducting fluid and magnetic fields. The basic features of solar-wind turbulence are investigated with the help of turbulence theory and modeling.

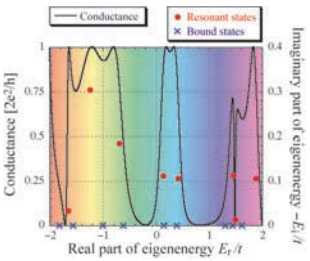


Schematic plot of solar wind and earth's magnetic field

HATANO Lab.

Electronic conduction in mesoscopic systems

Mesoscopic quantum systems attached to leads of quantum wires have resonant states because they are "open quantum systems." We showed how strongly these resonant states affect the electric conduction of the mesoscopic systems. This helps understand the characteristics of nano-devices.

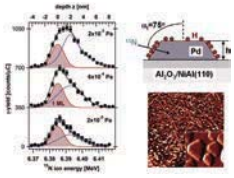


We can clearly see the correspondence between the conductance peaks (line) and the location of the resonant states (red dots).

WILDE Lab.

Hydrogen absorption in metallic nanocrystals

Hydrogen absorbed in Pd nanoparticles on oxide supports has long been suspected to play an active role in the industrial catalysis of olefin hydrogenations. We succeeded in detecting and distinguishing cluster-absorbed H from surface-adsorbed H atoms on tiny Pd nanocrystallites (6nm wide, 2nm high) with high-resolution H depth profiling by nuclear reaction analysis. Complementary reactivity studies prove the direct involvement of the absorbed nanocrystal-absorbed H in the catalytic process.

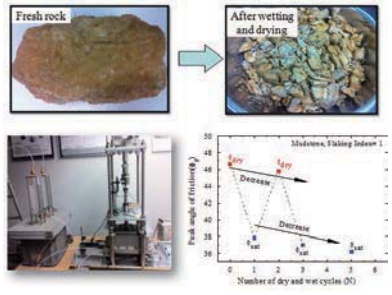


STM image of alumina-supported Pd nanocrystals (300nm x 300nm, inset: 17nm x 17nm) and high-resolution NRA depth profiles of surface (red) and absorbed (blue) hydrogen.

KIYOTA Lab.

Slaking-induced slope failure

Sedimentary rocks are susceptible to slaking disintegration. Broad distinction between dry and wet accelerates the disintegration of the rocks and cause landslides. A series of advanced experiments is carried out to investigate the triggering mechanism of the slaking-induced landslide.



Modified direct shear apparatus and test result

Department of Mechanical and Biofunctional Systems

The Department of Mechanical and Biofunctional Systems covers Mechanical, Precision, and Ocean Engineering those deal with integrated knowledge derived from a wide range of fields. The department conducts not only fundamental research on thermal science, fluidics, dynamical systems and manufacturing, but also applied research for the generation of novel techniques in machining, environmental sensing and utilization, and numerical simulation. The results obtained from these studies are applied to the field of Biofunctional Engineering.

Field Fine Machining and Fabrication Systems

- Thin film thermocouple built-in intelligent cutting tool
- Micro forming of thin films
- Air jet assisted machining of aero-space materials
- Development of high performance tool with microstructured faces

OBIKAWA Lab.

Field Computational Solid Mechanics

- Software development of advanced materials and devices
- Multiscale analysis of material damage and fracture
- Adaptive finite element collapse analysis of framed structures
- Industrial applications of computational mechanics

TOI Lab.

Field Polymer Processing

- Ultra-high-speed injection molding
- Pulp injection molding
- Visualization analysis of injection molding and extrusion molding phenomena
- Development of in-process measurement method

YOKOI Lab.

Field Hyper Functional Forming

- Microstructure control in hot forming
- Forming for ultra-lightweight construction
- Semi-solid forming
- Novel rolling theory

YANAGIMOTO Lab.

Field Design Engneering

YAMANAKA Lab.

Field Computational Fluid Dynamics

- Computational biomechanics of blood circulatory system
- Multi-scale and physics simulation of cardiovascular diseases
- Micro-PIV measurement of multi-phase flow in a microchannel
- Visualization and measurement of blood flow in an in vitro model

OSHIMA Lab.

Field Additive Manufacturing Science

- Application development of selective laser sintering
- Research on selective laser sintering
- Fabrication and application of molded interconnect devices
- UHV compatible mechatronics

NIINO Lab.

Field Phase Change Thermal Engineering

- Measurement of bound water in biosystem
- Design and development of bio- and foods cryopreservation
- Electromanipulation of cell membrane transport
- Dielectrospectroscopy of water in Biomaterial and clathrate hydrate

SHIRAKASHI Lab.

Field Automotive Simulation Technology

WU Lab.

Field Ocean Space Utilization

- Regeneration of coastal city
- Marine spacial planning
- Utilization of wave energy

KUROSAKI Lab.

Field Science of Manufacturing

- Road map for low-carbon society
- Ultimate high-efficiency thermal power plant
- Wave-activated power generation
- Countermeasure against unstable power output of renewable energy

HASHIMOTO Lab.

Field Robotics

- Nagasaki EV&ITS Project
- Analysis and control of nonlinear behaviors of mixture traffic flow
- Analysis and control of hyper-flexible manipulators
- Development of mechanisms for mechatronic artificial esophagus

SUZUKI, T. Lab.

Field Smart Material Systems

- High-sensitive optical-fiber ultrasonic sensor based on PS-FBG
- Damage detection in composites by using broadband Lamb waves
- Dynamic monitoring system with active and passive functions
- New deployable structures based on an elastic origami model

OKABE,Y. Lab.

Field Applied Micro Manufacturing

- Micro assembly under scanning electron microscope
- Functional surface with micro/nano structures by beam machining
- Pinpoint measurement of mechanical properties of biomaterials and organisms
- Development of micro medical devices

TSUCHIYA Lab.

Field Medical Engineering for Transplantation

- Islet transplantation

OKITSU Lab.

Field Manufacturing Science Fundamentals

- Fundamental manufacturing technology
- Terahertz microscopy
- Microscopy of thermal evanescent wave

KAJIHARA Lab.

Field Interfacial Transport Engneering

HASEGAWA Lab.

Field Cell Instrumentation Engineering

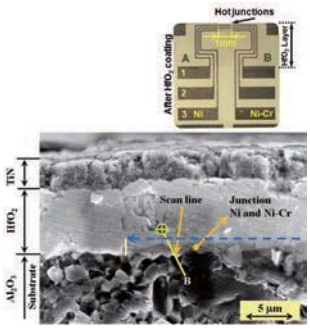
- Chemical senses and neuroscience
- Functional analysis of ion channels
- Electrophysiology and bio-imaging

SATO, K. Lab.

OBIKAWA Lab.

Thin film thermocouple built-in intelligent cutting tool

Thin film thermocouple (TFT) sensor built-in coated tools have been developed for tool condition monitoring. The sensor can measure the temperature at the tool-chip contact area. Hard coating materials applied to these tools include TiN, DLC (diamond -like carbon), etc.

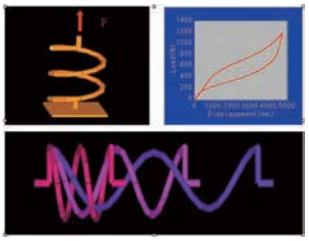


Cross section of a TFT built-in tool with HfO_2 coating for insulation and TiN for hard coating

TOI Lab.

Finite element analysis of superelastic behaviors of shape memory alloy devices

Finite element program has been developed for the analysis of superelastic, large deformation behavior of helical springs of shape memory alloy to be used as an actuator component. The incremental analysis procedure has been formulated by the total Lagrangian approach, in which Brinson's constitutive modeling is extended to asymmetric tensile-compressive behavior. The figure shows results for the superelastic deformation of helical springs under elongation.

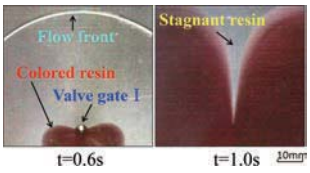


Superelastic behavior of helical springs of shape memory alloy

YOKOI Lab.

Analysis of cavity filling phenomena inside mold with hot runner system

In this study, we attempt to clarify the causes of molding defects unique to the hot runner system such as eccentricity of filling patterns. This figure shows the dynamic visualization result when molding was carried out using transparent resins inside the manifold and colored resins inside the cylinder. It was confirmed that the delay of the flow front occurs due to the influence of transparent stagnant resins which remain forming streaks from the gate to the downstream.

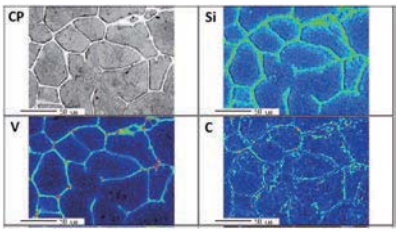


Flow behavior around a valve gate when the resin changed from transparent to colored one (Resin; GPPS, injection rate; 40cm³/s)

YANAGIMOTO Lab.

Microstructure control of tool steel by semi-solid process

By utilizing the materials processing technology at semi-solid state, refinement of microstructure and homogenization distribution of precipitates could be realized with shorter process chain and lower energy consumption. Globularization of microstructure at semi-solid state promotes the grain refinement, which necessitates many passes by hot metal forming.

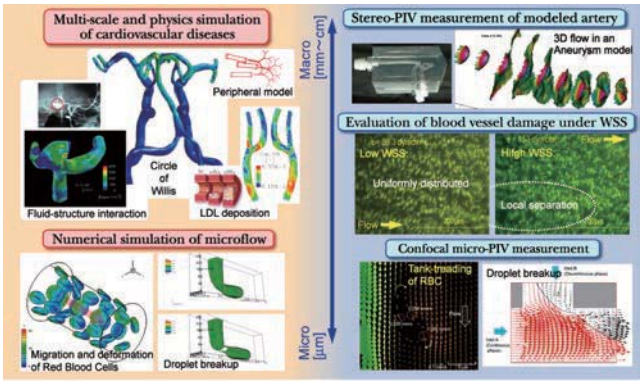


VC (vanadium carbide) precipitated on the grain boundaries of semi-solid processed SKD61 tool steel

OSHIMA Lab.

Computational biomechanics and visualization measurement of blood circulatory system

We have been conducting numerical simulation and experiments in order to elucidate the mechanism of vascular diseases such as cerebral aneurysm or arteriosclerosis. The large-scale simulation of fluid-structure interaction is conducted in a patient-specific manner to investigate the effects of mechanical stresses induced by blood flow on arterial walls with consideration of mechanical and physiological responses.

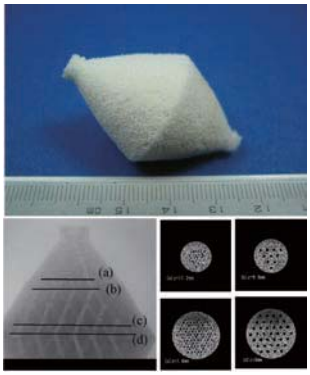


Numerical simulation and visualization measurement of blood circulatory system

NIINO Lab.

Fabrication of scaffolds for reconstruction of high metabolic rate organs

Aiming at fabrication of scaffolds for reconstruction of high metabolic rate organs such as liver, we applied selective laser sintering technology and obtained a high pore rate prototype including networked flow channels thinner than 1mm in diameters.

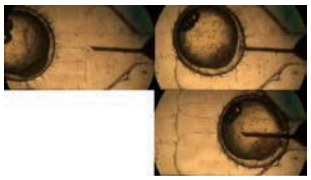


Prototype scaffold for high metabolic rate organ regeneration

SHIRAKASHI Lab.

Mass transport by electroinjection to single fish egg

Although the preservation of fish eggs or embryo is thought to be an effective method to enhance the yield ratio of large or rare species in the aquafarming seedling production, it has not been succeeded so far, because of the extreme low membrane permeability of egg membrane. We have developed the method of "Electroinjection" which allows a metal capillary syringe to puncture the egg membrane for injecting a bio protective agent without any moving parts in the developed device.

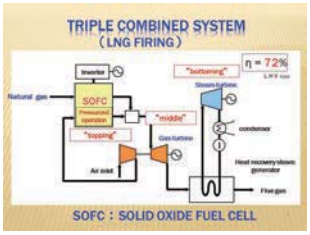


Needling of a fish embryo

HASHIMOTO Lab.

Ultimate high-efficiency thermal power plant(SOFC/ gas turbine/steam turbine combined system)

Highly efficient power generation systems are required to solve modern global warming and energy issues. Solid oxide fuel cells (SOFC) can be integrated into power generation systems that are expected to be more efficient than those in conventional power plants. The efficiency of conventional natural gas firing power plants is approximately 40%, while that of the SOFC/ GT/ST-combined plant is 72%. This demonstrates how we can contribute to a low-carbon society by reducing CO_2 emission.



SUZUKI, T. Lab.

Nagasaki EV&ITS Project

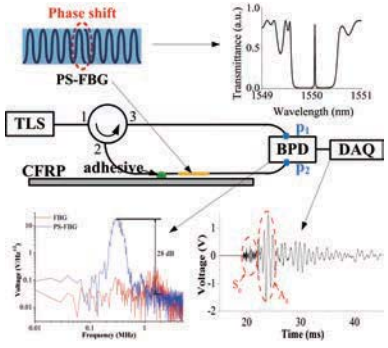
Nagasaki prefecture is promoting "Nagasaki EV&ITS Project", which aims to construct a futuristic driving tourism system with practical penetration and operation of EV (electric vehicles) and ITS (intelligent transport systems) in the field of Goto islands, a candidate area for the World Heritage.
Prof. Suzuki moved to Nagasaki prefectural government from 2011 to 2013 and directed the project aiming to develop an international standard ITS model originated from a region.

EV in Goto islands

OKABE, Y. Lab.

High-sensitive optical-fiber ultrasonic sensor based on PS-FBG

PS-FBG is introduced as a novel optical-fiber ultrasonic sensor. By using the steep peek in the middle of the spectrum, this sensor system increased the sensitivity drastically in the active ultrasonic damage-detection method. Moreover, AE signals could be detected by this system.

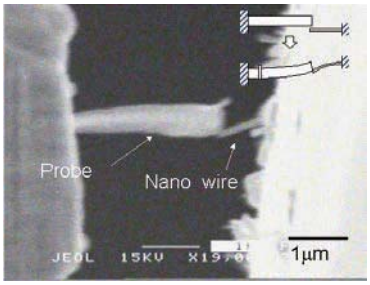


High-sensitive PS-FBG ultrasonic sensing system

TSUCHIYA Lab.

Micro assembly under Scanning Electron Microscope

We have developed the systems for manual operation of an arbitrary micro objects under observation. The systems realized several operations, including a microstructure construction, destructive test of nanostructures and decomposition of biological samples.

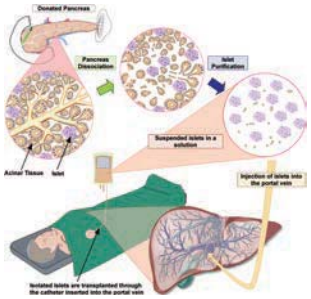


Measuring mechanical properties of tungsten oxide nanowire of 20nm in diameter using a probe of 200nm in diameter

OKITSU Lab.

Islet transplantation

Islet transplantation is the therapy for insulin dependent diabetes mellitus, which mainly consists of type 1 diabetes mellitus that is caused by the destruction of pancreatic beta-cells due to the autoimmune disorder. The islet contains pancreatic beta-cells that produce insulin, sense the blood glucose and secrete appropriate dose of insulin to control the concentration of blood glucose. To improve the outcome, considerable effort in basic research is currently devoted worldwide.

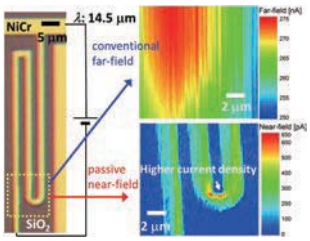


A schematic illustration of the procedure in islet transplantation

KAJIHARA Lab.

THz nano-thermometry

Our THz near-field microscope probes local temperature distribution on sample surfaces. The microscope is non-contact and achieves 60 nm-resolution. Figure shows the local temperature distribution on micro metal circuit, in which the current density at inner side of the pattern is much higher than the one at the outer side. We believe that our technique can be applicable to visualizing temperature distribution on bio-samples, local heating during the micro-machining process, and others.



Nano-thermometry on biased micro metal circuit

SATO, K. Lab.

Identification of chemosensory receptors in insects

Insects sense the chemical compounds in their environment through the olfactory and gustatory system. I reconstituted chemosensory responses of insects in heterologous expression systems. HEK293T cells expressing insect chemosensory receptor complex selectively responded to ligands with a nonselective cation current conductance in a G protein-independent manner. Outside-out patch-clamp recording provides evidence supporting the hypothesis that receptors constitute ligand-gated ion channels.

Department of Informatics and Electronics

The Department of Informatics and Electronics is engaged in three broad overlapping areas of research: (a) information and computer sciences; (b) nanoelectronics/photonics and very large-scale integration (VLSI); and (c) energy, motion control and micromachines. We strive to be at the forefront of research in the fundamentals as well as emerging technologies and their applications for the development of a future information society. This department is run in close collaboration with Center for International Research on Micronano Mechatronics (CIRMM), Advanced Mobility Research Center (ITS Center), Center for Photonics Electronics Convergence (CPEC), Center for Socio-Global Informatics, and Collaborative Research Center for Innovative Mathematical Modelling.

Field Integrated Circuits and Systems Design

- Low-power, high-performance VLSI design
- Nano-scale interconnect design
- Low-power oriented softwares
- Ultra short range wireless LSI

SAKURAI Lab.

Field Biological Information Systems

- Mathematical research of the brain and nervous systems
- Mathematical modelling and analyses of complex phenomena
- Research of chaos engineering
- Mathematical modelling of diseases

AIHARA Lab.

Field Integrated Device Engineering

- Ultra-low voltage nano CMOS
- Variability of scaled CMOS
- Silicon nanowire transistor
- Silicon single electron transistors and their physics

HIRAMOTO Lab.

Field Multimedia Communication Systems

- Haptic collaboration and its applications
- Mobile adhoc networks and sensor networks
- Context and location aware network services
- QoS control and measurement of multimedia streams in high-speed networks

SEZAKI Lab.

Field Nonlinear Mathematical Science

- Interval dynamics
- Random perturbation of dynamical system
- Fock representation of point processes
- Unitary matrices and probability

TAKAHASHI, Y. Lab.

Field Statistical Seismology

- Seismicity and probability forecasting
- Statistical modeling of point process
- Bayesian statistics
- Spatial statistics

OGATA Lab.

Field Highly Accurate Analog Integrated Circuits Engineering

- AD converter based on beta-expansion
- High precision AD converter
- Data acquisition system for sensor net

HOTTA Lab.

Field Complex Biological Networks Theory

- Modeling biomolecular network
- Nonlinear analysis of biomolecular network
- Reconstructing biomolecular network
- Analysis on complex diseases

CHEN Lab.

Field Earth Observation Data Engineering

- Construction of earth observation data integration and analysis system
- High performance and low power large scale archive system

NEMOTO Lab.

Field Information Security

- Network security
- Security management
- Cryptography
- E-Society engineering

MATSUURA Lab.

Field Versatile LSI Systems Design

- Low power wireless communication LSI
- RF CMOS circuits design
- Mixed-signal LSI
- Organic FET circuits design

TAKAMIYA Lab.

Field Biomathematical Science

- Nonlinear dynamics theory
- Biomathematical informatics
- Mathematical modeling

SUZUKI, H. Lab.

Field Quantitative Biology

- Information theory for dynamics of molecular, cellular and developmental phenomena
- Integrative research on biology
- Informatics on bioimaging data

KOBAYASHI Lab.

Field Mathematical Systems Theory of Communication

- Learning environment model from demonstration
- Hierarchical temporal model based on nonparametric Bayesian inference
- Bifurcation analysis using Conley-Morse graphs

MAKINO Lab.

Field Nonlinear Time Series Analysis

- Theoretical developments of nonlinear time series analysis
- Applications of nonlinear time series analysis
- Quantitative cancer research

HIRATA Lab.

Field System Software Engineering

- Ultrafast database engine
- Bigdata analytics platform
- Highly-functional storage systems

GODA Lab.

Field Computational Linguistics

- Ultrafast, robust language analysis technology
- Real-world knowledge acquisition from the web

YOSHINAGA Lab.

Field Natural Language Processing Engineering

- Robust analysis of CGM text
- Sentiment analysis
- NLP for supporting linguistic study

KAJI Lab.

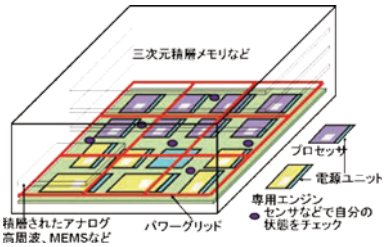
Field Spatiotemporal Mobility Informatics

ONO Lab.

SAKURAI Lab.

Power efficient 3-D integrated VLSI system

3-D integrated VLSI system is power efficient, because it reduces the communication distance by chip stacking. We have proposed and demonstrated several circuits for on-chip sensors, chip-to-chip wireless communications and power delivery/conversion.



Power efficient 3-D integrated VLSI system

AIHARA Lab.

Mathematical research on information processing of the brain and nervous systems

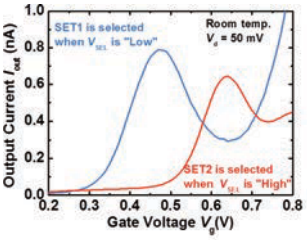
We study nervous systems mathematically as well as analyze their experimental data to understand the information processing in the brain. The topics include the relationship between neuronal properties and functions, optimal synaptic learning rules, and nonlinear dynamics of neural network models. We have also proposed new methods for analyzing experimental data and developed analog computation devices based on mathematical neuronal models.

Chaotic neurocomputer

HIRAMOTO Lab.

Integration of CMOS circuits and silicon single-electron transistors operating at room-temperature

A single-electron transistor (SET) is the extremely miniaturized device. We developed fabrication process of a silicon dot with diameter of as small as 2nm and demonstrated the integration of CMOS circuits and SETs operating at room temperature for the first time. The figure shows two SETs controlled by analog selector circuits. The new functionality added by Beyond CMOS is the key technology for future integrated nanoelectronics.

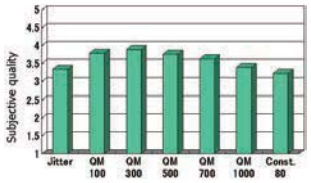


The first demonstraion of multiple SETs operating at room temperature integrated with CMOS circuits on a same chip

SEZAKI Lab.

Haptic collaboration and its application

With the development of commercial haptic devices, haptic communication and haptic collaboration have been studied intensely. Among them, we are now focusing on various issues related to keeping the subjective quality of haptic applications as high as possible under various network impairments. The examples are coding of haptic media, media synchronization for the compensation of the delay and jitter, various method for error correction including dead-reckoning.

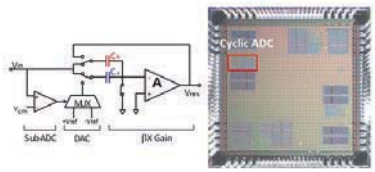


Effect of jitter in haptic collaboration (Either a full compensation of jitter or no control of jitter approach is optimal.)

HOTTA Lab.

A 10-bits cyclic ADC based on beta-expansion

A cyclic ADC architecture with beta-encoder outputs beta-expansion code and has an advantage of error correction. This feature makes ADC robust against capacitor mismatch, finite gain of amplifier in multiplying-DAC and temperature change by using beta-value estimation algorithm we proposed. Because power penalty of high-gain amplifier and the required accuracy of circuit elements for high resolution ADC can be relaxed, the proposed architecture is suitable for deep submicron CMOS technologies.

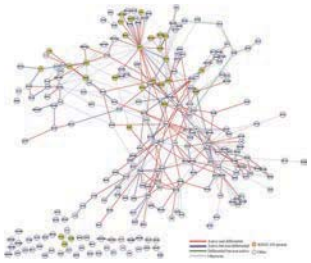


Circuit configuration and chip photo of cyclic 10-bit ADC based on beta-expansion

CHEN Lab.

Detecting and analyzing differentially activated pathways in brain regions of Alzheimer's disease patients

We developed a novel network-based framework to identify and analyze differentially activated pathways by integrating human protein-protein interaction data and gene expression profile data in six brain regions associated with Alzheimer's disease (AD). Those identified pathways are considered as important candidates as the biomarkers of AD. The analyses of the similarities and differences of these dysfunctional pathways provide insights into understanding the dynamics of AD progression.

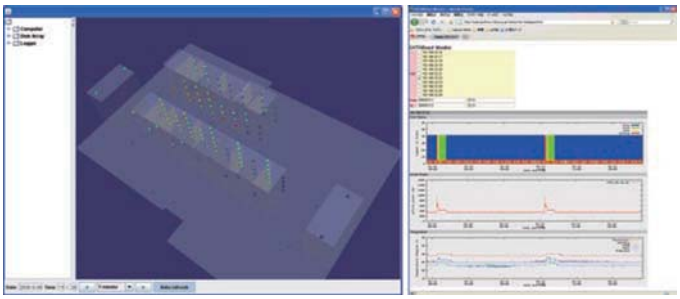


Identified active pathway of EC in the AD protein-protein interaction network

NEMOTO Lab.

Monitoring of archive system and its application to power saving

Monitoring of temperatures, power consumption and usage of archive systems by a lot of sensors scattered around a server room and using the information to reduce the total power consumption of the systems.



MATSUURA Lab.

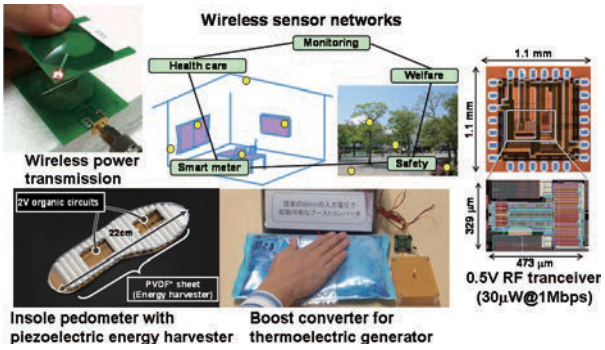
Fingerprinting attack against Tor anonymous communication system

Tor anonymity system drew the society's attention since it was used in the remote-control virus incident. We invented a fingerprinting attack against Tor; when the network condition allows, the success rate of our attack is higher than 80 percent. We examined features of countermeasures, and found anonymous communication is difficult if favorite homepages are less than 20. With the help of machine learning, the attack can be effective even when the number of possible homepages is around 50.

TAKAMIYA Lab.

Microwatt power management circuits and wireless transceiver circuits for wireless sensor nodes

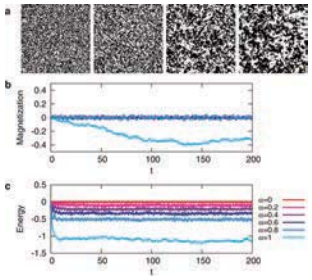
Ultra low power circuits for wireless sensor networks, including a boost converter for a thermoelectric generator, an insole pedometer with a piezoelectric energy harvester, and a 0.5V RF transceiver (30μW@1Mbps), are proposed and demonstrated.



SUZUKI, H. Lab.

Chaotic Ising-like dynamics in traffic signals

The green and red lights of a traffic signal can be viewed as the up and down states of an Ising spin. Moreover, signals in a city interact with each other, if controlled in a decentralized way. A model of interacting signals is shown to have Ising-like dynamics that undergoes a ferromagnetic phase transition. Probabilistic behavior is realized by chaotic billiard dynamics. Our model is expected to serve as a starting point for statistical mechanics of traffic signals. [Sci. Rep. 3, 1127, 2013]

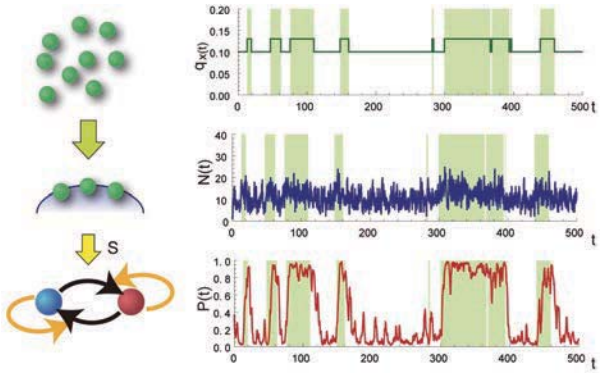


Dynamics of the traffic signal model

KOBAYASHI Lab.

Dynamic decision making of a cell by intracellular kinetics

Cells make a variety of decisions such as differentiation and apoptosis by extracting information from noisy input. Yet to be revealed is the mechanism that enables a cell to conduct efficient decision-making. In this work, we clarified theoretically that an intracellular kinetics with a dual positive feedback can implement dynamic Bayesian decision making. This result indicates that intracellular reaction kinetics can implement highly advanced information processing.

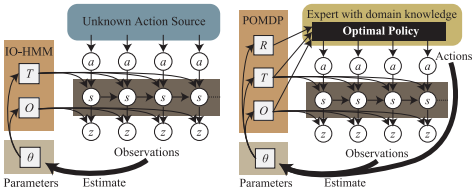


Change in the environmental states(upper row), noisy receptor dynamics on a cell membrane(middle row), and reconstruction of environmental change by the intracellular kinetics with a dual positive feedback

MAKINO Lab.

Learning environment model from demonstration

We consider apprentice learning, i.e., to make an agent learn a task by observing an expert demonstrating the task, when the model of the environment is uncertain. We show that we can extract information about the environment model by inferring action selection process behind the demonstration, under the assumption that the expert is choosing optimal actions based on knowledge of the true model of the target environment.



Sketch of existing estimation method and proposing estimation method

HIRATA Lab.

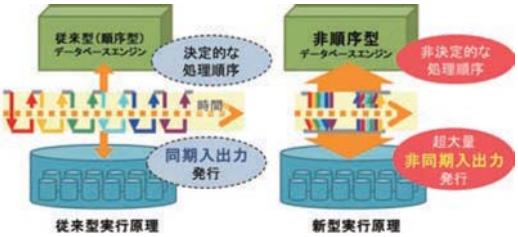
Nonlinear time series analysis and its cross-disciplinary applications

This laboratory develops methods for nonlinear time series analysis and applies them to real datasets obtained from, for example, brains, foreign exchange markets, cancers, earthquakes, weather, and renewable energy. Our current main focuses include (i) developing methods for analyzing point processes data, where events are observed at irregular times, (ii) personalizing treatments to improve the quality of life, and (iii) understanding high-dimensional time series in intuitive ways.

GODA Lab.

Development of ultrafast database engine based on novel execution principle

The laboratory is leading and conducting the development of ultrafast database engine based on novel execution principle, which has strong benefits of enabling highly efficient utilization of multicore processor power and storage system bandwidth. Significant potential boosting has been experimentally confirmed for many types of analytical queries over large-scale data.



Comparison of execution principles of database engines

YOSHINAGA Lab.

Fast and accurate deep text analysis

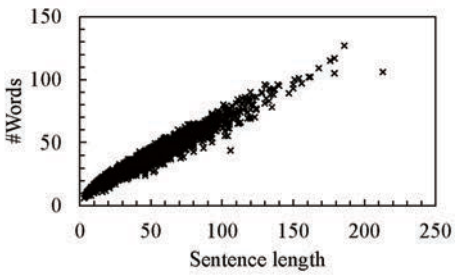
Deep language processing such as parsing requires us to consider massive conjunctive features, which cause speed-accuracy trade-off in processing. I have proposed feature sequence trie as a means of packing redundant classification problems to speed up the training/testing of a classifier. A dependency parser based on these techniques, J.DepP, can parse >10,000 sentences/sec, which is fast enough to analyze tweets in real time, while achieving the state-of-the-art dependency accuracy.

Analysis of people's behaviors and emotions recorded within Twitter and blog after the Great East Japan Earthquake

KAJI Lab.

Speeding-up morphological analysis

Morphological analysis that can handle non-normative linguistic expressions, including neologisms and casual expressions, is fatal to utilize Web textual data. It, however, has been difficult to achieve this without slowing down the processing speed. I developed a fast algorithm generating word lattice, which is a packed representation of analysis candidates, and achieved more than 10 times speed-up than previous approach.



Size of word lattice as a function of sentence length

Department of Materials and Environmental Science

The Department of Materials and Environmental Science covers the research field of material engineering and environmental science pertinent to organic and inorganic compounds as well as metals. The department conducts extensive research ranging from fundamental studies to studies for advanced material development. More specifically, studies include those for the analysis of chemical and physical properties of new materials, development of new synthesis methods and production processes, innovations in biotechnology and environmental analysis, and the development of eco-friendly technologies to realize a sustainable society.

Field Micro and Nano Materials Analytical Chemistry

- Development of advanced micro-beam analytical instruments
- Development of three-dimensional atom probe for atomic resolution analysis of real electronic devices
- Three-dimensional analysis of microstructure devices
- Compositional and structural analysis of environmental small particles

OWARI Lab.

Field Optoelectronic Functional Thin Films

- Universal heteroepitaxial growth
- Development of high quality group III nitrides
- Semiconductor devices on metals
- Polymer based electronics

FUJIOKA Lab.

Field Synthetic Organic Chemistry

- Development of solid-supported peptide catalysts that work in aqueous media
- Preparation of functional molecules based on interaction of amino acids with group 11 metals
- Development of polymer electrolyte membrane based on graft copolymer of polybenzimidazole

KUDO Lab.

Field Functional Metal Complexes Chemistry

- Development of novel organic-inorganic hybrid materials
- Photofunctional metal complexes
- Functional phthalocyanine complexes

ISHII Lab.

Field Nano-Materials Design

- Materials design by theoretical calculation and nano-analysis
- Developments of theoretical calculation methods for core-loss spectroscopy
- Chemical bonding analysis by electron energy loss near edge structures
- Investigation of non-stoichiometry at lattice imperfections

MIZOGUCHI Lab.

Field Environmental and Chemical Engineering

- Development of systems and technologies for sustainable integrations of local agriculture, water environment and biomass industries
- Development of adsorptive separation processes for environmental applications
- Synthesis and applications of novel carbon

SAKODA Lab.

Field Amorphous Materials Design

- Metastable phase formation by containerless processing
- Mixed conduction glasses
- Atomic arrangement around rare earth ions in glass
- Atomic arrangement of amorphous materials and their computer simulations

INOUE Lab.

Field Organs and Biosystems Engineering

- Development of advanced cell-based assays and their applications to efficacy/hazard evaluations
- In vitro organization and growth of implantable liver and pancreas beta-cell tissues
- Process development for mass production and differentiation of stem cells
- Development of advanced biosensing devices using carbon nanofibers

SAKAI, Y. Lab.

Field Environmental Catalyses and Materials Science

- System integration in a confined nanospace
- Catalytic system for automobile exhaust
- Selective catalyses in a confined nanospace

OGURA Lab.

Field Biomaterial Engineering

- Cell culture in fluorous solvents
- Development of inhibitors on EGF receptor tyrosine kinase
- Production of oligosaccharides by using cells
- Preparation of functional glyco-devices by use of fluorous interaction

HATANAKA Lab.

Field Inorganic Plasma Synthesis

- Doping control of crystal defects in oxide ceramics for functional thin film deposition
- Surface reactions of H and O radicals on diamond surface
- Depositions of carbon-related hard coatings with low friction coefficient
- Diamond film deposition by plasma CVD process

MITSUDA Lab.

Field Protein Engineering

- Antibody engineering for bio-better
- Bio-superior screening and optimization of small molecules for chemical biology dissection
- Disease-related molecular systems
- Smart design of proteins

TSUMOTO Lab.

Field Molecular Integrated System Engineering

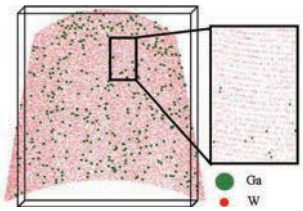
- Development of functional metallopolymers by molecular integration
- Material development using dynamic covalent bond and complexation
- Development of smart material using supramolecular interactions
- Function design of supramolecular materials based on theoretical chemistry

HOUJOU Lab.

OWARI Lab.

Atomic level imaging using Three-Dimensional Atom Probe

By applying positive high voltage on a sharp needle, apex atoms are ionized and emitted. Direction and sequence of the emission bring the information of atomic arrangement. In addition, flight speed of each ion corresponds to mass of the ion. By integrating these information, three-dimensional elemental images are reconstructed with atomic resolution (Three-Dimensional Atom Probe). This study aims at realization of ultimate three-dimensional elemental analysis for material science/technology.



Distribution of implanted gallium atoms. Atomic planes of tungsten crystal and position of gallium atoms are clearly shown.

SAKODA Lab.

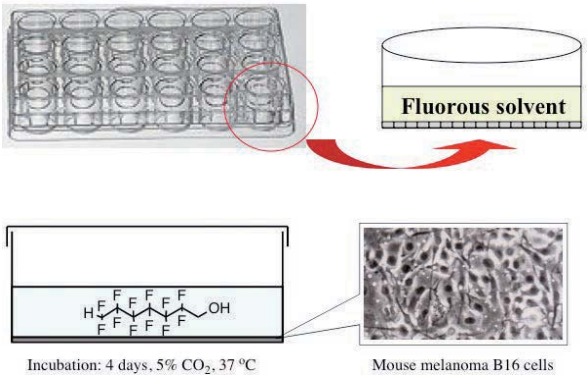
Environmental and chemical engineering

We are facing various global and regional environmental problems. Oil-based society caused problems such as global warming, and a shift to renewable-resources-based society is expected to reach a sustainable society. Contamination of environment by radioactive Cs is among the most urgent problems to be solved. Our laboratory especially focused on the followings. (1) Sustainable integrations of local agriculture and biomass industries (2) Adsorptive removal of radioactive Cs from environment.

HATANAKA Lab.

Cell culture in fluorous solvents

Highly fluorinated compounds contains a lot of oxygen. We are working on the long-term storage and the organization of cultured cells using fluorous alcohols.

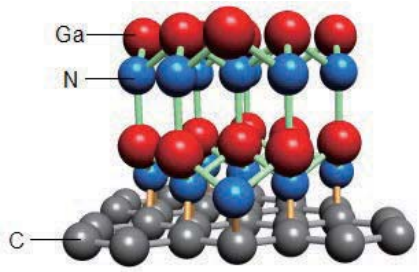


Mouse melanoma cells cultured in fluorous alchol

FUJIOKA Lab.

Flexible single crystalline semiconductor devices

We are developing a crystal growth technique of semiconductors on large area flexible substrates. This technique allows us to fabricate various flexible semiconductor devices such as low cost solar cells, large area displays, high efficiency LEDs, and high performance FETs.

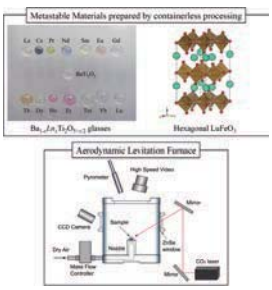


Atomic arrangement at the heterointerface between the GaN semiconductor and the graphite substrate

INOUE Lab.

Metastable phase formation by containerless processing

Containerless processing is well suited to promote deeper undercooling in molten materials, because it suppresses inhomogeneous nucleation from the container wall. Therefore, containerless processing is a useful method to vitrify materials with low glass forming ability and to crystallize metastable phases from undercooled melts. Our research subject is to prepare new metastable phases using an aerodynamic levitation furnace and investigate their electrical, optical and structural properties.

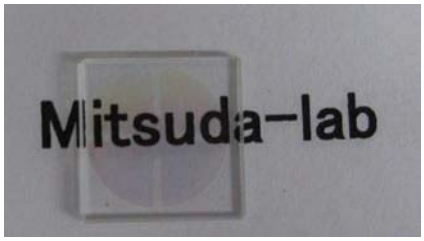


Metastable materials and aerodynamics levitation furnace

MITSUDA Lab.

Doping control of crystal defects in oxide ceramics for functional thin film deposition

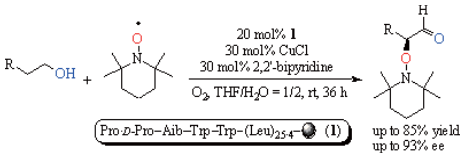
Transparent and Conductive Film (TCF) is essential in photovoltaic and flat panel displays. We study tin oxide as a substitution for indium tin oxide. In our method, oriented SnO was oxidized to SnO_2 at low temperature, which exhibited high transparency and conductivity on commercial glass.



Transparent and conductive SnO_2 thin films formed by oxidation of oriented SnO

KUDO Lab.
Development of selective bond-forming reactions catalyzed by immobilized peptide catalysts in aqueous media

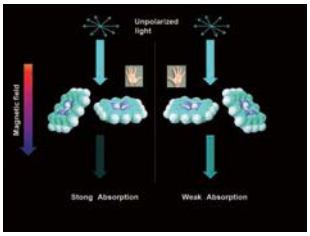
Enzymes are ideal catalysts because they work in water at ambient temperature with high substrate specificity and selectivity. Development of enzyme-like catalysts might enable efficient production of important compounds such as drugs. As enzymes are polypeptides made of amino acids, similarly amino-acid-made artificial peptides are expected to show enzyme-like catalytic ability. Concerning this, we have succeeded to realize selective bond-forming reactions catalyzed by immobilized peptides.



Asymmetric bond-forming reaction catalyzed by immobilized peptides

ISHII Lab.
Magneto-chiral Dichroism of organic compounds

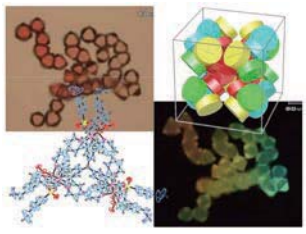
Magneto-chiral Dichroism (MChD, i.e. the dependence of the absorbance of a chiral molecule on magnetic field directions) is a plausible candidate for explaining the homochirality of life. Using chiral J-aggregates of water-soluble porphyrins, we have demonstrated the presence of MChD in organic compounds for the first time. This finding not only is useful for asymmetric synthetic methods and magneto-optical devices, but also opens up new possibilities for clarifying the homochirality of life.



Magneto-chiral dichroism of organic compounds

HOUJOU Lab.
Molecular design and assembly control of dye-conjugated complexes

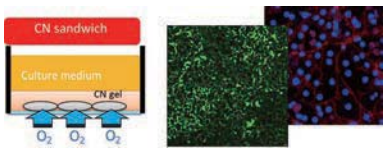
Organic dyes receive various perturbations from inter- and intramolecular interactions, showing color modulation as a result of change in electronic state. Without drastically modifying the molecular structure of chromophore, but changing high-order structure (e.g. crystal packing) will control their optical functions. Recently, we have proposed a concept of "dye-conjugated complex", on which we study the effects of molecular environment on the electronic state of dye molecules.



A complex luminescent in various colors depending on UV irradiation power

SAKAI, Y. Lab.
Development of advanced cell-based assays and their applications to efficacy/hazard evaluations

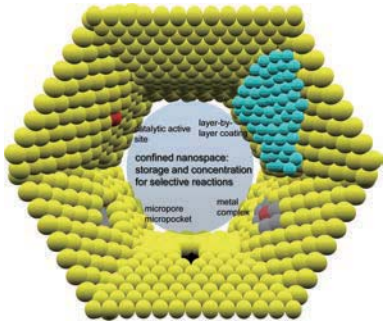
Cultured-organ models are expected to be used in drug efficacy/toxicity screenings. Particularly, models for the liver, the center of metabolism, are highly required to predict metabolism and excretion in humans. We developed a new culture model showing an enhanced bile excretion based on direct oxygenation of cells using oxygen-permeable membranes. We are now trying to develop miniaturized tissue array or microfluidic devices through collaborations with other laboratories at IIS.



Bile canaliculi formation of hepatocytes cultured on oxygen-permeable membranes

OGURA Lab.
A novel synthesis method for hierarchical porous materials and their functions

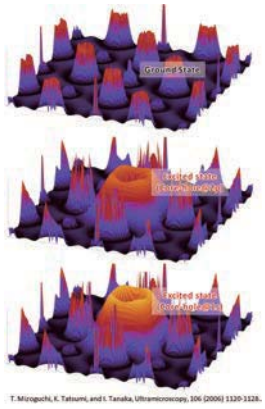
Several unique adsorption and surface reactions sometimes take place in a confined nanospace at a molecular level. In order to utilize such functions, a system-integrated porous network is designed and created in the nanospace, for achieving a highly selective catalytic reaction.



A design & creation of novel hierarchical porous system in a confined nanospace

MIZOGUCHI Lab.
Calculation and interpretation of core-loss spectroscopy: basics and applications

Electron energy loss near edge structures (ELNES) and X-ray absorption near edge structures (XANES) originate from the electron transition from a core-orbital to unoccupied bands. ELNES has high spatial resolution and XANES has high sensitivity. Therefore, they are powerful tool for materials characterization. We are developing and applying theoretical calculation method for the ELNES and XANES.



Electronic structure of excited states

Department of Human and Social Systems

The Department of Human and Social Systems conducts studies on architectural spaces, social infrastructure facilities, and urban and global environments.
Cities and the planet earth on which these cities are located are dynamic containers that house not only humans but also other forms of life. These life forms require various factors for convenience, comfort, sustainability, and safety. This department focuses on these issues from the multiple dimensions of engineering, natural environment, society, economy, and culture.

Field Geo-Information Engineering

- People Flow Project
- Detailed time-series monitoring of urban areas all over Japan
- Information bank concept: platform for self-management of personal information
- Developing ontological information to integrate global observation data

SHIBASAKI Lab.

Field Environmental Control Engineering

- Optimal design of indoor environment with CFD simulation
- Virtual building utilizing building information modeling
- Numerical simulation and wind tunnel experiment of air conditioning system using cross ventilation of buildings
- Indoor air chemical pollution research for healthy living environment

KATO, S. Lab.

Field Management of Project

- Construction sector as service provider
- Business model development for industrial ecology in contruction related activities
- Project based technology fusion
- Sustainable construction

YASHIRO Lab.

Field Geotechnical Engineering

- Deformation property of geomaterials at wide strain range
- Seismic behavior of retaining walls and reinforced soils
- Strength and deformation properties of improved soils
- Liquefaction characteristics of sandy soils

KOSEKI Lab.

Field Spatial Structure Engineering

- Development and safety of spatial structures
- Structural behavior of shell and spatial structures
- Dynamic behavior of spatial structures
- Computational morphogenesis of structures

KAWAGUCHI Lab.

Field Urban Heritage / Resource Development

- History of architecture and cities in Asia
- Reuse of urban heritage and resources

MURAMATSU Lab.

Field Concrete Engineering

- Crack resistant mechanism due to expansion, stress relaxation and self-healing function
- Durability assessment for structures based on surface quality of concrete
- Prediction model for heat generation and strength development of cementitious materials
- Theory for fluidity of fresh mortar

KISHI Lab.

Field Urban Energy Engineering

- Analysis and control of urban climate
- Simulation and wind tunnel experiment of flow and diffusion fields in urban areas
- Sustainable buildings in urban systems
- Zero energy building

OOKA Lab.

Field Engineering and Design for Timber Structures

- Middle-rise and high-rise timber buildings
- Traditional wooden buildings
- Modern timber building
- Seismic perforamance of wooden houses

KOSHIHARA Lab.

Field Design and Sustainability Engineering

- Design methodology for maintenance robots
- Life cycle simulation
- Design methodologies for multi-disciplinary systems

TOMIYAMA Lab.

Field Low-Exergy System Science for Built Environment

SHUKUYA Lab.

Field Isotope Meteorology

- Stable water isotopes circulation
- Dynamical downscaling

YOSHIMURA Lab.

Field Remote Sensing for Environment and Disaster

- Algorithm development for remote sensing of environment and disaster
- Development of remote sensing data set and distribution on WWW

TAKEUCHI, W. Lab.

Field Architectural Space System

- Urban analysis and estimation
- Design of architectural spatial system
- Methodology on architectural design
- Development of new materials for improving architectural and amenity space

IMAI Lab.

Field Global Monitoring for Ecology and Environment

- Remote sensing for terrestrial environments
- Environmental monitoring and modeling
- Planning of sustainable watershed area

OKI, K. Lab.

Field Human Centered Urban Informatics

- People movement analysis
- Mobile sensing
- Infrastructure data management
- Open data

SEKIMOTO Lab.

Field Environmental Ecology, Hydrology and Modelling

- Sediment transfer in the extreme volcanic environment
- Developement of catchment simulator

MOURI Lab.

Field Innovative Construction Materials Engineering

- Innovative repair methods for civil infrastructures based on crack self-healing technologies using cementitious materials
- Development of HPFRCC with self-healing capability for nuclear power plant
- Feasibility study on the solidification/sequestration of radioactive materials by biomineralization
- Establishment of durability assessment system by inspecting the surface quality of concrete

AHN Lab.

Field Satellite Remote Sensing of Land-atomosphere Interactions

- Understanding the hydrological response to climate variability and change
- Climate model evaluation and refinement
- Advances in the simulation, prediction, and projection of extreme events with regional and global climate models

FERGUSON Lab.

Field Urban Regeneration

- Research on urban regeneration process
- Morphological study of urban architecture
- Research of urban structure of small cities
- Study of public space network

OTA Lab.

Field Design of Architecture

- Design of architecture
- Locality and universality
- Theory of scenery

KAWAZOE Lab.

Field Humanospace-Safety Engineering

- Safety against falling of ceiling in large roof building
- Concept of deployable structures and mechanisms

OGI Lab.

Field Water and Environmental Engineering

- Diffuse pollution and control
- Risk assessment of chemicals
- Analyses of chemicals in waters

MURAKAMI Lab.

SHIBASAKI Lab.

People Flow Project

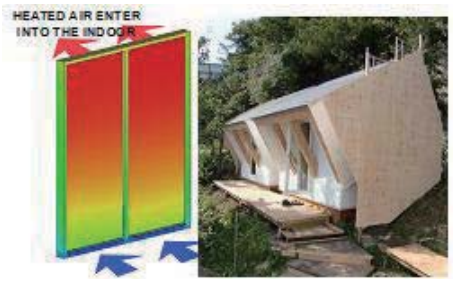
We start "People Flow Project (PFLOW)" which overviews data process technology, data quality and its common infrastructure for people flow on a large scale. Moreover, we provide spatio-temporal data processing service for all researchers through our platform named "People Flow Analysis Platform (PFLOW-AP)".

Example of visualization using People Flow Data

KATO, S. Lab.

Dynamic insulation system applied to window and its frame

We are developing a new dynamic insulation system applied to window and its frame. The laboratorial test shows the heat transmission coefficient of the prototypes' frame can be under 1W/m^2. The prototype installed in real scale building model is now in the experimental stage.

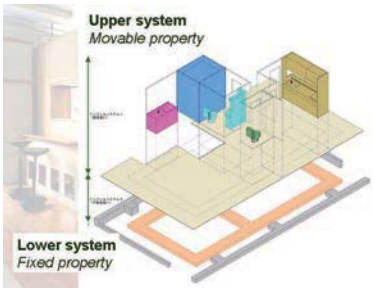


Result of CFD analysis and experimental house

YASHIRO Lab.

Development of morphological technology for redefinition of wealth of cities

The research project aims to develop 'morphological technology' that enable and enhance adaptable customization of built environment by replacing and upgrading infils of building concurrently. Morphological technology involves method of product design, lease and rental of components, IT based logistic and contract system.

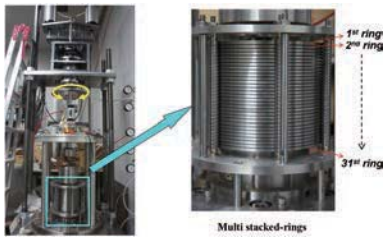


New business model enhanced by morphological technology

KOSEKI Lab.

Cyclic shear tests using stacked-rings on re-liquefaction properties of sand

A new torsional shear test apparatus using stacked-rings has been developed and employed to evaluate re-liquefaction properties of sandy soils, which became one of the major concerns in the areas damaged by liquefaction in the 2011 off the Pacific coast of Tohoku earthquake.



Newly-developed test apparatus

KAWAGUCHI Lab.

Safety in large space in buildings

Large spaces in buildings are used to enclose the area where many people gather for meetings or events. In the emergency of disasters, such enclosed spaces are often converted as refugee shelters. Therefore, the safety of the large enclosures should be highly ensured. We have been investigating the behavior and damage of large enclosures in disasters, and pointing out the design factors which should be imporved.

Impact test of ceiling panels dropped from heights

MURAMATSU Lab.

Analysis of process and principles of structural changes in urban environments of Asia

Structure of urban environments generally consists of three types of elements: historical/anthropological (urban DNA); ecological; and political/economic. Based on this understanding, we have conducted research in Shanghai, Hanoi, Bangkok, Huhhot, Jakarta, Medan and Padang. We are also currently working in Ulaanbaatar, Samarkand, Tehran, and some South Korean cities in order to investigate structural changes of their environments. This study should lead to a new urban understanding.

Survey in Jakarta

KISHI Lab.

Crack control by expansive concrete and durability assessment for concrete structures

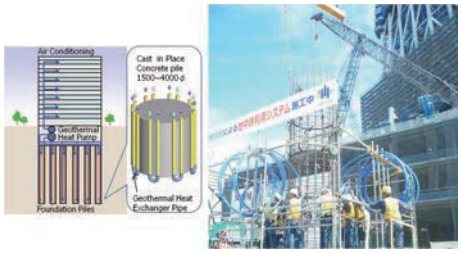
It is important for reinforced concrete to possess sufficient durability as fundamental construction materials for sustainable infrastructures. However, lots of low quality structures due to shrinkage induced cracks are often seen. Though expansive concrete is a promising material as a countermeasure to inherent shrinkage it could not replace conventional concrete yet. It is required to establish the inspection scheme to reveal quality of concrete at just after construction.

Devices for surface quality inspection and efficiency of expansive concrete

OOKA Lab.

Development of a ground source heat pump system

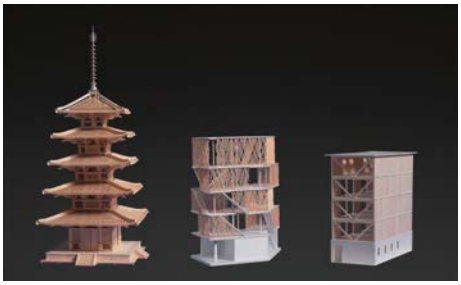
Although a ground source heat pump (GSHP) system is expected to save energy to a great extent, the use of this system has not been widespread because of the high initial cost inputs. In our study, we have attempted to develop a method which is more cost-effective than the GSHP system.



KOSHIHARA Lab.

Middle-rise and high-rise timber buildings

Revicing the Building Standard, middle-rise and high-rise new timber buidings can be built. Possibilities of timber structure are studied.



Five-storied pagoda and new five-storied wooden buildings

TOMIYAMA Lab.

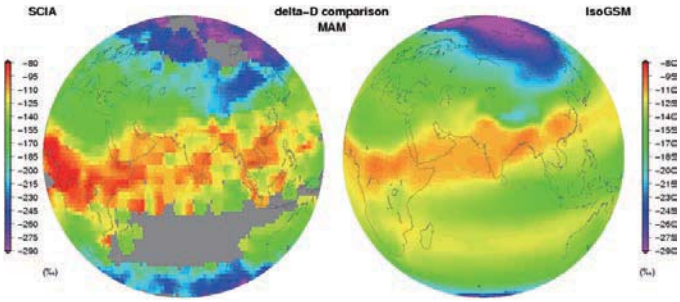
System architecting methodology and supporting systems

Modern multi-disciplinary systems are complex not only in terms of the number of components and size but also of functions, behaviors, and inter-subsystem interactions and dependencies. To design super-complex systems, systems engineering methodologies (e.g., V-model), are not powerful enough to dealing with system decomposition, implementation, and integration processes. This study focuses on the development and applications of system architecture modeling, system architecting CAD.

YOSHIMURA Lab.

Measuring vapor isotope ratio by spectroscopy sensors

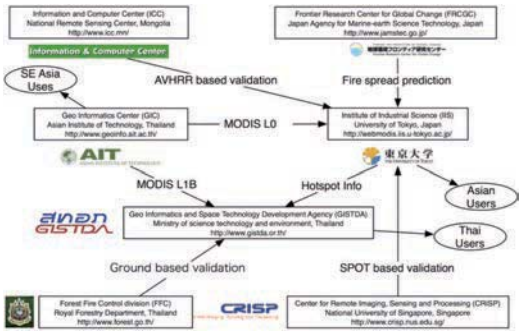
We measure spatial distribution and temporal variation of stable isotope ratio of vapor (delta-deuterium) by satellite-onboard and ground-based spectroscopy instruments.



TAKEUCHI, W. Lab.

A near-real time active fire monitoring over Asia with remote sensing

This research focuses on the near-real time network based active fire mapping and alert system over Asia using MODIS onboard Aqua and Terra satellite.



Monitoring of forest fires with remote sensing and its expansion modeling

IMAI Lab.

A study on Voronoi diagram with obstacles

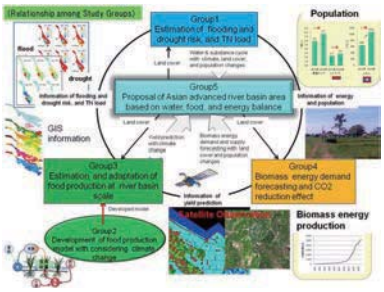
We study on a method for constructing Voronoi diagrams with free shape obstacles by a practical computer algorithm, using the shortest-path distance of a Delaunay network of many random vertices, which we termed as rDn. By measuring the shortest-path distance of the rDn for the detour distance, this method provides an approximate solution for the Voronoi diagrams with obstacles.

Voronoi diagram with eight strange shape obstacles by eight generators

OKI, K. Lab.

Development and dissemination of an environmentally advanced basin model in Asia

It is desirable to develop and disseminate an environmentally advanced basin model in Asia that takes into consideration the balance of water, food and energy in response to climate change. Among developed nations, Japan needs to pursue cooperation with other countries, especially since Japan is promoting green innovation to develop a sustainable society that balances the environment and the economy.



Proposal method

MOURI Lab.

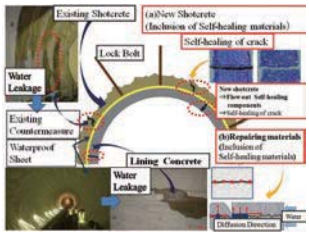
Sediment transfer in the extreme volcanic environment

Rivers of active volcanic territories in Kamchatka have a range of hydrological features which determine the extreme amounts terrain is strongly influenced by climate condition, particularly when heavy precipitation and warmer climate triggers a mud flow in association with snow melting in the catchment volcanic area. This study focused on the environmental change of Avachinsky volcano which is located at Kamchatka peninsula.

AHN Lab.

Innovative repair methods for civil infrastructures based on crack self-healing technologies using cementitious materials

Crack in concrete is one of the biggest problems in terms of durability of infrastructures. Maintenance and repair of cracked concrete are also very important for civil engineering fields. In our group, innovative repair methods based on crack self-healing technologies using cementitious materials are suggested in order to prevent water leakage in civil infrastructure such as slab, tunnel and water-retaining structure.

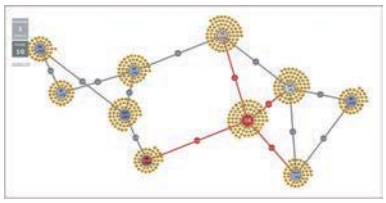


Application concept of self-healing technologies for underground civil infrastructures as tunnels

OTA Lab.

Architecture and public space in the chains of regeneration

It is rare that the reorganization of urban structure is entirely realized at one time. It is done partially and successively, especially in the city center where the land ownerships are complicated. In that case, the reorganization process that can have the chain reactions between the preceding project and the following one, become important for the success of regeneration. The research focuses the role of the architecture and public spaces in this process of urban spatial reorganization.



Multi agent simulation of "Chains of Regeneration" in Birmingham

KAWAZOE Lab.

Japanese low energy building

Low energy building is the big trend in the world. However, climate is different everywhere. Think of the possibility of Japanese low energy building.

Department of Management of Large Scale Complex System

Large scale complex system is characterized by multiple-inputs and multiple-output. The system is complex and characterized with non-linear features as well as some linear features. It is usually characterized with feed-back and also feed-forward controlling features. The Department of "Management of Large Scale Complex System" deals mainly with engineering aspects but does not deny to dealing with social aspects. The department seeks to explore how to stabilize the system with least control and how to control the system with safety and reliability.

Field Environmental Control Engineering

- Optimal design of indoor environment with CFD simulation
- Virtual building utilizing building information modeling
- Numerical simulation and wind tunnel experiment of air conditioning system using cross ventilation of buildings
- Indoor air chemical pollution research for healthy living environment

KATO, S. Lab.

Guest Chair for Advanced Interdisciplinary Modeling

The Guest Chair for Advanced Interdisciplinary Modeling was established to understand various complex phenomena by employing interdisciplinary modeling techniques. The research activity is characterized by the multi-disciplinary and multi-scale approaches maintaining the close liaison among the other departments, centers and industry.

Field Computational Surface Science and Functional Design

OHNO Lab.

Corporate Sponsored Research Program

The Corporate Sponsored Research Program was established in 1990 to promote knowledge and research by inviting Japanese and foreign researchers with excellent reputations in their fields. The invited researchers serve as Professors or Associate Professors at Institute of Industrial Science (IIS); they work from their home laboratories, exchange information, and promote interdisciplinary research.

Advanced Energy Conversion Engineering

Sponsor: Mitsubishi Heavy Industries, Ltd.
Period of activity: September 2008 – August 2013
Objectives:
Endowed Research Unit: Advanced Energy Conversion Engineering was established on September 1st, 2008, by the donation of Mitsubishi Heavy Industries, Ltd. to contribute to the solution of energy, economy and environmental problems effectively and in harmony. To utilize precious fossil fuels effectively, it is important to raise the efficiency as high as possible. This will also help to maintain good environmental conditions and help to prevent global warming by minimizing the production of CO_2.
The Advanced Energy Conversion Engineering Unit aims at elevating thermal efficiencies to the maximum.
Based on many years' experience which Dr. Kaneko has undergone during his years in industry, effective and promising projects has been selected as R&D Projects in the following areas;
1) Ultra-high efficiency thermal power plants: Further efficiency improvement for IGCC, IGFC and advanced USC plants.
2) Utilization of wider range of coals: Gasification for brown coal, anthracite and normal bituminous coals. Innovative drying system will be developed for brown coal gasification.
3) CO_2 recovery and storage
4) Innovative utilization of natural renewable energy
5) ECOMARINE Project: Energy conversion of driving system for fishing boats from petroleum-fueled diesel/gasoline engines to battery-motor driven system recharged by wave, solar or wind energy.

Field Advanced Energy Conversion Engineering

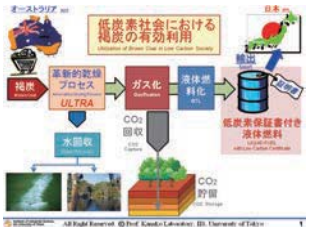
- Ultra-high efficiency thermal power plants
- Utilization of wider range of coals
- Innovative utilization of renewable energy
- Co_2 capture and storage

KANEKO Lab.

KANEKO Lab.

Innovative brown coal gasification by efficient drying

Brown coal or lignite contains large amount of moisture, say 50 to 60%. Drying of this moisture by heating consumes a great quantity of energy and decreases thermal efficiency. By adopting effective heat recovery system during drying, heat is recovered in all ranges - sub-cooling, evaporation, and superheating, hence minimizing heat losses. After drying, efficient and economical gasification is realized making full use of unique brown coal property.



Innovative brown coal gasification by efficient drying

Non-Ferrous Metal Resource Recovery Engineering

Sponsor: JX Nippon Mining & Metals Corporation
Period of activity: January 2012 – December 2016
Objectives:

For the sustainable growth of society, it is necessary to promote the recycling of valuable materials under strict environmental preservation measures in order to preserve mineral resources. This unit develops environmentally-friendly processes of recycling based on smelting and refining technologies for non-ferrous metals. Furthermore, it aims to train young researchers and engineers in collaboration with industrial sectors in this field.

Field Recycling and Processing of Critical Metals

- Dissolution of precious metals from alloys and intermetallic compounds in aqueous solutions
- Optimization of dehydration process of brown coals
- Refining silicon for solar cells by electron beam melting
- Thermodynamic study of alloys and oxides by Knudsen cell mass spectrometry

MAEDA Lab.

Field Resource Recovery and Materials Process Engineering

- Environmentally-sound recycling process for precious metals
- Production and recycling process of titanium
- New recycling process for Ga, Co, W, and Si
- New recycling process for rare earth metals

OKABE, T. H. Lab.

Field Metal Resources Recycling System

- "Artificial deposit ~Reserve to Stock~" A new approach to metal recycling
- Research on a metal recovery process that involves thermal decomposition of waste containing brominated flame-retardant resin
- Research on metal recycling process that involves the application of non-ferrous smelting technologies

NAKAMURA Lab.

MAEDA Lab.

Optimizing metal production processes and developing recycling methods for valuable metals

Metals including copper, lead, and zinc, as well rare earths and precious metals, require energy-efficient metal production processes, besides processes to recover valuable metals from wastes and treat hazardous byproducts. The study applies Knudsen cell mass spectrometry to measure the thermodynamic properties of alloys and oxides associated with high-temperature metal production processes. Focu sing on chemical thermodynamics and material transfer, improved production processes are presented.

Mass spectrometry equipment

OKABE, T. H. Lab.

Development of efficient recycling technology for rare metals

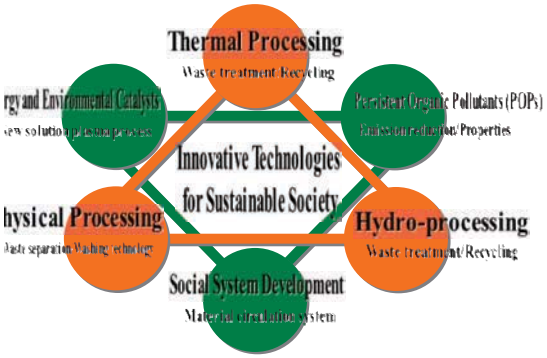
Recycling of rare metals is very important for the conservation of natural environment as well as for resource security. Our laboratory is developing new processes to recycle rare metals such as titanium, tungsten, cobalt, and gallium, for which a growth in demand is expected.

Resource circulation of rare metals

NAKAMURA Lab.

Metal recycling based on the new concept of “artificial deposit”

New concept of “artificial deposit” is proposed for future recycling systems. An urban mine has been developed on the basis of only economic rationality without strategy. The wastes, which contain valuable metals that are non-recyclable now, are reserved as artificial deposits in a new system.



Development of innovative technologies for sustainable society

Nikon Imaging Science

Sponsor: Nikon Corporation

Period of activity: April 2012 – March 2017

Objectives:

This chair succeeds the former Nikon Chair of Optical Engineering, which had operated since November 2006 to March 2012. The aim of this chair is to maintain international competitiveness of the optical industry in Japan through the education. Up to now, Japanese optical industry has great advantage to other countries. But this status will not be guaranteed in the future. In the field of optical science and optical engineering, it is said that there is a deep gap between that in the universities and industrial companies. This chair reduces the distance between academics and industries through the education of the optical engineering, and promotes students to be future leaders in the optical industries. One of the highlights of the educational programs is the lens design practice under the coaching of the professional lens designers.

Field Applied Nonlinear Optics

- Materials and devices for optical wave manipulation
- Holographic data storage
- Spin related optics and photonics
- Nano-structured novel optical materials

SHIMURA Lab.

Field Industrial Optics

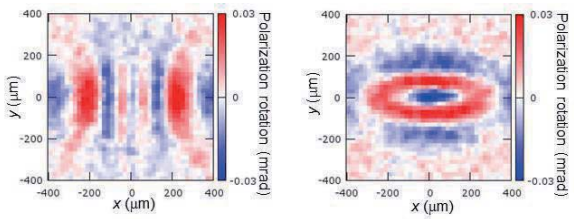
- Imaging optics
- Optical metrology
- Image processing
- Optical design

OOKI Lab.

SHIMURA Lab.

Ultrafast spin manipulation - Opto-magnonics

We investigate ultrafast coherent spin manipulation of magnetic materials by using femtosecond laser pulses and terahertz pulses. (Sub) terahertz spin precessions have been nonthermally induced by circularly polarized pulses. We also study imaging of spin wave propagation in ferrimagnets excited by optical pulses. We propose a principle to synthesize spin wave by using a spatially shaped light pulse with circular polarization.



Directional control of spin-wave emission in garnet ferrite

OOKI Lab.

Lectures on practical optics used in industry and hands-on training on lens design

The content of "Optical Engineering" included lectures on basic optics, covering topics from geometric optics to wave optics and the latest super-resolution technologies, as well as lectures on image technology covering topics from the structure of digital cameras to the basics of image processing and color science. Continuing from this, all students were lent laptop computers to learn about and comprehend the basics of lens design through hands-on training.

A lecture during the 2009 course on image technology (left) and a lab session during the 2010 course on lens design (right)

Social Cooperation Programs

Social Cooperation Programs were established in 2011 to carry out researches on subjects with hugh social benefits. This program is based on collaborative research program with industry. Chairs for the above subjects are founded with the aid of the fund from industry under this program and those researches are activated.

Proactive & Holistic Energy Demand Management for Construction Sector

Companies: Alter Buildings Japan Co., Ltd., Asahi-kiki Co., Ltd.
Period of activity: April 2012 – March 2015
Objectives:
For energy system in buildings in next generation, it is important to develop a comprehensive synergy system of renwable enegy, unused energy, and energy saving technologies etc. In this program, active and comprehensive control technologies are developed by use of optimization of verious energy systems.

Field Management of Project

- Construction sector as service provider
- Business model development for industrial ecology in contruction related activities
- Project based technology fusion
- Sustainable construction

YASHIRO Lab.

Field Urban Energy Engineering

- Analysis and control of urban climate
- Simulation and wind tunnel experiment of flow and diffusion fields in urban areas
- Sustainable buildings in urban systems
- Zero energy building

OOKA Lab.

Field Energy Demand Management Engineering

- Intelligent sensor development
- A.I. Artificial Intelligence control system development

MAGORI Lab.

YASHIRO Lab.

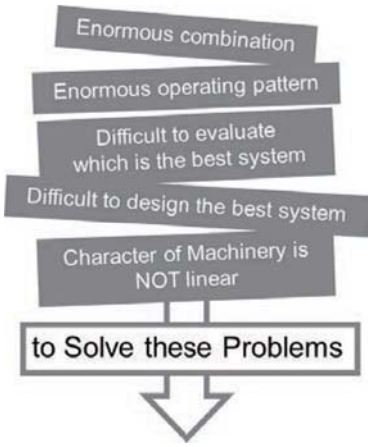
Project based technology fusion

In construction projects, various agencies and 'players' contribute to the process of designing technological details. The process can be termed as 'technology fusion' where knowledge of agencies and players are integrated something innovative. The peoject aims to create best practice model of technology fusion.

OOKA Lab.

Optimal design method for distributed energy system by means of genetic algorithms

Distributed energy system is expected to enlarge usage of renewable energy or unused energy effectively as local energy network. To promote planning distributed energy system widely, optimal design method is needed. A new optimal design method for building energy systems is proposed.



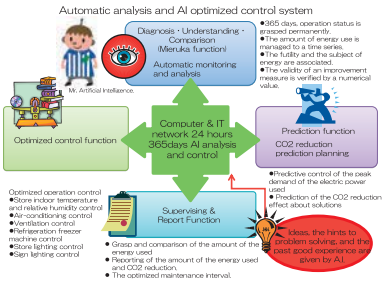
Need for optimal design

MAGORI Lab.

Research and development for the intelligent sensor and controller for integrative energy optimization

Intelligent sensor development
- Hold peculiar ID.
- Calculate the physical characteristic
- There is no faulty wiring, no mistakes in individual data, and can also grasp failure of the sensor itself automatically.

A.I. Artificial Intelligence control system development
Instead of human power, the monitoring data and the analysis result make predictive control and optimizing control. Structure improved continuously automatically.



The demand management example of the building group by development system

Mobility and Field Science

Companies: East Japan Railway Company, Bridgestone Corporation, Dai Nippon Printing Co., Ltd., Takano Co., Ltd.
Period of activity: April 2012 – March 2014
Objectives:
To enhance the performance of human activities and achieve for mobility, it is hoped to develop the technology innovatively concerning the monitoring and the sensing of the human biological, sensibility information and the technology about the provision of information and evaluation. We will be conducting a basic research and application by using the technology of Quasi-Electrostatic Field expected from various viewpoints for mobile society, and it applies to the communication technology and the sensing / monitoring in the future.

Field Dynamic Systems and Control

- Dynamics, control and evaluatoin of comfort of vehicles
- Development of virtual proving ground using driving simulators
- Contact mechanics of tire/road and wheel/rail
- Advanced transport system such as ITS, LRT, Eco-Ride, and PMV

SUDA Lab.

Field Quasi-Electrostatic Science

- Quasi-electrostatic field communication
- Quasi-electrostatic field multipole device
- Development of "Smart Reference", self reference device for measurement and near field communication
- Quasi-electrostatic field sensing by using laser excitation

TAKIGUCHI Lab.

SUDA Lab.

Study on personal mobility vehicle(PMV)

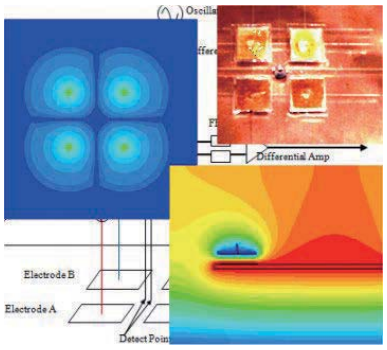
A proposal for a new vehicle that is both human- and environment-friendly, which is to be called a personal mobility vehicle - a compact and portable vehicle for personal usage - has been made. The proposed mobility vehicle will operate in two modes, namely the bicycle mode and the parallel two-wheel mode. These two modes are inter-convertible.

Developed PMV

TAKIGUCHI Lab.

Development of "Smart Reference" use of multipole electrodes structure

The device that acted artificially as standard potential (reference), and in a mobile environment where the earth such as bodies and human bodies was not able to be taken, it succeeded in making for trial purposes and the principle confirmation, and this was named "Smart Reference".



Smart Refernce

Immunology

Companies: BONAC CORPORATION, KYOWA Hakko Kirin Co., Ltd.
Period of activity: April 2012 – March 2015
Objectives:
The Program endeavors to better understand the fundamental mechanisms that underlie innate immune receptor signaling and gene expression and the effect of host-derived molecules on stimulating or suppressing inflammatory responses. It also aims to contribute to the development of new methods for the prevention and treatment of inflammation-associated diseases.

Field Organs and Biosystems Engineering

- Development of advanced cell-based assays and their applications to efficacy/hazard evaluations
- In vitro organization and growth of implantable liver and pancreas beta-cell tissues
- Process development for mass production and differentiation of stem cells
- Development of advanced bio-sensing devices using carbon nanofibers

SAKAI, Y. Lab.

Field Molecular Immunology

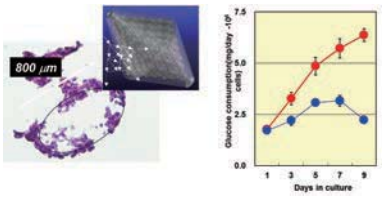
- Regulation of gene expression programme by the IRF family of transcription factors
- Modulation of inflammation and immunity by cytokines and dead cells.
- Regulation of immune responses by nucleic acids
- Development of new strategies for the control of inflammatory diseases and cancers

TANIGUCHI Lab.

SAKAI, Y. Lab.

In vitro organization and growth of implantable liver and pancreatic beta-cell tissues

It is necessary to integrate various knowledge and technologies ranging from basic biology and advanced engineering to clinical medicine to produce implantable organ/tissue equivalents in the future. As a chemical engineer, we have been trying to propose a design for multi-scale optimization of oxygenation to cells. On the basis of such fundamental design, we have been making biodegradable 3D scaffolds comprising 3D branching/joining flow channels and also trying perfusion culture of liver cells.



3D fabrication and cell culture in a 10-mL scale scaffold

TANIGUCHI Lab.

Molecular mechanisms underlying the inflammation and immunity

In the context of cytokine gene regulation, we originally discovered a family of transcription factors, interferon regulatory factors (IRFs). We have since focused on elucidating the functions of these factors in the regulation of immunity and oncogenesis. The broad scope of our current scientific interests encompass a number of areas including those that pertain to inflammation, autoimmunity, and oncogenesis. Finally, we also aim to translate our achievements in basic research for the development of new strategies in the treatment of immunological diseases and cancers.

Research Centers

Collaborative Research Center for Energy Engineering (CEE)

Established on January 1, 2008 for a six-year period

Director: SHIKAZONO, Naoki

Energy and environmental technologies are expected to play important roles for ensuring energy security as well as global warming prevention.
The Collaborative Research Center for Energy Engineering (CEE) was established on January 1, 2008 to develop energy technologies that will be essential for solving energy and environmental issues. CEE aims to contribute to the global issues through innovative R&D activities.

Field Thermal Energy Engineering

- Research on solid oxide fuel cell
- Research on steam engine and refrigeration cycle

SHIKAZONO Lab.

Field Advanced Energy Conversion Engineering

- Ultra-high efficiency thermal power plants
- Utilization of wider range of coals
- Innovative utilization of renewable energy
- CO_2 capture and storage

KANEKO Lab.

Field Energy Process Engineering

- Energy and material co-production systems for minimizing the exergy loss and CO_2 emission
- Exergy recuperative energy conversion technology
- A novel fuel cell/battery (FCB) system for energy sparkling

TSUTSUMI Lab.

Field Global Warming Scenario Analysis

- Scientific assessment of recent climate change
- Analysis of global energy scenarios
- Analysis of overseas study of ocean renewable energy
- Tohoku recovery project (wave and tidal energy convertors)

MARUYAMA Lab.

Field Energy System Integration

- Energy strategy
- Dynamic energy demand and supply balance analysis and evaluation
- Distributed energy system integration
- Material and energy integration analysis and evaluation

OGIMOTO Lab.

Field Energy Storage Engineering

- Study on energy network system concepts including advanced batteries
- Creation of advanced battery information
- Creation of future energy storage system for renewable energy
- Study on concepts of future distributed energy storage devices

HORIE Lab.

Field Sustainable Energy System

- Autonomic cooperative energy management system
- Energy service and consumption in residential and commercial sector

IWAFUNE Lab.

Field Local Energy Chemical Engineering

- Design and demonstration of sustainable biomass utilization system
- Development of advanced bioenergy technologies based on the concept of biomass refinery
- Establishment of biomass refinery processes

MOCHIDZUKI Lab.

Field Process System Engineering

- Process design for energy saving
- Process optimization based on exergy
- Process control

KANSHA Lab.

Field Computational Energy Materials Engineering

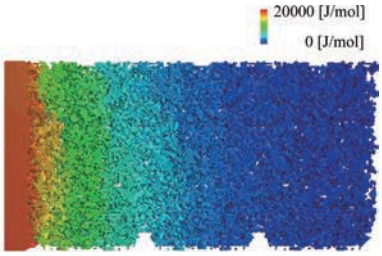
HARA Lab.

＊In this page, only IIS Members of CEE are introduced.

SHIKAZONO Lab.

Quantification and overpotential prediction of solid oxide fuel cell electrodes

Electrode microstructural parameters such as three phase boundary length and tortuosity factor have significant effects upon the cell polarization characteristics and durability. The electrode microstructural parameters are quantified by FIB-SEM, and overpotentials are simulated by the lattice Boltzmann method.



Electrochemical potential distribution of oxide ion inside SOFC anode

KANEKO Lab.

Improvement of IGCC (Integrated coal Gasification Combined Cycle)

IGCC is considered as most advanced coal firing system to generate electricity today, satisfying energy saving and reduction of CO_2 emission simultaneously. 250MW IGCC Demonstration has been successfully in operation in Nakoso, Japan since Sept. 2007. Further system improvement is under study by elevating gas turbine inlet temperature, conversion of gas clean-up system from wet system to dry system, and by minimizing heat losses and auxiliary power consumption.

IGCC demonstration plant

TSUTSUMI Lab.

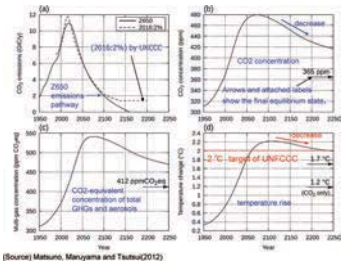
Energy and material co-production systems for minimizing the exergy loss and CO_2 emission

The drastic energy saving and minimization of CO_2 emission can be achieved by restructuring of industrial structure based on the co-production of energy and material. The exergy analysis with an index for efficient energy utilization and a novel process design methodology are developed to minimize the exergy loss. In addition, the grand design of energy and material co-production systems toward sustainable society is conducted based on the concrete scenarios for the industry.

MARUYAMA Lab.

Proposal of new emissions scenario Z650 (Zero emissions pathways)

A new scenario is proposed, where CO_2 emissions are reduced to zero at 2150 and the atmospheric CO_2 concentration is decreased by natural removal processes, eventually reaching an equilibrated stable state. The Carbon Cycle Model shows that considerably larger emissions are permissible in the future compared to traditional scenarios.

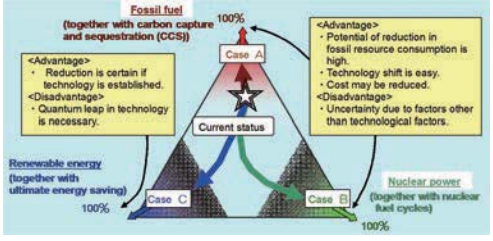


Proposal of a new emission scenario and recovery of climate

OGIMOTO Lab.

Energy strategy

Energy issues consist of real sustainability, connectivity of step-by-step improvement, robustness to uncertainties, and environmental issues. For the solution of energy issues we are investigating and proposing the energy strategy and, in parallel, the index system of the solution of the energy issues.

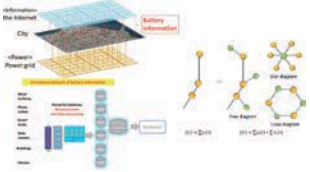


Long-term Transition of energy supply-demand structure

HORIE Lab.

Energy and information consolidated networks with advanced batteries

Systems working based on electricity enjoy advantages of efficiency or environmental friendliness, meanwhile, suffer from the disadvantage that electricity could not be reserved, which gives a huge constraint on systems. However, advanced batteries emerge, which could exert pivotal functions to provide/absorb energy at any system points. We would like to establish energy and information consolidated network concepts with advanced batteries, which benefit any conceivable systems in the future.

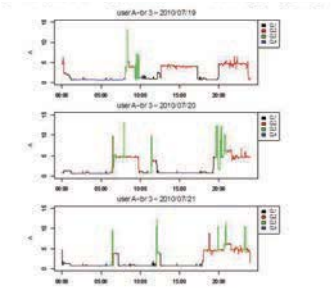


Studies on electric energy and information consolidation by means of advanced batteries

IWAFUNE Lab.

Study on standards of space heating services in residential buildings

We evaluated a standard indicator of space heating services based on actual measurement values on 30 dwellings in Hokkaido, Tohoku and Kanto area. The indicator is calculated using an average room temperature in a space heating period, a room floor area and a number of days of a space heating period. A space heating efficiency in a dwelling can be analyzed by examining the correlation between the indicator and energy consumption.



Relation between service level and energy consumption in space heating demand in dwellings

KANSHA Lab.

Exergy loss minimization for industrial process

To construct a sustainable society, it is necessary to reduce energy consumption in industrial section consuming a plenty of energy in Japan. For this issue, we must introduce energy circulation in industrial processes and minimization of process exergy loss during operation. In this research, theoretical investigation to design such processes is performed.

MOCHIDZUKI Lab.

Demonstration of local bioenergy system

This work deals with the design and demonstration of the small-scale biorefinery that produces the local fuel from locally available biomass. The core of the process is a bioethanol production powered by a biomass boiler. The feedstocks for both bioethanol and boiler are unused biomass resources and/or energy crop obtained in the region. Evaluating the material/energy flow, land use, environmental effects and local economy, we are trying to develop the sustainable biomass utilization system.

Demo-scale local biorefinery process

Underwater Technology Research Center

Established on April 1, 1999, for a ten-year period, and reorganized on April 1, 2009, for a five-year period

Director: ASADA, Akira

The Underwater Technology Research Center was established in 1999. This center develops robots and sensing systems for observation of underwater platform. With the aim of leading the ocean-related research worldwide and developing integrated observation systems for sub-sea valuable resources for future, the present center has expanded its research fields and also extended its contribution to the education centers teaching oceanology. With this vision, many researchers and engineers, both domestic and foreign, and from various fields, have created networks, and exchange necessary information on a global scale.

Field Underwater Acoustic Systems Engineering

- Research & development of advanced sonar systems
- Research & development of deterioration assessment method for underwater structure
- Research & development of acoustic measurement systems for underwater and sub-bottom objects
- Research & development of seafloor geodetic observation

ASADA Lab.

Field Ocean Environmental Engineering

- Observation of sea surface waves by using active microwave remote sensing
- Dynamics of underwater line structure
- Development of numerical simulation system for behavior analysis of sea ice and oil spill in ice-covered sea
- Hydro-elastic behavior analysis of very large floating structure

RHEEM Lab.

Field Deep Ocean Engineering

- Spatial mapping of hydrothermal plume using multiple in-situ sensors
- Research on deep sea in-situ chemical measurement system
- Development of long term borehole monitoring system

KYO Lab.

Field Subsea Technology

- Study on designing method of light weight and high strength pressure vessel for deep underwater use
- Study on vibration drilling/coring
- Study on the mechanism of rotation problem of multi-layered torque balance cable and the establishment of the countermeasures
- System design of recovery of deep sea mineral resources

TAKAGAWA Lab.

Field Marine Ecosystem Engineering

- Prediction of future changes in coastal and lake ecosystems
- Development of modern marine food production technology
- Treatment of waste water by electrolysis
- Environmental impact assessment for marine utilization

KITAZAWA Lab.

Field Underwater Platform Systems

- Seafloor mapping system based on multi underwater platforms
- 3D imaging of seafloor
- Power generation from hydrothermal vent fields

MAKI Lab.

Field Ocean Perception Systems

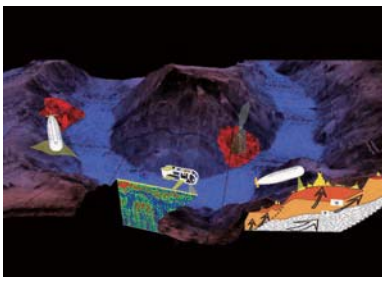
- Laser-induced plasma as a mechanism for in situ multi-element analysis at sea
- Continuous measurement of seafloor radiation using a towed gamma ray spectrometer
- Wide area seafloor 3-dimensional visual mapping
- Non-linear acoustic and 3D visual mapping for measurement of the volumetric distribution of manganese crusts

THORNTON Lab.

ASADA Lab.

Developments of advanced sonar systems for seafloor hydrothermal deposit survey

Asada Lab. has been developing observation systems for assessing spatial distribution and amount of seafloor resources, based on advanced sonar technology. Combination of sonar techniques such as precise seafloor positioning, interferometry sonar system, synthetic aperture sonar system will make it possible to achieve seafloor positioning and bathymetry with sub decimeter accuracy.

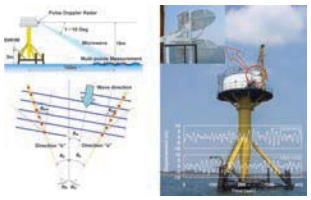


Surveys for hydrothermal deposit based on advanced sonar systems

RHEEM Lab.

Development of sea surface wave observation system by using microwave pulse Doppler radar

A real-time sea surface wave observation system by using a microwave pulse Doppler radar has been developed. The system is installed at seashore, offshore structure and ship, and measures sea surface waves of multi-measure points simultaneously. The wave direction, period, height and phase of each wave component of sea surface waves are retrieved. The wave conditions around the measurement site can be predicted in space and time.

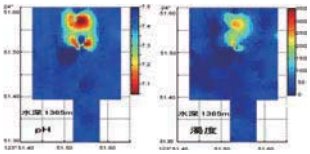


Sea surface wave measurement by a pulse Doppler radar and its results (Off Hiratsuka, Sagami-Bay)

KYO Lab.

Spatial mapping of hydrothermal plume using multiple in-situ sensors

Based on the recent technological trend of in-situ sensor development and unmanned vehicle maneuverability improvement, we are developing the spatial mapping observation method with multiple in-situ sensors (ex. ISFET pH sensor, CTD, transmissometer) installed on unmanned vehicle with aiming to efficiently discover the source of hydrothermal plume and to spatially investigate the behavior of hydrothermal plume. We are also developing the numerical model of hydrothermal plume by applying with the actual data.



pH and turbidity mapping of hydrothermal plume at Hatoma Knoll in Okinawa Trough

TAKAGAWA Lab.

Study on designing method of light weight and high strength pressure vessel for deep underwater use

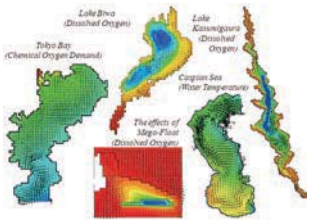
This study aims to establish a design method of pressure vessel for deep submergence system capable of diving to 11,000m deep. Ceramics is one of the best candidate materials. However, as it is brittle, a design method to obtain smooth stress flow field is studied. A test sample of ceramic ball showed the very high strength. This study shall be expanded to cylindrical pressure hull, and also the easy design method shall be established.

Hemispherical end caps and cylinder made of silicon nitride ceramics, and connection rings made of zirkon ceramics (Operational water depth= 11,000m, safety factor= 2)

KITAZAWA Lab.

Hydrodynamic and ecosystem coupled model for analysis of aquatic environment in lakes and coastal seas

A numerical model is useful for analysis of aquatic environment, interpolating observations in time and space. A hydrodynamic and ecosystem coupled numerical model is developed to understand the mechanism of physical, chemical, and biological phenomena in aquatic environment, and to predict the natural and anthropogenic effects on aquatic environment. The model is applied to lakes and coastal seas such as Tokyo Bay, Lake Biwa, Lake Kasumigaura, Lake Ikeda, the Caspian Sea, etc.

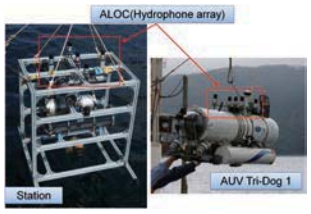


Horizontal distributions of current velocity and water quality in lakes and coastal seas

MAKI Lab.

Wide area seafloor mapping method based on collaboration of multiple AUVs

We propose a wide-area seafloor mapping method based on multiple AUVs. The AUVs alternatively perform the two roles of observation and landmark. Relative position is stochastically estimated based on mutual acoustic positioning. The method was implemented on the AUV Tri-Dog 1 and the vehicle succeeded in observing within the range of 100m from a temporal seafloor station at Kagoshima Bay, in Japan. The next step is to deploy the two AUVs, Tri-Dog 1 and Tri-TON.



Instruments used at the sea trial.
Left: Seafloor station
Right: AUV Tri-Dog 1

THORNTON Lab.

Development and application of in situ sensors for marine surveys

By investigating fundamental physical mechanisms such as the interaction of light and matter underwater at high pressure, we aim to expand and enrich the tool set of techniques available for in situ measurements at sea. Our activities include the application of laser induced plasma for in situ multi-element analysis, development of long range imaging technology for wide area 3D seafloor reconstruction, and development of a towed gamma ray spectrometer to monitor seafloor Cs-137 distribution.

Advanced Mobility Research Center (ITS Center)

Established on April 1, 2009, for a five-year period, succeeding Collaborative Research Center for Advanced Mobility founded in 2005

Director: SUDA, Yoshihiro

ITS (Intelligent Transport Systems) provides safety, sustainability, and comfort in mobility through the integration of information, mechanical and civil engineering technologies, which requires interdisciplinary efforts among disciplines. Thus, this Center has been established by researchers with various backgrounds. The goals of the center are to provide industry, government and academia with an inter-sector research area for ITS and to educate the next generation of ITS researchers.

Field Dynamic Systems and Control

- Dynamics, control and evaluatoin of comfort of vehicles
- Development of virtual proving ground using driving simulators
- Contact mechanics of tire/road and wheel/rail
- Advanced transport system such as ITS, LRT, Eco-Ride, and PMV

SUDA Lab.

Field Computer Vision

- e-Heritage project: 3D modeling, analysis and visualization of cultural heritage assets
- Physics-based vision and computer graphics
- Robotics (learning from observation)
- Sensing and visualization technologies for ITS (intelligent transport systems)

IKEUCHI Lab.

Field Traffic Engineering

- Road network planning theory
- Traffic flow analysis/traffic signal control strategies
- Traffic and pedestrian simulation models
- Traffic data standardization & international traffic database

KUWAHARA Lab.

Field Traffic Management and Control

- Highway traffic capacity
- Geometric design and driving behavior
- Advanced traffic operation, management and control
- Highway planning and design harmonized with traffic operation

OOGUCHI Lab.

Field Advanced Transport System

CHUNG Lab.

Field Industry-Academia Cooperation

TANAKA, T. Lab.

Field Science and Technology Policy

FUJITA, A. Lab.

Field Industrial Policy

IWATA Lab.

Field Applied Acoustic Engineering

- Environmental noise assessment
- Room acoustics
- Psychological acoustics
- Development and application of sound field simulation

SAKAMOTO Lab.

Field Mechanical and Biological Systems Control

- Human centric mobility engineering
- Application of independent component analysis to mechanical systems
- Self-powered active vibration control

NAKANO, K. Lab.

Field Spatiotemporal Media Engineering

- Digitization and representation of cultural heritage assets

OISHI Lab.

Field Transportation Policy

YOSHIDA Lab.

SUDA Lab.

Condition monitoring and abnormal condition detection in vehicle system

Automobile and railway vehicles are covered for monitoring system. Condition monitoring and abnormal condition detection is conducted by using sensing from vehicle/infrastructure system; road surface state estimation by using electromagnetic suspentions, modeling of dynamic tire characteristics by using tire tester, and abnormal condition detection before derailment by using railway vehicle facilities.

Experimental traffic light for ITS research

IKEUCHI Lab.

MR mobility system for virtual reconstruction of cultural heritage assets

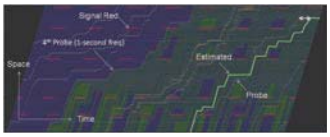
We are developing a Mixed Reality (MR) system which allows multiple users to move around the virtually reconstructed cultural heritage sites that are superimposed into the real world. Conventional MR systems are designed for personal use, and users cannot move freely in a large space. Therefore, we are developing an MR mobility system using the electric vehicles that shows multiple users the virtually reconstructed ancient scenes.

Virtual reconstruction of Asukayo capital by MR mobility system

KUWAHARA Lab.

Fusion of probe, passing time and signal timing data to estimate vehicle trajectories on urban arterials

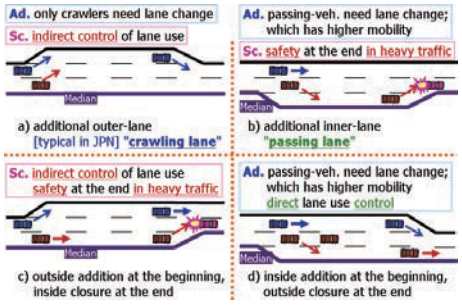
Data fusion technique is proposed to estimate vehicle trajectories several related traffic data by applying concepts of traffic engineering. Majority of existing fusion techniques estimate travel time merely based on statistical methods. In addition, probe data include much richer information than only travel time, and the probe data can be used more effectively to estimate trajectories of all running vehicles. Proposed method is based on the simplified 3D kinematic waves theory. The methodology is capable of estimating reliable vehicle trajectories on an arterial as well as an motorway.



OOGUCHI Lab.

Traffic congestion countermeasures at basic expressway segment bottlenecks

The basic segments of sags or tunnels are popular bottlenecks in Japan's Expressway. The type d) installation of auxiliary lane upstream of the bottleneck in the figure, is revealed to be the most effective measure and the novel permanent operation is started from March 2012 in Japan.



Auxiliary lane configurations

SAKAMOTO Lab.

Hearing subjective test on low-frequency noise

In order to reproduce a low frequency noise, a special facility, in which 16 woofers of large diameters (see the photograph) having a large backing space was installed on a partition wall between hemi-anechoic and reverberation rooms, has been established in our acoustic laboratory. Using the facility, hearing subjective tests on various environmental and industrial noises including low-frequency components are being performed.

System of hearing subjective test on low-frequency noise

NAKANO, K. Lab.

Human centric mobility engineering

For development of mobility, it is needed to consider human behavior as well as dynamics of vehicles and traffics. Aiming to realize safety, comfortable and ecological mobility, researches on human factor in mobility such as condition monitoring of a driver using bio-signals, haptic guidance control, analysis on human-machine interface of a truck for automatic platooning, driving ability of elderly drivers suffering white matter lesions, and personal mobility vehicles are being conducted.

Scene of the experiment

Center for International Research on Micronano Mechatronics (CIRMM)

Established on April 1, 2010, for a six-year period

Director: FUJITA, Hiroyuki

The purpose of the Center is to carry out research activities for developing micro-machines and nano-systems that are greatly needed in science, industry and society, using micro/nano-machining technology that utilizes both semiconductor processing and precision machining. Instead of simply downsizing existing machines, it integrates mechanical devices, electronics, optics, RF communication, and biological technology in micro-sizes, aiming to realize new functions and features. Based on micro/nano -machining studies that have been conducted in IIS and collaborative research activities with the French National Center for Scientific Research (CNRS), the Center promotes international cooperation and expands frontiers in research activities. International Research Group on Nano and Micro Systems (NAMIS) was established on November, 2005. Partners in the network are Tohoku University, CNRS, Swiss EPFL, German Freiburg University, Finnish VTT, Korean SNU and KIMM, Canadian EP Montreal, Taiwanese Tsing Hua University, and US Washington University. We have organized workshops, visiting partner organizations and learning research activities. As a result, several international research projects were launched with financial support from EU FP7, Taiwanese NSC and Japanese JSPS and JST. Also MEMS school for graduate students is annually held with 60-70 participants.

CIRMM http://www.cirmm.iis.u-tokyo.ac.jp/

NAMIS http://namis.iis.u-tokyo.ac.jp/

Field Micro-Nano Electro Mechanical Systems

- IC-compatible micromachining
- MEMS application to nano technology (MEMS-in-TEM)
- Bio-MEMS hybrid nano system
- Distributed micro systems integrated with arrayed actuators, sensors and circuits

FUJITA, H. Lab.

Field Applied Scientific Instruments

- Liquid AFM
- Nanocantilever
- Metrological application of SPM

KAWAKATSU Lab.

Field Applied Microfluidic Systems

- Fundamental technologies in microfluidics
- Deep sea in situ measurement and analysis systems
- Cell/tissue engineering devices
- Molecular systems

FUJII Lab.

Field Nano-electronics

- Optical and electrical characterization at nano-scale by light-illuminated SPM
- Small current detection by magnetic force microscopy
- Nano-scale characterization by conductive AFM
- Development of novel methods of scanning tunneling spectroscopy

TAKAHASHI, T. Lab.

Field Micromachine System Engineering

- Radio frequency MEMS
- Optical MEMS
- MEMS for medical applications
- Integrated MEMS design & process

TOSHIYOSHI Lab.

Field Fundamental Micro and Nano Electromechanical Systems Engineering

- Large area and broadband semi-reflective Bragg mirror membranes
- Optical metrology for 3D integration processes control
- Optomechanical actuation and detection

BOSSEBOEUF Lab.

Field Applied Microsystems

- Microsystems related to information and communication
- Microsystems for nanoscience and nanobiology
- Microtechnologies development and integration with electronics

COLLARD Lab.

Field Micro Components and Systems

- Nanoscale fluorescent thermometry and nanowire fabrication
- Micro/nano patterning technology
- Bio/molecular sensor devices development
- Development of new functional micro/nano probes (SNOM,SPM,Probe Cards, Bio-chemical sensors)

KIM Lab.

Field Micromechanism

- Bio hybrid microsystems
- Remote inductive powering for driving microactuators

TAKEUCHI, S. Lab.

Field Biomimetic Microsystems

- Neuromorphic systems
- Mathematical modeling of neural networks

KOHNO Lab.

Field Integrated Quantum Electronics

- Physics and applications of thermal conduction in semiconductor nanostructures
- Optical control of semiconductor nanomechanical oscillators

NOMURA Lab.

Field Integrated Micro Mechatronics

- Intelligent chemical MEMS sensors
- Autonomous long-term analyses chemical sensors
- Wireless integrated MEMS sensors

TIXIER Lab.

Field Bio Molecular Micro Engineering

- Synthetic molecular programs

RONDELEZ Lab.

Field Medical Biotechnology

- Building living tissue system by bottom-up tissue engineering
- Development of microdevices for the preparation for the vascular tissue engineering

MATSUNAGA Lab.

Field Ocean Nanosensing

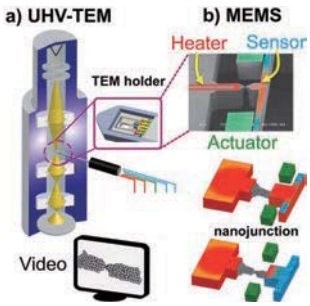
- Development of underwater nanoprobe technology
- Development of high-resolution atomic force microscopy

NISHIDA Lab.

FUJITA, H. Lab.

Heat transfer through nanojunction measured by MEMS-in-TEM

We measured thermal conductance in nano scale using MEMS-in-TEM setup. Micro heater and sensor are integrated on silicon tips between which a junction of 7-38 nm in diameter was formed. The conductance was 10 times larger in nano scale than bulk due to ballistic phonon transport. Dimension of the junction was changed by applied force and measured by TEM.

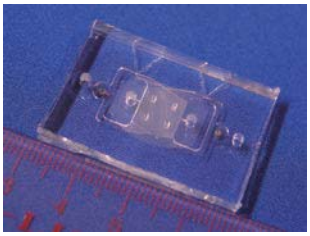


MEMS-in-TEM setup allows measurement of thermal conduction via nanojunction formed between MEMS-driven tips.

FUJII Lab.

A study on integrated tissue culture devices

An integrated microfluidic device that mimics in vivo environment has been developed as a new platform for the analyses of cells and tissues. The device has two compartments, separated by a semi-permeable membrane, with integrated pumping and detection systems. Active transport of fluorescent substrate by the tissue cultured in the device could successfully be measured online. A co-culture system based on the device with small intestinal models is under development.

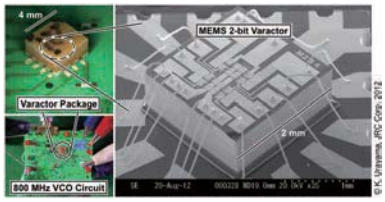


Integrated tissue culture device

TOSHIYOSHI Lab.

RF-MEMS electrostatic variable capacitor for cognitive radio

A packaged 2-bit RF-MEMS (Radio Frequency Micro Electro Mechanical Systems) tunable capacitor has been developed by the surface micromachining technique based on electroplating, and digital control of 800 MHz VCO (Voltage Controlled Oscillator) has been demonstrated for the mobile phone application.

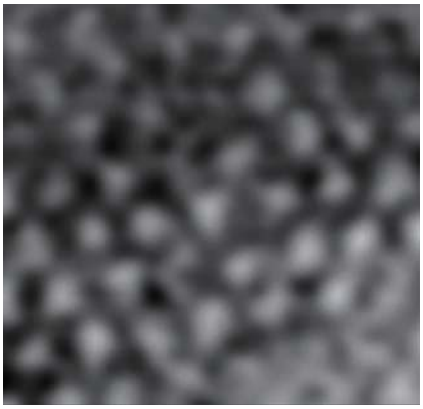


RF-MEMS 2-bit variable capacitor

KAWAKATSU Lab.

Atomic resolution liquid atomic force microscopy

A Liquid AFM operating in the MHz regime was capable of resolving structured water molecules,

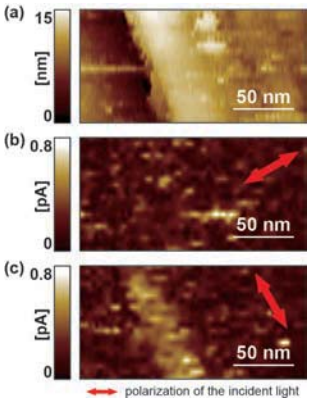


An image of mica in pure water acquired with lateral force microscopy at 1 MHz.

TAKAHASHI, T. Lab.

Local investigation of electronic and optical properties in semiconductor nanostructures

By the dual light illumination method in STM we originally proposed to investigate optical and electronic properties in semiconductor nanostructures, photo-absorption spectra and their dependence on the polarization of the incident light were investigated on single InAs wire structures.

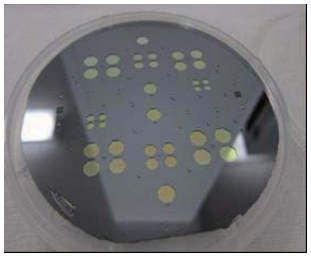


(a) Topographic and (b)(c) photoinduced current images on an InAs wire taken by the dual light illumination method in STM.

BOSSEBOEUF Lab.

Large area and broadband semi-reflective Bragg mirror membranes

The manufacturing with a 100% yield of high flatness dielectric membranes having a diameter up to 5.9 mm and an approximately 50% reflectivity in the 570-900nm wavelength range has been demonstrated. The membranes are made from a stack of up to 13 alternating SiN_x and SiO_2 PECVD films deposited and annealed on silicon. Optical measurements show that these membranes are suitable for their use in MOEMS devices working in the visible-NIR range.

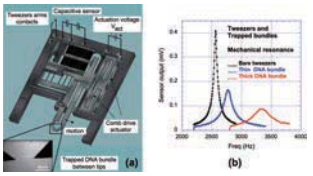


100mm wafer with 8 layers Bragg mirror membranes

COLLARD Lab.

Molecule capture and characterization with MEMS tweezers

Performing biological test at the molecular level is current challenge. To that purpose, a silicon nano tweezers was developed. The tweezers has a mobile electrode that is electrostatically actuated and its motion is sensed by the capacitive sensor. When dielectrophoresis is applied between the opposing tips of the tweezers, molecules bundles is trapped. The molecules can be electrically and mechanically characterized in airand in solution.

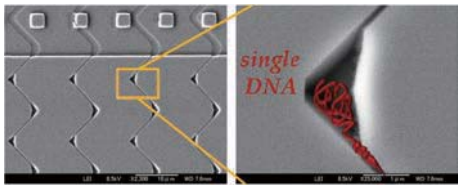


a) Tweezers and trapped molecules bundle
b) Frequency analysis with different DNA bundles

KIM Lab.

Nanochannel fabrication for single DNA manipulation

A single biomolecule, DNA now draws much attention, since relevant dimension of nanometer level chips are possible to be made by nano fabrication techniques. Among many DNA analysis devices, recently nanochannel is highlighted as it provides a proper platform based on DNA stretch phenomenon. We will continue on the development of complete fabrication of these nanochannels and deep investigation with various DNA or enzyme.

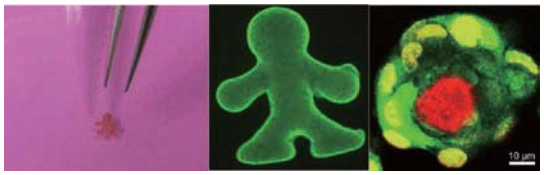


Nano channel with micro chamber for single DNA detection

TAKEUCHI, S. Lab.

Bead-based tissue engineering

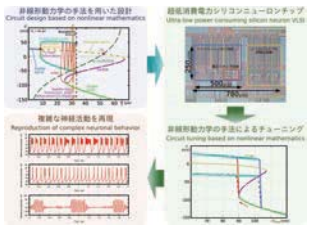
We propose mass-producible monodisperse collagen microbeads coated with cells that we could stack into a mould to produce millimetre-thick 3D tissues with uniform cell density. Unlike the existing units, the cells on the collagen gel beads can grow and migrate into/between the beads. The bead-stacking structure allows nutrients to reach cells located in the centre of the tissue, preventing necrosis during tissue formation for more than 24 hours, which was not observed with cell aggregates.



KOHNO Lab.

Construction of silicon neural network circuit and its application

Silicon neuron is electronic circuit that mimics the electrophysiological behaviors in neurons. One of the most important application is to construct silicon neural network in combination with silicon synapses. Such network is expected for example to generate motion patterns like central pattern generator in nerve systems and execute robust and autonomous information processing like associative memory. We are studying a small-scale network that generates control signal for MEMS actuators.

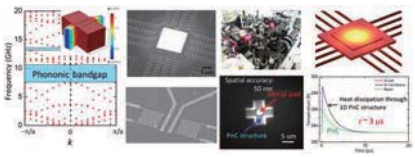


Constructing silicon CPG utilizing silicon neuron circuits designed by mathematical-model-based method

NOMURA Lab.

Application of semiconductor nanostructure fabrication technology to thermoelectronics

About the half of the electric power generated in the world runs off as waste heat energy. Therefore, development of thermoelectric devices, which can convert the waste heat energy into electric energy, is highly expected. However, the conversion efficiency stays only several % at present and the improvement in the efficiency is required before practical use. We investigate heat transfer in nanostructures with a dimension below 100-nm fabricated by top-down lithographic technology.

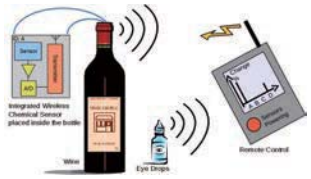


Application of semiconductor nanostructure fabrication technology to thermoelectric generation

TIXIER Lab.

Autonomous integrated chemical sensors

How to know, without opening the bottle, wine or medecine went bad or not? By placing inside the container an intelligent chemical sensor which will inform in-situ, on a long-term, about the deviation in the composition. The system is tiny (micro-system) and autonomous in term of data processing (with integrated LSI intelligence) and energy. It is actuated from outside by a remote control and the data are transmitted by RF communication.

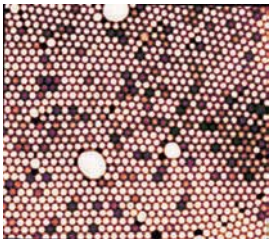


Principle of the system. A remote control powers on the integrated chemical sensors placed inside the container. The sensors transmit their answer in a wireless way.

RONDELEZ Lab.

Artificial reaction networks for the design of in vitro dynamics

The dynamic principles underlying biological molecular networks is the focus of intense interest for both fundamental and therapeutic reasons. Simpler system can be built in vitro in order to disentangle the basic design rules from biological noise or complexity. Here we bridge the chemical and biological approaches to demonstrate that small DNA strands can be used to control the topology of a network of standard biochemical transformations, and hence control its dynamic behaviour.



DNA oscillators in micro-droplets

MATSUNAGA Lab.

Rapid construction of macroscopic 3D tissue architecture using cell beads

Tissue engineering has been seeking a method to construct large-scale 3D tissue architectures that mimic microscopic tissue structures and tissue functions in vivo. We developed a method to prepare size-controlled collagen gel beads to form micro-tissue units, "cell beads", as building blocks. By stacking cell beads, millimeter-scale tissue was fabricated rapidly. This method allows application into the 3D cell-bead printing, achieving fabrication of functional complex tissues.

Bottom-up tissue engineering: Fabrication of 3D tissue architecture using micro-tissue units

NISHIDA Lab.

Development of underwater nanoprobe technology

To observe precise nanoscale structures of various underwater micro-samples in natural conditions, we develop implementable underwater nanoprobe technologies for underwater vehicles.

International Research Center for Sustainable Materials

Established on April 1, 2004, for a six-year period, and reorganized on April 1, 2010, for a six-year period

Director: OKABE, Toru H.

The International Research Center for Sustainable Materials was established for realizing a sustainable society by resolving issues related to the design, production, treatment, and final disposal of materials. The activity of the center covers (i) inspecting the recycling process of industrially important materials and their byproducts, (ii) identifying boundary conditions for the design, production, and disposal of materials, and (iii) developing new materials with extra-long life spans and low environmental loads. This center promotes collaborative research in Japan as well as abroad.

Field Resource Recovery and Materials Process Engineering

- Environmentally-sound recycling process for precious metals
- Production and recycling process of titanium
- New recycling process for Ga, Co, W, and Si
- New recycling process for rare earth metals

OKABE, T. H. Lab.

Field Polymeric and Environmentally Conscious Materials

- Functions of polymers with dynamic bonds
- Self-healing polymers
- Fabrication of nano-scale periodic patterns in polymers
- Bio-based polymer materials

YOSHIE Lab.

Field Recycling and Processing of Critical Metals

- Dissolution of precious metals from alloys and intermetallic compounds in aqueous solutions
- Optimization of dehydration process of brown coals
- Refining silicon for solar cells by electron beam melting
- Thermodynamic study of alloys and oxides by Knudsen cell mass spectrometry

MAEDA Lab.

Field Materials Production and Recycling Engineering

- Physical chemistry on the refining of solar grade silicon
- Resurrection of slags by microwave
- Preparation of β-$FeSi_2$ thin film by the exchanage reaction between molten salt and Si substrate and its characterization
- Thermal conductivity of silicate melts

MORITA Lab.

Field Mechanical Properties of Sustainable Materials

- Strength of sustainable materials
- Dislocation dynamics and plasticity
- Electrical properties of dislocations in semiconductors
- Development of novel photonic-crystal related materials

EDAGAWA Lab.

Field Mineral Strategic Security

- Supply chain and implication for mineral resources
- Changing world mining industry and mineral security
- World mineral exploration trends
- Natural resources and economic development

SAWADA, K. Lab.

Field Metal Resources Recycling System

- "Artificial deposit ~reserve to stock~" a new approach to metal recycling
- Research on a metal recovery process that involves thermal decomposition of waste containing brominated flame-retardant resin
- Research on metal recycling process that involves the application of non-ferrous smelting technologies

NAKAMURA Lab.

Field Resources Processing and Recycling Engineering

- Rare metal separation from E-waste
- Mutual separation of aluminum alloys
- Electrical disintegration
- Kinetics of surface grinding

OWADA Lab.

Field Extractive Metallurgy and Resource Recovery

- Thermodynamic study of emerging non-ferrous smelting process
- High temperature calorimetry

YAMAGUCHI Lab.

Field Mineral Process Engineering

- Metal recovery from municipal solid waste
- Development of advanced mineral processing and metal extraction

SHIBAYAMA Lab.

Field High Temperature Sustainable Materials Processing

- Rapid solution growth of single crystalline silicon carbide using alloy solvent
- Silicon refining under the non-equilibrium condition using solid-liquid coexisting flux
- Surface tension of multi-component alloy

YOSHIKAWA, T. Lab.

OKABE, T. H. Lab.

Development of environmentally-sound production process for rare metals

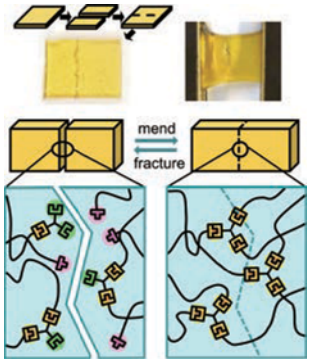
High-performance materials require many rare metals. We are developing new production processes for rare metals such as titanium, silicon, and niobium, as well as environmentally-sound recovery processes for platinum group metals, rare earth metals, etc. to realize a sustainable society.

Innovation of production process for rare metals

YOSHIE Lab.

Network polymers with healing ability

By introducing dynamic bonds into polymers such as gels and elastomers, we can obtain self-healing soft materials relatively easily. However, development of hard and tough self-healing polymers remains a challenge. We have succeeded in obtaining a crystalline self-healing polymer by controlling crystallization kinetics and molecular mobility.

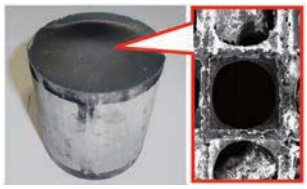


Top: Healed sample (left) withstands stretching (right).
Bottom: Healing mechanism.

MAEDA Lab.

Physical chemistry of metal recycling

We are developing environmentally friendly and economical processes to recycle valuable metals. A convenient separation process is being studied for precious metals used as automotive catalysts. To produce high purity silicon for solar cells at low cost, an impurity removal method using an electron beam melting technique is devised. Additionally, a dehydration process for brown coals, which are abundant and may be used for thermal power generation, is under study.



Automotive catalytic converter. Precious metal particles are distributed in oxide mixtures.

MORITA Lab.

Physical chemistry of solidification refining of Si with Si-Al melt

We have targeted "the solidification refining of Si for solar cells using Si-Al solvent at low temperature" by utilizing the thermodynamic instability of impurities in solid Si at lower temperature. Refining ability has been clarified thermodynamically by evaluating the segregation ratios of various impurities between solid Si and Si-Al melt. Presently, we are trying to optimize such solidification refining processes through the study for the interfacial chemistry in the Si-Al system.

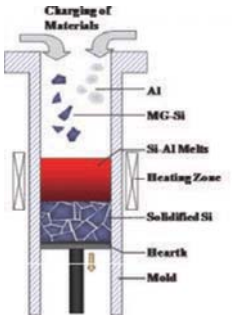
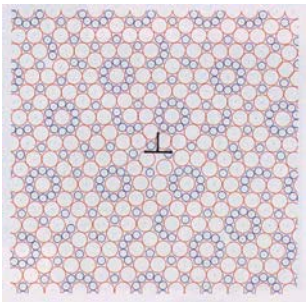


Image of the solidification refining process of SOG-Si using Si-Al solvent.

EDAGAWA Lab.

Dislocation dynamics in quasicrystals

In general, the structure of the 3D quasicrystal can be described as a 3D section of a higher dimensional periodic structure. This fact allows us to define a new type of dislocation whose Burgers vector has the high dimensional components. In the present study, such a dislocation has been constructed in a model quasicrystal and its dynamical properties have been investigated.



SAWADA, K. Lab.

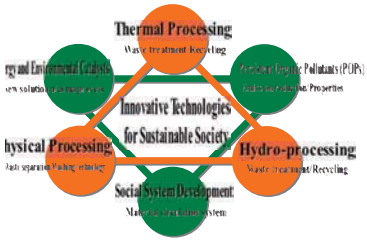
Supply chain and implication for mineral resources

Historically, Japan has been importing minerals from foreign countries, smelting & refining, fablicating and providing materials to manufactures on a large scale by putting value-added. The upper stream of Supply Chain will be examined from exploration, acquisition and corporate merger. Japanese copper security will be also discussed for the sustainability in the future.

NAKAMURA Lab.

Metal recycling based on the new concept of “artificial deposit”

New concept of “artificial deposit” is proposed for future recycling systems. An urban mine has been developed on the basis of only economic rationality without strategy. The wastes, which contain valuable metals that are non-recyclable now, are reserved as artificial deposits in a new system.

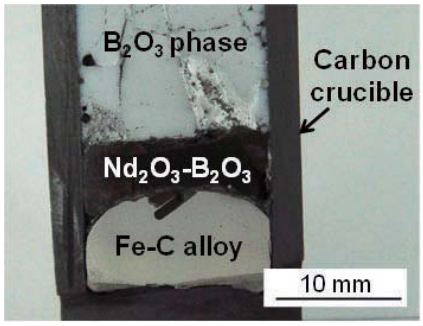


Development of innovative technologies for sustainable society

YAMAGUCHI Lab.

Enrichment of rare earth elements from the Fe-Nd-B alloy by the liquid phase separation of RE_xO_y (RE=Nd, Pr, Dy)-B_2O_3 system

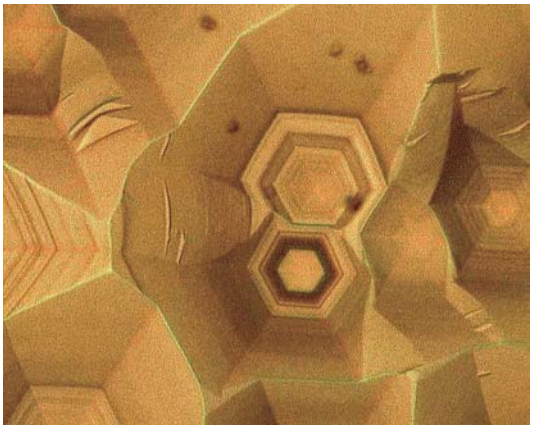
A mixture of Fe-Nd-B alloy and B_2O_3 were melted in a carbon crucible. The top layer of B_2O_3 rich phase, the middle layer of RE_xO_y (RE=Nd, Pr, Dy) rich phase and the bottom of Fe-C alloy were clearly separated in the crucible. Distribution ratios of RE between the RE_xO_y rich and the iron phases are more than eight hundred (800).



View of the three phases separation

YOSHIKAWA, T. Lab. Low-temperature and rapid FZ growth of silicon carbide single crystal using alloy solvent

We are conducting the low-temperature rapid solution growth of silicon carbide using an Fe-Si alloy as a solvent due to its high carbon solubility. Rapid growth of SiC over 200 micron/hour at 1623 K has been obtained. We are then trying the growth of large SiC single crystal by the FZ growth method. In addition, we have developed the in-situ observation method of the growing interface, and are now investigating its growth mechanism.



Local dissolution of the SiC interface during the melt-back process

International Center for Urban Safety Engineering (ICUS)

Established on April 1, 2001, for a ten-year period, and reorganized on April 1, 2011, for a five-year period

Director: MEGURO, Kimiro

The International Center for Urban Safety Engineering (ICUS) was established in April 2001 with the objective of developing new systems and methods to protect individuals from various accidents and disasters that could possibly occur in everyday life, mostly in urban areas throughout the world. The research areas of this center are infrastructure design and maintenance, development of monitoring methods to prevent and guide people in case of accidents and hazards, and safety analysis and evaluation of important facilities not only in Japan but also in other Asian metropolises. ICUS works in collaboration with researchers and engineers from around the world.

Field Urban Earthquake Disaster Mitigation Engineering

- Strategy for urban safety and disaster reduction
- Universal disaster environment simulator
- Lifeline earthquake engineering
- Disaster information system and disaster manual

MEGURO Lab.

Field Global Hydrological System

- World water resources assessment by an integrated hydrological model considering anthropologic activities
- Land-atmosphere interactions and climate change
- Virtual water trade and water resources
- Global hydrologic cycle using stable water isotopes

OKI, T. Lab.

Field Life Cycle Management of Urban Infrastructure

- Development of life-cycle management system
- Evaluation of performance degradation due to materials deterioration
- Spatial variation of deterioration progress in concrete structures

YOKOTA Lab.

Field Applied Remote Sensing

- Remote sensing technology for great disaster
- Land ecosystem monitoring
- Mitigation of global warming
- Landscape in developping country

SAWADA, H. Lab.

Field Geotechnical and Geoenvironmental Engineering

- Evaluation of soundness of earth structures
- Long term behaviour of buried pipe and its renewal
- Soil improvement using the function of microbes
- Deformation characteristics of geo-materials

KUWANO Lab.

Field Planning and Engineering for Social Safety System

- Vulnerability assessment to natural disaster
- Urban planning for climate change
- Post- disaster rehabilitation and re-construction
- Development and implementation of systems for social safety and security

KATO, T. Lab.

Field Integrated Disaster Management Engineering

- Study on effective use of earthquake early warning considering regional impacts
- Study on disaster and crisis management system for hospital
- Development of multi-media tools for increasing disaster response capacity
- Study on land use control for disaster risk reduction in depopulation society

OHARA Lab.

Field Infrastructure Management for Developed Society

- Anchorage performance of RC structures
- Mechanics of fiber reinforced concrete under multi-dimensional stress condition

NAGAI Lab.

Field Watershed Environmental Change Adaptation Planning

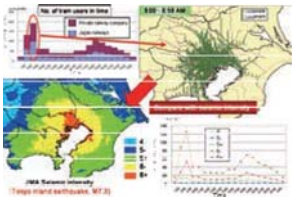
- Watershed environmental change adaptation strategy
- Development of practical disaster information dissemination system in developing countries
- Disaster information dissemination to diverse communities including foreigners

KAWASAKI Lab.

MEGURO Lab.

Study on countermeasures for train users in case of Tokyo metropolitan inland earthquake

The possibility of Tokyo metropolitan inland earthquake is getting high, however, the preparedness of countermeasures considering train users is not enough. To improve the countermeasures, we are studying the relationship between the distribution of train users and the seismic intensity in the event that the inland earthquake occurs. Based on the results, it is found that there are over 1.78 million people using the trains from 8:00 to 9:00 am, in areas with more than JMA seismic intensity 6-.

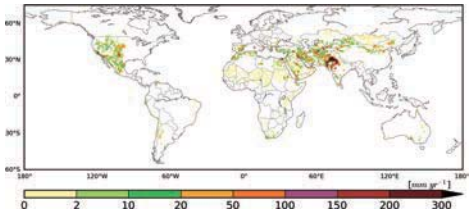


Estimation of the number of train users in each seismic intensity area in the event of Tokyo metropolitan inland earthquake

OKI, T. Lab.

Non sustainable groundwater use in the world

Approximately 300 cubic kilometer per year of fossil groundwater is estimated to be exploited for irrigation among 3,000 cubic kilometer per year of total water used for agricultural sector in the world. Fossil groundwater is stored in aquifers with practically no recharge under current climatic condition, and it is a non-sustainable water source. Figure illustrates the groundwater depletion by such a human intervention.



Global groundwater depletion (mm) in a year

YOKOTA Lab.

Development of life-cycle management system

It is extremely important to pursue collaboration between durability design and strategic maintenance for structures. Furthermore, to realize the strategic maintenance, the comprehensive life-cycle management is one of the key technologies. The life-cycle management formulates scenarios for future maintenance work based on the initial durability design level and is followed by verification and/or modification of the scenarios. The life-cycle management includes a series of actions to evaluate the grade of deterioration and structural performance degradation by inspection, to predict the future progress of performance degradation, and to propose the alternatives of appropriate intervention based on life-cycle cost minimization or performance maximization under budget capping. This research delelopes the life-cycle management system for civil infrastructure.

SAWADA, H. Lab.

Rehabilitation monitoring of the East Japan Great Earthquake disaster

This study aims to develop remote sensing technologies to detect the situation of the East Japan Great Earthquake disaster, which happened on 11 March 2011. Value added remote sensing maps will be developed for city planners as well as for government officers who need to monitor the rehabilitation stages of the east Japan coast.

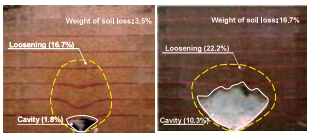
Tsunami inundation aerial photo map

KUWANO. Lab.

Generation and expanding process of cavity and loosening in the ground

Local subsides or cave-in's of the ground often occur in urban area. The complicated underground situation as well as the necessity of urgent restoration do not usually allow full investigation of the real cause. The detailed mechanism of the phenomenon has not been, therefore, well understood. Cave-in is usually initiated by the formation of cavity in the ground due to soil loss. In this study, characteristics of formation/expansion of cavity and surrounding ground loosening are investigated, aiming at effectively indicating dangerous pattern of cavity and loosening.

Cave-in due to the corrosion failure of sewer pipe



Cavity and loosening generated in a model test

KATO, T. Lab.

Establishment of residents participatory planning system in widespread built-up area against climate change

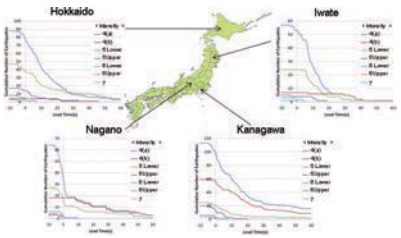
Wide and dense built-up area, which has more than four million of population, has been formed below sea level in Japan. Climate change will accompany increase of wide-scale flood disaster risk in such areas. The objective of this study is to establish a residents-participatory planning system which can find solutions from both short-term and long-term viewpoint through practical approach in the district of Tokyo Metropolitan.

Residents participatory planning system in widespread built-up area

OHARA Lab.

Study on effective use of earthquake early warning considering regional impacts

The earthquake early warning (EEW) started to be announced to the public on October 1st, 2007. The number of earthquakes at which EEW was announced so far is too limited to understand the effectiveness of EEW properly. In this research, regional characteristics of expected lead times by EEW were analyzed using past earthquake data. Based on these results, future strategies for making the best use of EEW were discussed.

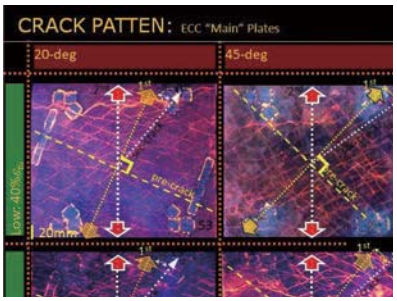


Expected distribution of lead times by earthquake early warning

NAGAI Lab.

Mechanics of fiber reinforced concrete under multi-dimensional stress condition

High-Peformance fiber-reinforced cementititous composite (HPFRCC) exhibits multiple cracks and pseudo-strain-hardening behavior under tension stress. This research aims to develop a robust HPFRCC under stress rotation for wider application of it in construction industry.

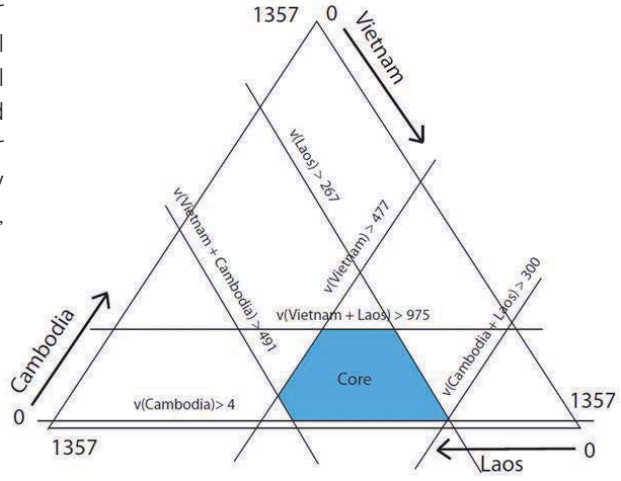


Multi-directional cracking of HPFRCC

KAWASAKI Lab.

Game theory approach to transboundary impacts of hydropower development in the Mekong

The objective of this study is to propose a methodology for analyzing complex transboundary river-basin issues, which will provide an important basis for local policy decisions and regional planning in the Mekong River and beyond. This study investigated the utility of a game theory approach for the impact of hydropower dam development on water resources adaptation in transboundary basins. The study area is the 3S basin in the Mekong River Basin, covering areas in Cambodia, Laos, and Vietnam.



Ternary plot of the core for comparing benefit among 3 countries

Center for Photonics Electronics Convergence

Established on October 1, 2012, for a five-and-half-year period

Director: ARAKAWA, Yasuhiko

The Center for Photonics Electronics Convergence (CPEC) promotes basic research based on nanoscience and nanotechnology to realize unique functionalities and systems converging quantum nature of electrons, photons, and spins in nanostructures such as semiconductor quantum dots, metal nanoparticles, and functional complexes. On the basis of this research, the CPEC is aiming to open novel research fields in electronics, and create technological innovations for the future.

Field Quantum Nanodevices & Nanooptoelectronics

- Growth and fabrication technologies for high-quality quantum dots and photonic crystals
- Physics of electrons, spins, and photons in semiconductor nanostructures
- Cavity quantum electrodynamics and its applications
- Quantum information technology: physics and devices
- Nanophotonic devices
- Photonics-electronics convergence technology
- Organic semiconductor devices and flexible electronics
- Fundamental researches for next-generation high-efficiency solar cells

ARAKAWA-IWAMOTO Lab.

Field Applied Nonlinear Optics

- Materials and devices for optical wave manipulation
- Holographic data storage
- Spin related optics and photonics
- Nano-structured novel optical materials

SHIMURA Lab.

Field Advanced Electrochemical Devices

- Plasmonic photoelectrochemical devices based on metal nanoparticles
- Plasmonic antenna effects of metal nanostructures
- Photoelectrochemical materials and devices based on metal clusters
- Novel photocatalysts and photocatalysis technologies

TATSUMA Lab.

Field Quantum Semiconductor Electronics

- Physics and applications of quantum nanostructures and new electronic materials
- Femtosecond spectroscopy of ultrafast phenomena in semiconductor nanostructures
- Generation, amplification, and detection of terahertz radiation
- Engineered materials

HIRAKAWA Lab.

Field Quantum Semiconductor Spintronics

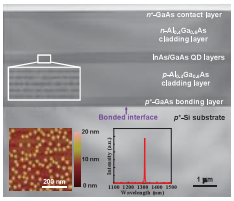
- Quantum transport in graphene
- Control of nuclear spins in semiconductors
- Quantum Hall effect
- Spin transport in quantum dot spin valves

MACHIDA Lab.

ARAKAWA-IWAMOTO Lab.

Development of quantum-dot lasers on silicon

Quantum dot lasers are promising light sources for use in the future electron-photon convergence systems because of their unique characteristics, including high temperature stability and high temperature operations. We are developing quantum-dot lasers on silicon substrates and the corresponding technology for their integration with electronic systems. We have demonstrated a quantum-dot laser on a silicon substrate with a threshold current density of 205A/cm^2.

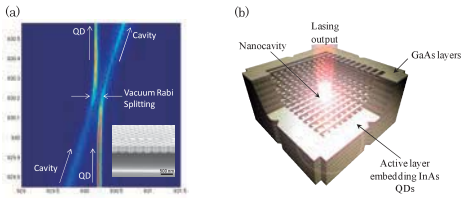


Cross-sectional TEM image of quantum-dot laser on silicon substrate fabricated by direct wafer bonding technique: Insets show a magnified TEM image of stacked InAs quantum dots in active media, an AFM image of InAs quantum dots and a typical lasing spectrum.

ARAKAWA-IWAMOTO Lab.

Fundamental study of solid-state cavity quantum electrodynamics and its application to nanophotonic devices

We are exploring physics of cavity quantum electrodynamics (CQED) in quantum-dot nanocavity systems. Many cutting-edge results including the observation of phonon effects in CQED phenomena and the first demonstration of single quantum dot laser have been obtained. We have also demonstrated several nanophotonic devices utilizing CQED effects. Recently, we achieved the highest quality factor of 3D photonic crystal nanocavities and reported the world-first 3D photonic crystal nanocavity laser.

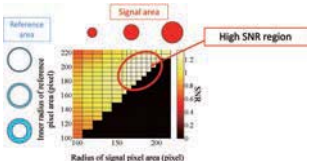


(a) Vacuum Rabi splitting observed in a strongly coupled QD-PhC nanocavaity system
(b) Illustration of a 3D photonic crystal nanocavity laser

SHIMURA Lab.

Temporally coded collinear holographic memory

We invented a temporally coded collinear holographic memory system. Using Run Length Limited (RLL) coding, we can increase the recording density comparing to the page oriented memory system. With the shift of the recording media, the reconstructed image of the holography changes. This means that state of each pixel, ON or OFF, is changing temporally. The number of signal channels huge, and massively parallel write and read operation of the temporal signal is available.

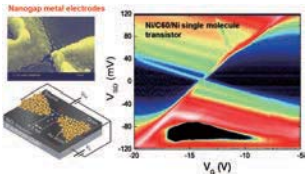


Dependence of the SNR on the reference and signal area. The total raw data capacity was set to be 10 TB/disk.

HIRAKAWA Lab.

Physics and applications of single molecule transistors

Electrical manipulation and read-out of quantum mechanical states in single quantum nanostructures by nanogap metallic electrodes is expected to bring about great innovations in IT devices. In this project, we will establish technologies of accessing to single molecules by nanogap metallic electrodes and explore device applications of novel physics manifested in such nanogap junctions.

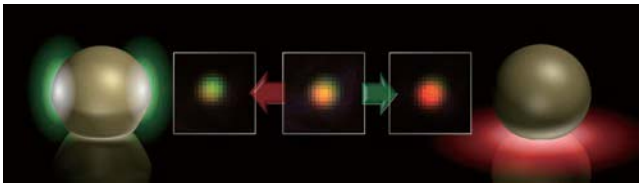


An atomic-scale nanogap electrodes prepared by ultra-precise electromigration technique and typical transport properties of a single molecule transistor

TATSUMA Lab.

Advanced photoelectrochemical devices

Plasmonic metal nanostructures exhibit strong light absorption and nanoscale light localization. We apply the nanostructures to photoelectrochemical materials and devices including photovoltaic cells, photocatalysts, versatile photochromic materials, and photomorphing gels.

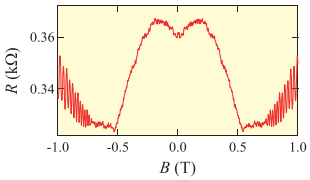


Color changes of a single silver nanoparticle

MACHIDA Lab.

Ballistic transport in high-mobility graphene/h-BN

We study magnetotransport in ballistic graphene mesoscopic wires on hexagonal boron nitride (h-BN). We observed enhancement of the magnetoresistance due to diffusive boundary scattering in ballistic graphene. The resistance peak occurs at a magnetic field with a unique commensurability ratio between cyclotron radius and wire width, suggesting that the presence of unique relativistic charge carriers, massless Dirac fermions, has lead to the emergence of novel transport phenomena.



Enhancement of magnetoresisntace due to the commensurability effect in a ballistic graphene/h-BN

Center for Socio-Global Informatics

Established on April 1, 2013, for a five-year period

Director: SATO, Yoichi

A tight integration between the ICT infrastructure and various elements of the physical world is expected to play an essential role for providing effective solutions to many important problems in a wide range of application fields. Center for Socio-Global Informatics, established in April 2013, aims to establish and advance the emerging field of socio-global informatics on the integration of the cyber and physical worlds based on deep understanding human activities at various levels ranging from each individual to a society.

Field Visual Media Engineering

- Vision-based human motion sensing and behavior understanding
- Object appearance modeling and analysis
- Computer vision

SATO, Y. Lab.

Field Database Engineering

- Discovery of cyber-communities with web mining and next generation search engine
- Parallel data mining/database on very large PC clusters
- Digital earth and scalable archiver
- Storage network system

KITSUREGAWA Lab.

Field Computer Engineering

- Computer architecture
- High performance computing
- Database storage system

ODAKA Lab.

Field Information Retrieval

ADACHI Lab.

Field Applied Multimedia Information Processing

- Intelligent transportation systems
- Pedestrian security
- Protein engineering

KAMIJO Lab.

Field Web Engineering

- Multimedia web analysis

TOYODA Lab.

Field Data Architecture Engineering

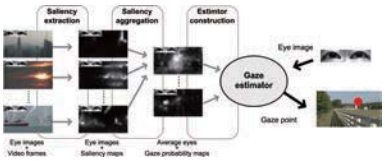
- Green database
- High performance database systems
- Large scale data access mechanisms
- Efficient algorithms for I/O intensive applications

NAKANO, M. Lab.

SATO, Y. Lab.

Calibration-free gaze sensing using saliency maps

Current gaze sensing technologies share the common problem that cumbersome calibration is necessary in prior to measurement. It is well known that our gaze tends to be fixated at salient regions in our field of view. Our method exploits this property of human vision to realize calibration-free gaze sensing. We believe that this work is the first step to bridge the gap between the psychophysical study of human vision and applied engineering of gaze sensing.



Our method uses saliency maps computed from video frames in bottom-up manner for automatically constructing a gaze estimator

KITSUREGAWA Lab.

Extracting cyber communities from the entire Japanese WWW pages

One of the exciting challenge in Web mining is to draw the entire cybermap. We crawled most of .jp and .com pages which are written in Japanese. Cyber communities, densely interlined subgraph, are extracted from the entire cyber space by link and contents analysis. In addition, the relationships among the communities are also extracted to generate the community chart. The system is being implemented on the digital wall.

WWW community chart

KAMIJO Lab.

On-board image sensor

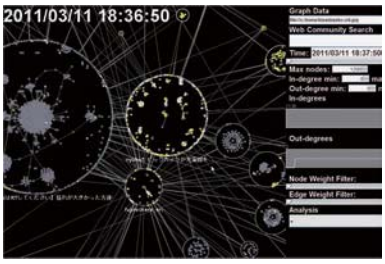
National projects to protect pedestrians from accident with vehicles are maneuvered in many regions in the world. In our Lab., our original image processing technology is employed to detect pedestrians by on-board cameras.

On-board image sensor

TOYODA Lab.

Analysis and visualization of information diffusion in microblog

Various information is now spreading over social networks in real-time. We analyzed patterns of information diffusion, and found that various social activities tends to have different ways of cascade. We visualized diffusion patterns in Twitter when the 3.11 earthquake occurred.



Information diffusion in Twitter after the 3.11 earthquake

NAKANO, M. Lab.

Research on power saving method for large storage system considering I/O intensive applications

The total costs of datacenters, where large data-intensive applications are executed, are increasing every year. Especially, the increased power and cooling costs have been remarkable. Therefore, a new power-saving approach is likely to put application knowledge to good use for power reduction of IT equipment without degrading application performance.

Run time power saving method with OLTP applications (TPC-C) - 5 disks case -

Center for Research on Innovative Simulation Software (CISS)

Established on January 1, 2008, for a five-year period, and reorganized on April 1, 2013, for a five-year period

Director: KATO, Chisachi

The Center for Research on Innovative Simulation Software (CISS)—founded in January 2008—has successfully completed its first five-year mission involving the development and dissemination of cutting-edge simulation software for use in industries and for assistance to researchers and engineers capable of developing and efficiently using such software. CISS has developed over 10 types of cutting-edge simulation software, many of which are widely used in the industries.
In April 2013, CISS started its second five-year term and welcomed two new members. With the spread of the developed simulation software in related industries and the assistance to researchers and engineers, CISS is strongly committed in researching highly innovative simulation methods optimized for exascale computing and for the development of design methods that are fully equipped by such simulations.

Field Fluid Flow and Thermal Systems Control

- Control and reduction of aerodynamic sound
- Numerical simulation of fan noise
- Thermoacoustic engine/refrigerator
- Study on ultra-micro-scale gas-turbine

KATO, C. Lab.

Field Environmental Control Engineering

- Optimal design of indoor environment with CFD simulation
- Virtual building utilizing building information modeling
- Numerical simulation and wind tunnel experiment of air conditioning system using cross ventilation of buildings
- Indoor air chemical pollution research for healthy living environment

KATO, S. Lab.

Field Multi-scale Solid Mechanics

- Meso-mechanics of carbon fiber reinforced plastic
- Meso-mechanics of die cast aluminium alloy
- Meso-mechanics for skin beauty
- Optimum design of FRP high pressure tank for fuel cell vehicle

YOSHIKAWA, N. Lab.

Field Computational Biomolecular Science

- Development of quantum chemical simulation for proteins
- Development of GUI for protein simulations

SATO, F. Lab.

Field Computational Fluid Dynamics

- Computational biomechanics of blood circulatory system
- Multi-scale and physics simulation of cardiovascular diseases
- Micro-PIV measurement of multiphase flow in a microchannel
- Visualization and measurement of blood flow in an in vitro model

OSHIMA Lab.

Field Knowledge-based Engineering

- Software platform for high-performance computing
- Design simulation by knowledge integlation
- Simulation technology for innovation
- Project management

HATADA Lab.

Field Nanostructured Materials Strength and Science

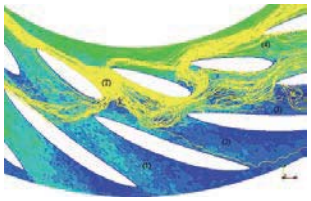
- Ab initio and molecular dynamics simulations of mechanical properties of nanomaterials
- Evaluation of mechanical instability criterion of materials by atomistic model
- Ab initio analysis of functional aspects of nanomaterials and strain effect

UMENO Lab.

KATO, C. Lab.

Large-scale computation of the pump-turbine rotating stall

This computation consists in the simulation of the rotating stall appearing into a pump-turbine operating at part load condition in pumping mode. The computations are performed using an Overset Finite Element Large Eddy Simulation code with the dynamic Smagorinsky turbulence model.

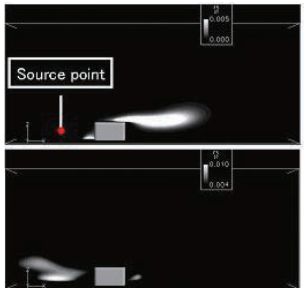


Instantaneous streamlines passing through the guide vanes throat (T)

KATO, S. Lab.

Reverse simulation to indentify source information

When a hazardous substance is diffused, it is necessary to identify the pollutant source. Then we are developing a reverse simulation method to identify the source information. Moreover, we survey the dependence of reverse simulation accuracy on the grid resolution and filter width.

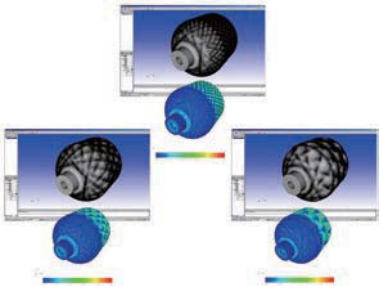


Result of riverse simulation

YOSHIKAWA, N. Lab.

Meso-mechanical optimum design of carbon fiber reinforce plastic (CFRP) tank for fuel cell vehicle

A precise strength estimation of filament winding hydrogen tank is carried out by means of meso-model, where the CF bundle and the resin are strictly discretized. The Optimum design is to be searched for in terms of meso-scale material parameters such as bundle width, path and so on.

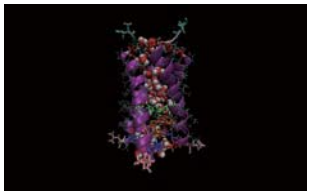


Meso-mechanical optimum design of carbon fiber reinforce plastic (CFRP) tank for fuel cell vehicle

SATO, F. Lab.

Born-Oppenheimer MD simulation of ion channel

The RNA of influenza virus is protected by a viral envelope, but these become obstructive after being taken into a host. M2 protein enables hydrogen ions to enter the viral particle, and lowering the pH inside of the virus is a crucial step in uncoating of the virus and exposing its content to the host cell. The mechanism of the hydrogen ion channel of M2 protein is energetically analyzed using the most reliable Born-Oppenheimer molecular dynamics method.

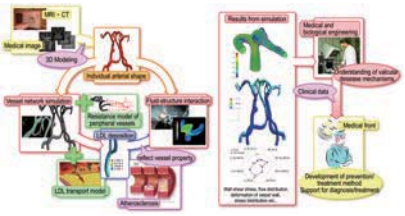


Structure of M2 protein of the influenza A virus

OSHIMA Lab.

Multi-scale and physics simulation of cardiovascular diseases

Cardiovascular diseases such as atherosclerosis or cerebral aneurysm have known to have strong correlation with hemodynamics. The present research aims to develop an integrated numerical simulation system in order to elucidate the mechanism of formation and growth of cardiovascular diseases. The multi-scale simulation system features a patient-specific modeling and simulation by considering physiological responses induced by mechanical stresses.



Schematic illustration of integrated simulation

HATADA Lab.

Seamless simulation platform for innovative product design

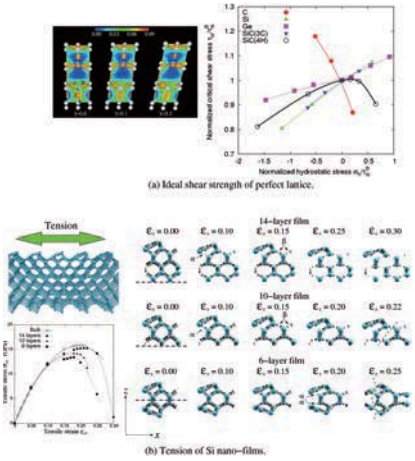
A product concept is made in upper development stage. It is necessary for the possibility to be evaluated enough by the seamless simulation. The application lineup that HPC/PF has is utilized to realize the seamless simulation. The simulation process enables the effective evaluation and the optimization use of the advanced elemental technology and realizes accelaration of the product innovation.

Concept of seamless simulation for innovative product design

UMENO Lab.

Ab initio density functional theory study on ideal strength of crystals

The ideal strength, which is defined as the ultimate strength of crystals under uniform deformation, is an important mechanical parameter to estimate the strength of microscopic materials such as MEMS and electronic devices and to understand the elementary process of plastic deformation and fracture. We conduct theoretical studies with the ab initio density functional theory (DFT) to reveal the ideal strength of perfect crystals under multiaxial stress and nanometer-scale thin films.



Ab initio DFT analysis of effect of normal stress on ideal shear strength in covalent crystals (top) and ideal tensile strength of Si nano-film (bottom).

Collaborative Research Centers

Nanoelectronics Collaborative Research Center (NCRC)

Established on January 23, 2002

Director: ARAKAWA, Yasuhiko

In 2002, University of Tokyo established the Nanoelectronics Collaborative Research Center (NCRC). Based on semiconductor nanotechnology, we are developing advanced nanophotonic and nanoelectronic devices for the development of future information and communication systems. In addition, we aim to realize such devices not only in laboratories but also in the real world. The NCRC is promoting advanced researches in close collaboration with various industrial leaders and domestic/overseas universities. Significant results have already been achieved by these collaborations; some of these achievements include the development of high-performance quantum-dot lasers and organic CMOS devices. The collaborative research network established between universities and industries also serves the purpose of training young individuals of exceptional ability who can undertake a strong leadership role in the nanoelectronics field.
NCRC is the main organization for the Japan–Italy international collaboration in the field of nanotechnology. Furthermore, a strong collaboration with the Institute for Nano Quantum Information Electronics (NanoQuine), University of Tokyo, is underway for the development of core technologies for quantum information. We have also been developing fundamental technologies for the future photonic-electronic integration systems under Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST) by since 2010 and Future Pioneering Project the Ministry of Economy Trade and Industry (METI) since 2012.
Through these activities, we aim to establish a Center of Excellence (COE) for advanced nanophotonics and nanoelectronics in the Komaba Research Campus.

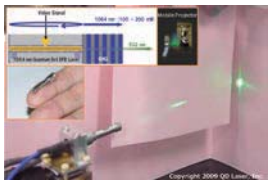


Fig. 1 : Green laser using quantum-dot technology

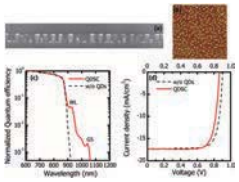


Fig. 2 : Quantum-dot solar cell with high open voltage

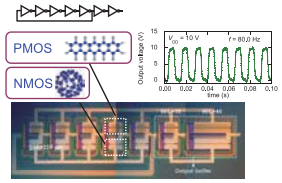


Fig. 3 : High-speed organic CMOS circuits with low operation voltage

The main research fields of the NCRC are as follows:
- Investigation of nanotechnology and nano science
- Development of advanced nanophotonic and nanoelectronic devices
- Development of photonics-electronics convergence technologies
- Explorative research on organic electronics, molecular electronics, and bioelectronics
- Basic research on quantum information and communication technologies

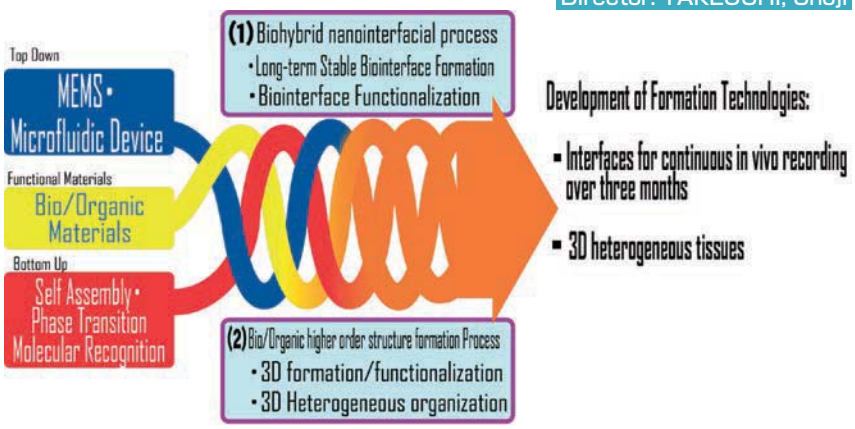
Collaborative Research Center for Bio Nano Hybrid Process

Established on July 16, 2008

Director: TAKEUCHI, Shoji

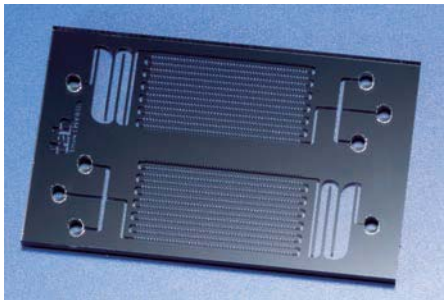
This center has established since 2008. The target area of the process development is “Bio/Organic Materials Integration Process”. The mission of this center is to establish innovative process platforms by combining cutting-edge researchers from academia and leading companies. This unique scheme enables technology convergence by close and dense interaction among the centers and development of human resources that are indispensable for hetero-functional research and development.

Core members:
FUJITA Hiroyuki, Professor
FUJII Teruo, Professor
SAKAI Yasuyuki, Professor
TAKEUCHI Shoji, Associate Professor
OKITSU Teru, Project Associate Professor
MATSUNAGA Yukiko, Project Lecturer
ONOE Hiroaki, Research Associate
OSAKI Toshihisa, Project Research Associate
HEO Yun Jung, Project Research Associate



Outline of bio/organic materials integration process

Implantable sensors for continuous glucose monitoring



Microfluidic devices for handling of cells/ beads/liposomes

Collaborative Research Center for Innovative Mathematical Modelling

Established on March 4, 2010

Director: AIHARA, Kazuyuki

This research center aims at constructing a mathematical theory for modelling complex systems, and applying the theory transdisciplinarily. The theory will be based on "Chaos Engineering," which the director of the center has proposed for applying chaos, fractal, and complex networks to engineering problems. This research center is mainly supported by one of Funding Programs for World-Leading Innovative R&D on Science and Technology (FIRST Program), "Mathematical Theory for Modelling Complex Systems and its Transdisciplinary Applications in Science and Technology."

In this center, we first combine dynamical systems theory in mathematics with control theory in engineering to form an "innovative control theory for complex systems", a core of which is hybrid dynamical systems. Second, based on mathematical methods including this control theory, complex network theory, and time series analysis theory, we construct a basic mathematical theory for modelling complex systems. Third, we apply the basic theory to important and urgent problems in our society such as prostate cancer, infectious diseases, and AD/DA convertors. Then, we will reinforce the mathematical theory for modelling complex systems by providing the feedback from the above applications to basic theoretical researches.

Mathematical Theory for Modelling Complex Systems

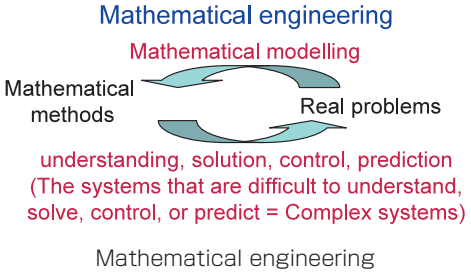
Dynamical systems theory and control theory, while they deal with similar problems, have been highly developed almost independently of each other because dynamical systems theory started with astrodynamics, which does not have inputs, while control theory has paid attention mainly to stability analysis of linear systems, but not to nonlinear phenomena including chaos. However, since both theories have been developed well, it is possible to establish a very powerful innovative control theory for complex systems by unifying them. This innovative control theory will be a basis of the mathematical theory for modelling complex systems, and will produce various transdisciplinary applications.

Applications of Modelling Complex Systems

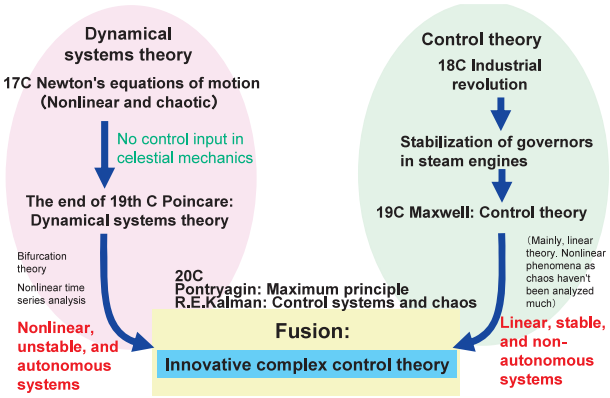
The mathematical theory for modelling complex systems we establish will be applicable transdisciplinarily to science and technology of various complex systems. As a start, we personalize a hormonal treatment of prostate cancer by mathematical methods including fitting a time series dataset of a tumor marker measured from each patient. In addition, we apply the constructed mathematical methods to optimizing general chemotherapy schedules and suppressing viruses with multi-drug resistance. Through analysis of a dynamical network biomarker, we predict pre-disease states of complex diseases like hepatitis C. Moreover, we construct a system to simulate spreads of epidemics like pandemic flu to plan countermeasures such as movement restrictions. We will also develop brand new AD/DA convertors based on the beta-transformation.

Integration of Theory and Applications for Modelling Complex Systems

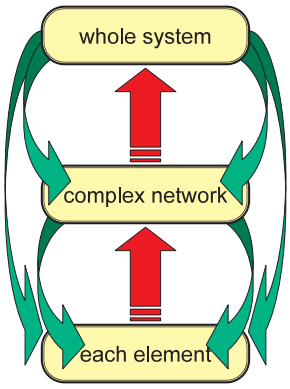
In the last stage of this project, we will deepen the above researches in various applications, and expand other transdisciplinary applied researches on various complex systems in engineering and biology. In addition, we will bring back the applied results and transdisciplinary knowledge to the theoretical researches for extending and systematizing the mathematical theory for modelling complex systems. Moreover, we are planning to explore widely the future possibilities of the mathematical theory for modelling complex systems that models mathematically various complex dynamical phenomena.



Mathematical engineering



Innovative complex control theory



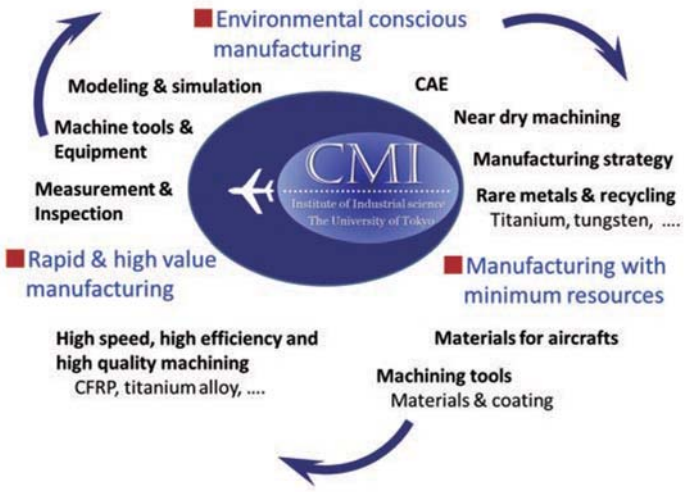
Structures of complex systems

Collaborative Research Center for Manufacturing Innovation (CMI)

Established on April 10, 2013

Director: OBIKAWA, Toshiyuki

This research center was established for developing innovative manufacturing technologies, which will contribute to (1) rapid and high value manufacturing, (2) environmentally conscious manufacturing and (3) manufacturing with the minimum natural resources and less amount of rare metals. Nowadays, there are lots of demands for manufacturing technologies which enable us to continue the sustainable development of our societies. For example, manufacturing of light weight aircrafts and automobiles, which consume less fossil fuel, are highly demanded. Carbon fiber reinforced plastic (CFRP) of high specific strength and high specific rigidity is one of the most promising materials to meet the demand, and thus, has been applied to commercial aircrafts and automobiles. Although the performances of the aircrafts are excellent as expected, fabrication of CFRP fuselages and wings is still a developing technology. Manufacturing technologies developed through collaborative researches between the center and the industries, which are also supported by the Ministry of Economy, Trade and Industry, will solve common pains among the industries on advanced manufacturing processes and systems.



- Research for rapid and high value manufacturing includes high-quality, high-efficiency and high-speed machining of CFRP, titanium alloy and aluminum-lithium alloy with advanced machine tools and cutting tools, precision measurement and highly reliable inspection with advanced equipment, and rapid manufacturing strategies
- Research for environmentally conscious manufacturing includes near dry machining for reducing cutting oil and electric power used for machine tools and machining systems, and high efficiency machining and manufacturing with the minimum emission from the processes
- Research for manufacturing with minimum natural resources and less amount of rare metals includes reduction of chips of titanium alloy removed by machining, extension of the life of a carbide tool consisting of lots of rare metals such as tungsten, titanium, cobalt, niobium, tantalum, etc., and recycling of removed chips of titanium alloy

Core members:
OBIKAWA, Toshiyuki (Professor); YANAGIMOTO, Jun (Professor); OKABE, Toru H. (Professor); HASHIMOTO, Akira (Project Professor); OKABE, Yoji (Associate Professor); TSUCHIYA, Kensuke (Associate Professor)

LIMMS-CNRS/IIS (UMI 2820), International Collaborative Research Center

Established on April 1, 2004

Co-directors: FUJII, Teruo and COLLARD, Dominique

The LIMMS, the Laboratory for Integrated Micro Mechatronic Systems, is operational in Tokyo since 1st of January 1995. The LIMMS was established as a joint research laboratory between the Engineering Science Department (SPI) of the Centre National de la Recherche Scientifique (CNRS) and Institute of Industrial Science (IIS) of the University of Tokyo. After 9 years of operation, on the 1st of April in 2004, the LIMMS has become the first Unité Mixte Internationale de Recherche (UMI 2820) created in Asia by CNRS and the University of Tokyo. At the same time, LIMMS got a new status at IIS as an international collaborative research center. These new statuses recognize LIMMS as a well-established and fruitful way to promote scientific collaborations between, now, the Institute for Engineering and Systems Sciences (INSIS) of CNRS and IIS of the University of Tokyo.

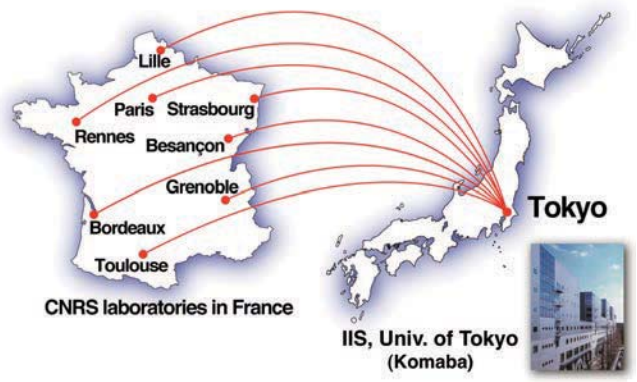


Fig. 1 LIMMS welcomes French scientists, CNRS permanent researchers, and post-doctoral researchers in host research groups at IIS and is working with more than 10 French laboratories directly involved in the research projects.

The purpose of LIMMS is to combine expertise of both Japanese and French researchers and to explore new frontiers of MEMS and NEMS for various fields such as micromechatronics, micro robotics, nano metrology, microoptics, bio-engineering, molecular engineering and integrated circuits.

Since its creation, LIMMS has welcome at IIS more than 110 researchers including, 28 CNRS researchers, 59 post-doctorates fellows supported by JSPS, 5 by CNRS, 7 CNRS PhD students. The hosting activities are supported by 2 CNRS administrative and research engineers, and 3 IIS secretaries as well as host Professors and members of their laboratories. Today, in IIS 50 peoples are directly involved in LIMMS activities (Fig.1) .

The extended know-how developed by LIMMS in micro and nanotechnology has allowed the laboratory to build its scientific policies on three research axes;

- Development of new nanotechnologies (Fig. 2)
- Micro- and Nanotechnologies applied to biology (Fig. 3)
- Advanced integration of MEMS and NEMS functions (Fig. 4)

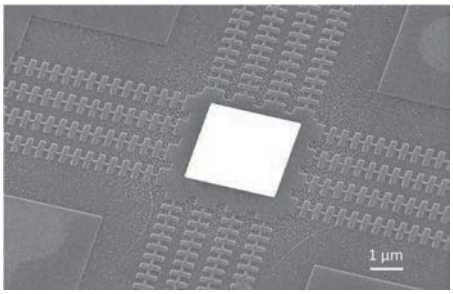


Fig. 2 Suspended phononic crystal for thermo-electric energy harvesting device

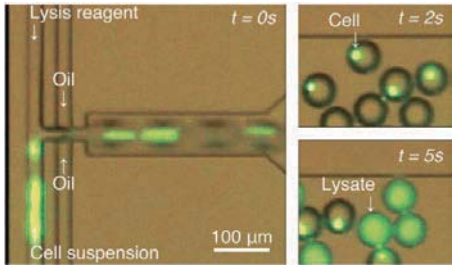


Fig. 3 Microfluidic device for cell lysis in droplet

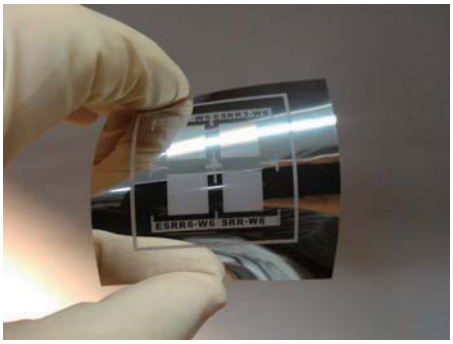


Fig. 4 Aluminum split ring resonator on PEN substrate

■EUJO-LIMMS "EUrope Japan Opening of LIMMS"

A project to reinforce the EC collaboration in Japan by opening LIMMS/CNRS-IIS to our 3 European partners : EPFL (Ecole Polytechnique Fédérale de Lausanne, Switzerland), IMTEK (Albert-Ludwigs-Universität Freiburg, Germany) and VTT (Valtion Teknologian Tutkimuskeskus, Finland), was approved by the European Commission in 2011. Through this project, since December 2011 and for 4 years, LIMMS and its EUJO-LIMMS extention became the European Commission's first international laboratory in Japan. This project is funded through the EU, and The Japan Society for the Promotion of Science granted IIS for EUJO-LIMMS counter part activity (Fig. 5).

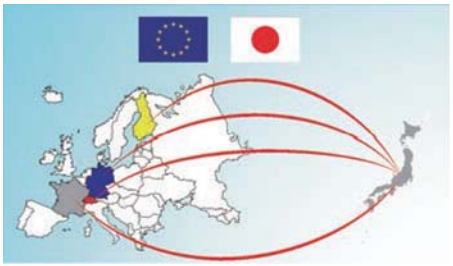


Fig. 5 LIMMS and its EUJO-LIMMS extention open the collaboration to 3 new European partners

Core members:

ARAKAWA, Yasuhiko, Professor	FUJII, Teruo, Professor	FUJITA, Hiroyuki, Professor
HIRAKAWA, Kazuhiko, Professor	KAWAKATSU, Hideki, Professor	KIM, Beomjoon, Associate Professor
KOHNO, Takashi, Associate Professor	MITA, Yoshio, Associate Professor (Faculty of Engineering)	NOMURA, Masahiko, Associate Professor
SAKAI, Yasuyuki, Professor	SOMEYA, Takao, Professor (Faculty of Engineering)	TAKEUCHI Shoji, Associate Professor
TIXIER-MITA, Agnes, Associate Professor (Research Center for Advanced Science and Technology)	TOSHIYOSHI, Hiroshi, Professor (Research Center for Advanced Science and Technology)	

Chiba Experiment Station

Chiba Experiment Station is part of Institute of Industrial Science of the University of Tokyo. The station covers an area of 9.2 ha and was established in 1962 when the Institute moved its campus from the city of Chiba to Roppongi, the location of the former campus till March, 2001. Its purpose is to accommodate large scale research facilities and experimental works that cannot be carried out on the Komaba II campus in downtown Tokyo. Research projects are renewed according to the progress made in respective fields and to meet social needs. In recent years, about 30 laboratories have been engaged in roughly 40 projects at the station. The station is opened to associate researchers or general people including pupils and students in November every year. More than 850 participants visited the facilities in 2012. The participants can touch on the latest researches, which are also introduced in many media. Sometimes new joint research projects are initiated through the exchange of ideas among wide variety of study fields in open campus. Some of the projects carried out at the station are selected and summarized below.

Study on advanced guide way vehicle

Motion and vibration control of guide way vehicle is investigated. Running experiment of straight/transition/curve/constant curve is performed by 1/10 scale model vehicle. Moreover, actual-sized running experiment is conducted by using the Chiba experimental test track and actual bogies. Development of new concept bogie, friction control between wheel and rail, active controlled vehicle are being conducted using these experimental facilities.

SUDA Lab.

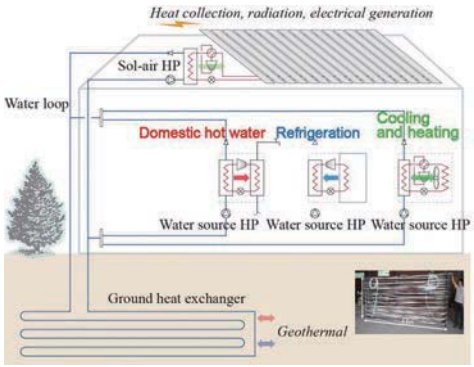
Running experiment using the Chiba experimental track

1/10 scale model vehicle

Development of Multiple Source and Multiple Use Heat Pump system

A new concept of a ground-source heat pump system called Multiple Source and Multiple Use Heat Pump system has been developed. In this system, soil temperature is daily restored to the original state with artificial heat supply to replenish with natural recovery. And this system has higher efficiency and needs less soil volume than typical Ground Source Heat Pump system.

OOKA Lab.



System diagram

Research on the deterioration mechanism of reinforced concrete and development of countermeasures through exposure tests

Exposure tests are performed at Chiba Experiment Station and Izu exposure site to clarify the deterioration mechanism of reinforced concrete and to develop countermeasures. Chemical analyses and Electron Probe Micro Analyzer (EPMA) are used to investigate contamination by harmful ions from the environment and their movements within concrete.

KISHI Lab. / NAGAI Lab.

Exposure site at the Chiba Experiment Station

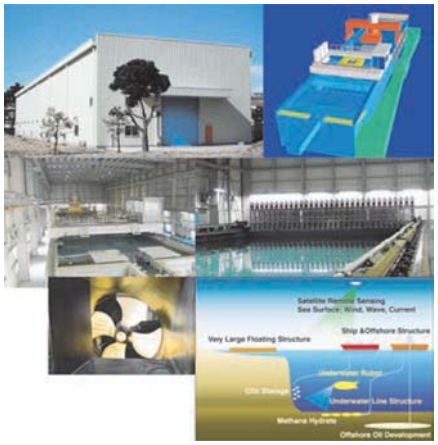
Izu exposure site in marine environment

Electron Probe Micro Analyzer (EPMA)

IIS ocean engineering basin

In recent year, ocean space utilization, relationship between global environmental change and ocean, and development of ocean resources such as renewable energy, offshore oil, methane hydrate and seafloor massive sulfides have attracted attention and have been widely discussed. Experiments and observations carried out in IIS ocean engineering basin support development of related elemental technologies. The dimensions of the basin are 50 m in length, 10 m in width and 5 m in depth. Various ocean conditions can be artificially generated using multidirectional wave maker, current generator and wind blower.

RHEEM Lab.



Development of biomass conversion technologies

To establish the Biomass Refinery System, we are investigating some key technology to convert lignocellulosic biomass into fuels and chemicals. As one of the promising technologies, we focused on high temperature/pressure water treatment, such as supercritical/subcritical water treatment and steam-explosion. In these processes hydrothermal reactions occur to decompose lignocellulosic biomass. We have tested the production of sugars and furfurals and their separation under hydrothermal condition. Also, some applications of the hydrothermal treatment in the filled of biomass pretreatment for boiethanol process were developed.

SAKODA Lab. / MOCHIDZUKI Lab.

Continuous high temperature/ pressure water treatment apparatus with a screw feeder

Batch type steam-explosion apparatus

Energy saving urban transport system “Eco–Ride”

To demonstrate the effectiveness of a next-generation short-distance public transport system called "Eco-Ride", which targets lower energy consumption and lower construction cost, a 100m test track has been installed at Chiba Experiment Station. Basic track performance and adaptability to public traffic systems are verified with the facilities and a full scale vehicle.

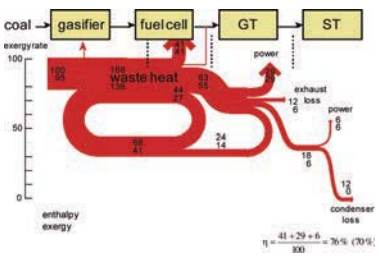
SUDA Lab. / NAKANO, K. Lab.

Eco-Ride

Advanced-integrated coal gasification combined cycle / integrated coal gasification fuel cell combined cycle (A-IGCC/IGFC) with exergy recuperation

The integrated coal gasification combined cycle (IGCC) and integrated coal gasification fuel cell combined cycle (IGFC) were developed to use coal more efficiently. In our laboratory, we propose an advanced IGCC/IGFC to achieve highly efficient power generation through exergy recuperation. In this power generation system, coal gasification is carried out at low temperatures and the heat required for gasification is provided by steam from the exhausted heat of a high-temperature gas turbine or a fuel cell.

TSUTSUMI Lab.



Schematic image of advanced integrated coal gasification fuel cell combined cycle and exergy conversion diagram

A large-scale triple-bed CFB cold model

Seismic performance evaluation of RC frames with unreinforced masonry wall

This study is to evaluate seismic capacity of RC frame with URM wall using 1/4 scale specimens under in-plain loading. From the test results, their failure mechanism and lateral strength are investigated based on curvature distribution along RC columns and principal compressive strains of URM wall.

NAKANO, Y. Lab.

Test setup (left), 1/4 scaled concrete block (top-right), URM Wall with 3-axis strain gauges (bottom-right)

Applying electron beam melting to purify silicon

Silicon refining processes are energy intensive, costly, and environmentally unfriendly. Given increasing demand for solar-grade silicon, an inexpensive and environmentally sound process is required. We apply an electron beam melting method to improve the properties of scrap silicon to solar-cell grade by removing impurities such as P and Sb. Research is underway on new industrial-scale metallurgical refining methods for silicon.

MAEDA Lab.

Polycrystalline silicon ingots

Electron beam melting equipment

Tension strut dome system / White Rhino

A tensegrity system has been appealing for many designers due to its applicability to the building structures with a unique appearance. Its complicated self-stress nature, however, prevented itself from the real application. The precise and elaborate investigation of structural behavior and prestress scheme of the basic tensegrity unit, a three-strut system, enabled the world first successful construction of the real tensegrity building. The enclosed area is used for the several research purposes, such as steel structure research, dynamic systems and control for vehicles, and spatial structure engineering.

KAWAGUCHI Lab. / IMAI Lab.

Free Access Platform Gate

Free Access Platform Gate to correspond to different type of train cars are composed to investigate their acceptability for passengers.

SUDA Lab.

Experimental engineering mockup (1st test model)

Equipment for evaluation test (2nd test model)

Interdisciplinary Group Researches

Interdisciplinary research serves as an important backbone for modern engineering science. This approach to research can only be achieved by coordinating the efforts of researchers from various disciplines through a highly integrated framework that allows free communication at all levels among the different fields. Evolving requirements have led to the formation of groups whose research activities transcend the boundaries of traditional disciplines. In order to acknowledge their achievements, prominent interdisciplinary groups have been certified under the name of Research Group of Excellence (RGOE); the realization of the RGOE aids and further promotes the activities of these groups. Each research group is flexible and is capable of adapting its organization to accommodate different stages of its activities according to the requirements.

Production Technology Research Group

The Production Technology Research Group was originally established in 1971 as a research group in IIS, The University of Tokyo. The research group mainly consists of seven to eleven professors of Institute of Industrial Science working in the field of production technology.

The group organizes technical visits to industry and national laboratories, domestic and international workshops, seminars etc., with the aim of promoting scientific collaboration among the members as well as joint-research with other organizations. The research group also maintains a joint-laboratory for exchange of new ideas and technologies.

A report of the activities of the research group is published in the bimonthly journal of the institute every eighteen months.

Research fields

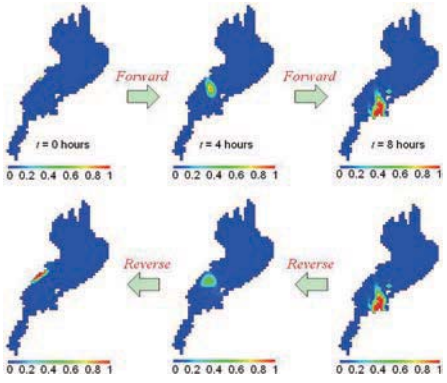
Knowledge Dissemination Unit

The Knowledge Dissemination Unit (KDU) is designed to make use of the research that is carried out at IIS to promote interest and awareness in science and technology among the public. The activities of KDU provide opportunities for the public to improve their scientific knowledge.

Visiting Lecture to the High School

TSFD (Turbulence Simulation and Flow Design) Research Group

The TSFD group develops methods for numerical simulation of turbulent flows to investigate their complex physics concerning various fields of industrial science and to contribute to flow design and control. Numerical analyses are applied for proposal and proof of turbulence models. Validation of models in applications to science and engineering problems is performed using large-scale computer simulations. This group also contributes to research transfer by organizing an annual symposium and publishing issues in the institute report (Seisan Kenkyu).



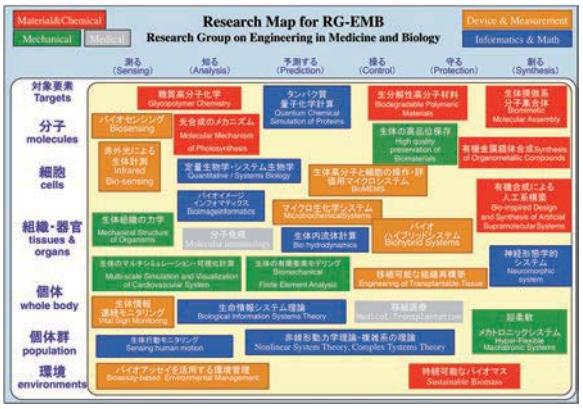
Reverse simulation of dissolved matter in Lake Biwa

Earthquake Resistant Structure Research Center (ERS)

To understand actual behaviors of the ground, structures, failure mechanisms and soil-structure interactions during natural earthquakes, earthquake response observations of weak structural models which were designed intentionally weak to be damaged by moderate earthquakes have been carried out since 1983.
Recently hysteresis dampers made of steel with low yield strength are placed on the first floor of one steel structure, and their effectiveness to reduce structural responses are investigated.

Research Group on Engineering in Medicine and Biology

Since the interdisciplinary area has been rapidly spreading out over engineering and biotechnology research field, it is important to discuss the applicability of the well-established engineering discipline to the bio-related research fields.
Some challenging research projects, such as biomimetic approach in organic synthesis, studies on hybrid tissues and organs, etc. have been already launched at Institute of Industrial Science (IIS), the University of Tokyo.
Moreover, the advanced technologies incubated at IIS, such as microelectromechanical systems (MEMS), electronics device technology, and computational fluid dynamics are seeking new applications in the bio-related field. A Research Group on Engineering in Medicine and Biology (RG-EMB) was organized in 1999 to explore the frontiers of engineering in the field of medicine and biology focusing on the fundamental relationships between “Shapes and Functions in Biological Components”.
A novel engineering discipline for elucidation and utilization of such fundamentals should be established through the activities of the RG-EMB.

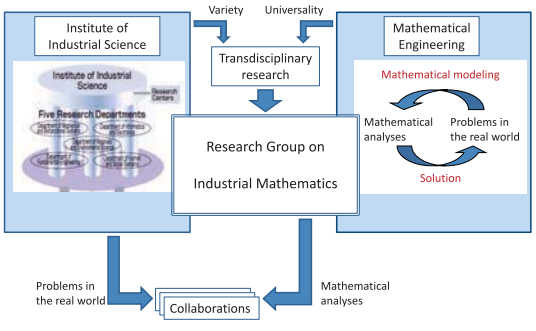


Research Group Focusing on Comfort and Its Application to Engineering

This research group focuses on comfort and its application to various engineering fields. Members with a background in architecture, mechanical engineering, information technology, electrical engineering, ecological psychology, and bio-functional systems work in cooperation with each other in the institute. Topics dealing with space design, air-conditioning, acoustics, lighting in architectural space and vehicles, and vibration control in vehicles are being investigated.
Our research aims at establishing a model that would help explain the relationship between human behavior and senses, and developing a method for designing such a model and evaluating its functions. We are engaged in collaborative research with industry to perform evaluations of vehicle comfort. Moreover, we organize seminars about comfort.

Research Group on Industrial Mathematics

The aim of Research Group on Industrial Mathematics is to develop mathematical foundation of industrial science by exploring applicability of mathematical modeling to various research fields in Institute of Industrial Science (IIS). To promote use of mathematical methodology in the wide variety of research conducted in IIS, our group is continuously providing opportunities to develop collaborations between engineering fields and mathematical fields.



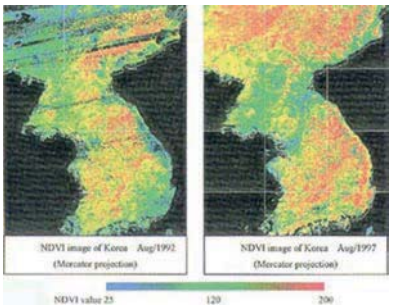
Research Group on Industrial Mathematics

Innovative Renovation Research Group

In many developed countries, the importance of maintenance and preservation of existing buildings and established infra-structures is becoming substantial.
The preservation of such structures usually requires highly balanced evaluation from various aspects, such as, 1. Function, 2. Safety, 3. Finance and 4. Culture.
The Innovative Renovation Research Group provides a unique platform, on which the IIS experts of various field of disciplines can gather, exchange and integrate their advanced skills and knowledge for the most integrated renovation program for any types of structures.

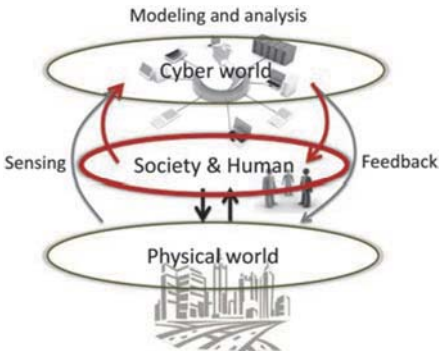
Earth Environmental Engineering Group

An inter-disciplinary group is associated for approaching to the global environmental issues based on information science, remote sensing, GIS, hydrology, and ecology.



Research Group on Socio-Global Informatics and Its Applications

A tight integration between the ICT infrastructure and various elements of the physical world is expected to play an essential role for providing effective solutions to many important problems in a wide range of application fields. This interdisciplinary research group focuses on the development and its applications of the emerging research field that we name as the socio-global informatics on the integration of the cyber and physical worlds based on deep understanding human activities at various levels ranging from each individual to a society.



Research Group on Integrated Urban Infrastructure Services

Popularization of smart phones and expansion of sensor networks embedded in social infrastructure system make it possible for us to acquire a very large real-time data on movement of people and vehicles, operation of facilities, situational information on disasters and environment. If we could make full use of the diverse information in an integrated manner, energy efficiency, safety and comfort of cities could be achieved at much higher level.
Group on Integrated Urban Infrastructure Services includes researchers with diverse backgrounds such as urban design, architecture, transportation, computer science, geospatial engineering, disaster risk management and environment. Target is to set a research agenda to make further acceleration of interdisciplinary research projects.

Common Facilities

Central Workshop

The Central Workshop is involved in the design and fabrication of machines and instruments for experimental programs and supplies many useful materials for research activities. It conducts metal, wood, and glass workshops; further, it operates like an open-use machine shop. In recent years, it has conducted various technical instruction and training programs and has always obtained a high evaluation from the university. The important equipment used by the Workshop include a wire electric discharge machine (WEDM), a machining center (MC) and a turning center.

Image Technology Room

Image Technology Room provides the resources necessary for research activities and postgraduate education. It also provides photographs and videos for research presentations. The content varies widely, and there are numerous unique processes that require advanced technologies. The processes include photography and image processing with commercial digital cameras and scanners, photo-printing with high-resolution photo printers, and filming and video editing with commercial video cameras. Further, it is introducing photo poster printers that enable the printing of photo-quality posters of size up to B0 on open-access printers.
In addition, we are involved in advertising activities such as the production of picture postcards and greeting cards that have photographs of the university campus and can help promote a friendlier atmosphere in the university.

Computer Center

The Computer Center provides computing and Internet Protocol (IP) network services for Institute of Industrial Science (IIS).
The computing resources consist of UNIX workstations, client personal computers (PCs), and various servers such as Mail, DNS, Storage, and Web hosting. A unified accounting system assists the operation of a user environment not only for user computing (Windows/Mac OS/Linux), but also for network resource access (Mail/Storage/WiFi/VPN).
The network consists of ten-gigabit Ethernet backbone router, gigabit Ethernet switches, unified wireless control systems, and various security devices. The equipment, which serve more than 6,500 components, are dynamically controlled by central maintenance system. Therefore, users can connect to the network not only from their labs, but also anywhere in IIS. Further, the completely redundant network topology and remote backup storage facility at Kashiwa campus provide the advantage of disaster tolerance.
Moreover, the Computer Center provides several application services such as electrical notice board, web mail, and VPN.

Cryogenic Service Room

The Cryogenic Service Room supplies cryogenic liquids (liquid helium and liquid nitrogen), dry nitrogen gas, and deionized water, which are indispensable ingredients for research activities on semiconductor technologies, material sciences, and biotechnologies at IIS. The Room runs a helium liquefier/recovery system, which was renewed in 2010 and can produce liquid helium at a rate of 70L/hr, and possesses two 13,000L liquid nitrogen storage tanks. Because security is important when handling cryogenic liquids, the Room offers tutorials to researchers and students. Further, the Room operates a large-capacity water purifier and supplies high quality deionized water throughout the institute.

Environmental Safety Center

This office was established in 2004 to set up and maintain a reliable and continuous safety and health management system based on the industrial safety and health law for all IIS members participating in research and educational activities. The main activities of the office are as follows: assigning operation chiefs for specific accident or hazard prevention control; providing health and safety education and training; conducting work environment measurements; providing healthcare through medical examinations; and performing and implementing point-by-point safety inspections and various safety and health measures to preserve a good research environment. These activities are performed in cooperation with the industrial physician, other sections of IIS, and other health and safety management offices on the Komaba Research Campus. In addition, the office has various equipment for safety checks, a waste-water monitoring system, and a safety depot for chemically hazardous wastes.

Library

IIS Library, located at the south end of Komaba Research Campus, collects academic journals and books on the overall field of IIS activities. The library material is open for the University members and visitors.
The library houses 1,600 titles of foreign journals, 1,100 titles of Japanese journals, 98,000 foreign books, and 59,000 Japanese books. Since 1986, we have maintained the online catalog, and have provided the library information via the University of Tokyo Library OPAC or CiNii Books provided by National Institute of Informatics. We have also provided document delivery service to IIS members through domestic and foreign interlibrary cooperation.

As for Research Management Office (RMO), check the 4th page. For Office for the Next Generation (ONG), check the 7th page.

Public Relations

Reports and News

Figures in parentheses are those as of December 31, 2012.

SEISAN-KENKYU (Bimonthly; total number: 689)

This is the journal of Institute of Industrial Science (IIS) and presents the latest research findings.

REPORT OF IIS, THE UNIVERSITY OF TOKYO (Irregularly; total number: 244)

This report contains all results of research.

ANNUAL REPORT OF IIS, THE UNIVERSITY OF TOKYO (Annually; total number: 60)

Reports the performance and the research activities of IIS within the academic year.

DIGESTS OF PROJECT RESEARCH ACTIVITIES, IIS, THE UNIVERSITY OF TOKYO (Irregularly; total number: 8)

Summarizes the results of research projects.

IIS, THE UNIVERSITY OF TOKYO (Annual guidebook, alternately published in Japanese and English)

CHIBA EXPERIMENT STATION

This guidebook provides a summary of the research activities of the Chiba Experiment Station.

SEIKEN LEAFLET (Irregularly; total number: 348)

Contains short individual reports on research results.

SEIKEN LEAFLET SOFTWARE BASE (Irregularly; total number: 159)

Contains an outline of software developed by staff at IIS and applications.

IIS NEWS (Bimonthly; total number: 139)

Presents news reports about personnel, awards, etc.

Education and Communication

Figures in parentheses are those as of December 31, 2012.

INTERNATIONAL SYMPOSIA (Irregularly; total number: 71)

Held to exchange ideas and to report progress in special fields covered by researchers of IIS and related fields.

OPEN HOUSE OF THE INSTITUTE (Annually; total number: 59)

Komaba Research Campus is open to the public once a year for two days around May 31 — foundation day — to present recent activities of the Institute. Chiba Experiment Station is also open every year.

SEMINARS (total number: 260)

The curriculum of the seminar includes experimental workshops to obtain timely feedback on the application of research to production activities.

BASIC COURSES (total number: 18)

The basic courses informs advanced engineers of the latest advances in the basic research activities of the IIS.

IIS CHRONICLE

Important research conducted by various societies and industries are discussed on the website.
(http://www.iis.u-tokyo.ac.jp/iis-chronicle/) (in Japanese)

VIDEO

A DVD “Towards a Prosperous Future” introduces IIS.

IIS Alumni Association

IIS Alumni Association was established in June 2004 to promote friendship among members and to support the research and educational activities of IIS. In 2007, we established Thai and Korean branch offices. Any person who has held a position at IIS can be a member of the Alumni Association; they include students, faculty members, researchers, technicians, administrative staff, and part-time staff. To become a member, an application is to be submitted to the Alumni Association office. Please access the website for details (http://www.iis.u-tokyo.ac.jp/alumni/index.html).

The above-mentioned educational and communicative activities are conducted with the cooperation of the Foundation for the Promotion of Industrial Science.
Coordinated by: Administration Office of IIS and the Foundation for the Promotion of Industrial Science

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- General Section of the Foundation for the Promotion of Industrial Science
  Phone and Fax : +81-3-5738-5224
  E-mail : fpis@interlink.or.jp

History

1877 Establishment of the University of Tokyo

1886 The Engineering College, the predecessor of the Faculty of Engineering, was absorbed by the main body of the University.

1942 The Second Faculty of Engineering was founded in Chiba to cope with urgent demand for skilled engineers. It operated until 1951.

1949 The Institute was established as a result of the reorganization of the Second Faculty of Engineering (May 31).

1954 Experimental blast furnace for iron production research started operation.

1955 A project on rockets for space research was started.

This activity, which was successfully carried out by the Institute of Space and Aeronautical Science of the University of Tokyo in 1965, contributed to the development of observation rockets in Japan.

1962 The main body of the Institute transferred from Chiba to Tokyo.

Since then, the Chiba campus, called the Chiba Experiment Station, has accommodated oversize experiments.

1965 The Earthquake Resistant Structure Research Center was formed.

1973 The Center for Development of Instrumentation Technology was established.

1975 The Composite Materials Research and Development Center was established.

1977 The Research Center for Multidimensional Image Processing was established.

1983 Facilities for observation and simulation of earthquake motion were completed in the Chiba Experiment Station.

1984 The Center for Function-oriented Electronics was established.

1985 The Research Center for the Development of Advanced Materials was established.

1990 The Information Fusion (RICOH) was established.

1991 The International Center for Disaster-mitigation Engineering (INCEDE), the Intelligent Mechatronics (TOSHIBA) and The Globe Engineering (TOYOTA) were established.

1994 The Center for Conceptual Processing of Multimedia Information was established.

1995 The Joint Laboratory for Integrated MicroMechatronic Systems (LIMMS) with the French National Research Organization, CNRS, was established.

The Research Center for Soft Material Engineering was established.

1997 The ground-breaking ceremony for the Komaba II Campus was held.

1998 The first phase of the transfer to the Komaba II Campus was accomplished.

1999 The Underwater Technology Research Center was established.

The 50th anniversary of the founding of IIS was observed.

2000 The Center for International Research on Micro Mechatronics was established.

Three Research Departments were set up as a new research structure.

The second phase of the transfer to the Komaba II campus was accomplished.

2001 The transfer to the Komaba II Campus was completed.

The International Center for Urban Safety Engineering (ICUS) and the Endowed Chair of Complex Precision Machining System were established.

2002 The Collaborative Research Center for Frontier Simulation Software, the Nanoelectronics Collaborative Research Center and Ebara-Donated Research Unit on Biomass Refinery were established.

2003 The Donated Chair for Advanced Display Technology and Center for Information Fusion were established.

2004 All National Universities were transformed into National University Corporations, and the University of Tokyo was incorporated.

Five Research Departments were established as a new research structure.

The International Research Center for Sustainable Materials was established.

2005 The Collaborative Research Center for Advanced Mobility (ITS Center) was established.

Construction of the General Research Experiment Building was completed.

2006 The Nikon Chair of Optical Engineering was established.

2007 The Endowed Chair of Color Science (Sony) was established.

2008 Center for Research on Innovative Simulation Software, Collaborative Research Center for Energy Engineering (CEE), Collaborative Research Center for Bio Nano Hybrid Process and Advanced Energy Conversion Engineering were established.

2009 Mobility and Field Science (TAKARA TOMY), Underwater Technology Research Center and Advanced Mobility Research Center (ITS Center) were established.

The 60th anniversary of the founding of IIS was observed.

2010 Collaborative Research Center for Innovative Mathematical Modelling, Energy Engineering for Low Carbon Society (TOKYO ELECTRIC POWER COMPANY), Center for International Research on Micronano Mechatronics (CIRMM), International Research Center for Sustainable Materials were established.

2011 The International Center for Urban Safety Engineering (ICUS) was established.

2012 Endowed Research Unit for Non-ferrous Metal Resource Recovery Engineering, Nikon Imaging Science, Academic-industry Partnership for Proactive & Holistic Energy Demand Management for Construction Sector, Mobility and Field Science, Social Cooperation Program, Center for Photonics Electronics Convergence were established.

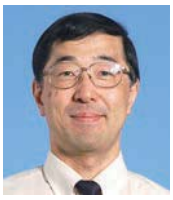
2013 Immunology Social Cooperation Program, Center for Research on Innovative Simulation Software, Center for Socio-Global Informatics, Collaborative Research Center for Manufacturing innovation (CMI) were established.

Faculty Members

As of May 1, 2013

Department of Fundamental Engineering

Professor
KONAGAI Kazuo
Earthquake Engineering



Professor
TANAKA Hajime
Physics of Complex Fluids

Professor
NAKANO Yoshiaki
Earthquake Engineering

Professor
FUKUTANI Katsuyuki
Surface and Interface Physics

Professor
SAKAI Keiji
Nano-Rheology Science

Professor
HAMBA Fujihiro
Fluid Physics

Associate Professor
HATANO Naomichi
Many-Body Physics

Associate Professor
WILDE Markus
Nanoscale Surface Physical Chemistry

Associate Professor
KIYOTA Takashi
Geo-disaster Mitigation Engineering

Department of Mechanical and Biofunctional Systems

Professor
OBIKAWA Toshiyuki
Fine Machining and Fabrication Systems

Professor
TOI Yutaka
Computational Solid Mechanics

Professor
YOKOI Hidetoshi
Polymer Processing

Professor
YANAGIMOTO Jun
Hyper Functional Forming

Professor
YAMANAKA Shunji
Design Engineering

Professor
OSHIMA Marie
Computational Fluid Dynamics

Professor
NIINO Toshiki
Additive Manufacturing Science

Professor
SHIRAKASHI Ryo
Phase Change Thermal Engineering

Visiting Professor
WU Kuanchan
Automotive Simulation Technology

Project Professor
KUROSAKI Akira
Ocean Space Utilization

Project Professor
HASHIMOTO Akira
Science of Manufacturing

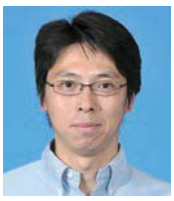
Associate Professor
SUZUKI Takahiro
Robotics

Associate Professor
OKABE Yoji
Smart Material Systems

Associate Professor
TSUCHIYA Kensuke
Applied Micro Manufacturing

Project Associate Professor
OKITSU Teru
Medical Engineering for Transplantation

Lecturer
KAJIHARA Yusuke
Manufacturing Science Fundamentals



Lecturer
HASEGAWA Yosuke
Interfacial Transport Engineering

Project Lecturer
SATO Koji
Cell Instrumentation Engineering

Department of Informatics and Electronics

Professor
SAKURAI Takayasu
Integrated Circuits and Systems Design

Professor
AIHARA Kazuyuki
Biological Information Systems

Professor
HIRAMOTO Toshiro
Integrated Device Engineering

Professor
SEZAKI Kaoru
Multimedia Communication Systems

Visiting Professor
TAKAHASHI Yoichiro
Nonlinear Mathematical Science

Visiting Professor
OGATA Yoshihiko
Statistical Seismology

Visiting Professor
HOTTA Masao
Highly Accurate Analog Integrated Circuits Engineering

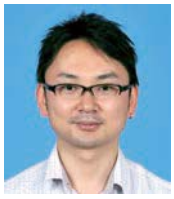
Visiting Professor
CHEN Luonan
Complex Biological Networks Theory

Associate Professor
NEMOTO Toshihiro
Earth Observation Data Engineering

Associate Professor
MATSUURA Kanta
Information Security

Associate Professor
TAKAMIYA Makoto
Versatile LSI Systems Design

Associate Professor
SUZUKI Hideyuki
Biomathematical Science



Associate Professor
KOBAYASHI Tetsuya J.
Quantitative Biology

Project Associate Professor
MAKINO Takaki
Mathematical Systems Theory of Communication

Project Associate Professor
HIRATA Yoshito
Nonlinear Time Series Analysis

Project Associate Professor
GODA Kazuo
System Software Engineering

Project Associate Professor
YOSHINAGA Naoki
Computational Linguistics

Project Associate Professor
KAJI Nobuhiro
Natural Language Processing Engineering

Project Associate Professor
ONO Shintaro
Spatiotemporal Mobility Informatics

Department of Materials and Environmental Science

Professor
OWARI Masanori
Micro and Nano Materials Analytical Chemistry

Professor
SAKODA Akiyoshi
Environmental and Chemical Engineering

Professor
HATANAKA Kenichi
Biomaterial Engineering

Professor
FUJIOKA Hiroshi
Optoelectronic Functional Thin Films

Professor
INOUE Hiroyuki
Amorphous Materials Design

Professor
MITSUDA Yoshitaka
Inorganic Plasma Synthesis

Professor
KUDO Kazuaki
Synthetic Organic Chemistry

Professor
SAKAI Yasuyuki
Organs and Biosystems Engineering

Professor
TSUMOTO Kohei
Protein Engineering

Professor
ISHII Kazuyuki
Functional Metal Complexes Chemistry

Associate Professor
OGURA Masaru
Environmental Catalyses and Materials Science

Associate Professor
HOUJOU Hirohiko
Molecular Integrated System Engineering

Associate Professor
MIZOGUCHI Teruyasu
Nano-Materials Design

Department of Human and Social Systems

Professor
SHIBASAKI Ryosuke
Geo-Information Engineering

Professor
KATO Shinsuke
Environmental Control Engineering

Professor
YASHIRO Tomonari
Management of Project

Professor
KOSEKI Junichi
Geotechnical Engineering

Professor
KAWAGUCHI Kenichi
Spatial Structure Engineering

Professor
MURAMATSU Shin
Urban Heritage/ Resource Development

Professor
KISHI Toshiharu
Concrete Engineering

Professor
OOKA Ryozo
Urban Energy Engineering

Professor
KOSHIHARA Mikio
Engineering and Design for Timber Structures

Visiting Professor
TOMIYAMA Tetsuo
Design and Sustainability Engineering

Visiting Professor
SHUKUYA Masanori
Low-Exergy System Science for Built Environment

Associate Professor
YOSHIMURA Kei
Isotope Meteorology

Associate Professor
TAKEUCHI Wataru
Remote Sensing for Environment and Disaster

Associate Professor
IMAI Kotaro
Architectural Space System

Associate Professor
OKI Kazuo
Global Monitoring for Ecology and Environment

Associate Professor
SEKIMOTO Yoshihide
Human Centered Urban Informatics

Project Associate Professor
MOURI Goro
Environmental Ecology, Hydrology and Modelling

Project Associate Professor
Ahn Tae-Ho
Innovative Construction Materials Engineering

Project Associate Professor
FERGUSON CRAIG
Satellite Remote Sensing of Land-atomosphere Interactions

Lecturer
OTA Hiroshi
Urban Regeneration

Lecturer
KAWAZOE Yoshiyuki
Design of Architecture

Project Lecturer
OGI Yoshiro
Humanospace-Safety Engineering

Project Lecturer
MURAKAMI Michio
Water and Environmental Engineering

Department of Management of Large Scale Complex System

Professor
KATO Shinsuke
Environmental Control Engineering

Guest Chair for Advanced Interdisciplinary Modeling

Visiting Professor
OHNO Takahisa
Computational Surface Science and Functional Design

Advanced Energy Conversion Engineering

Project Professor
KANEKO Shozo
Advanced Energy Conversion Engineering

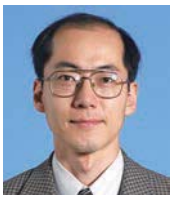
Non-ferrous Metal Resource Recovery Engineering

Project Professor
MAEDA Masafumi
Recycling and Processing of Critical Metals

Project Professor
OKABE Toru H.
Resource Recovery and Materials Process Engineering

Visiting Professor
NAKAMURA Takashi
Metal Resources Recycling System

Nikon Imaging Science



Project Professor
SHIMURA Tsutomu
Applied Nonlinear Optics

Project Professor
OOKI Hiroshi
Industrial Optics

Proactive & Holistic Energy Demand Management for Construction Sector

Project Professor
YASHIRO Tomonari
Management of Project

Project Professor
OOKA Ryozo
Urban Energy Engineering

Project Lecturer
MAGORI Bumpei
Energy Demand Management Engineering

Mobility and Field Science

Project Professor
SUDA Yoshihiro
Dynamic Systems and Control

Project Associate Professor
TAKIGUCHI Kiyoaki
Quasi-Electrostatic Science

Immunology

Project Professor
SAKAI Yasuyuki
Organs and Biosystems Engineering

Project Professor
TANIGUCHI Tadayasu
Molecular Immunology

Collaborative Research Center for Energy Engineering (CEE)

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SHIKAZONO Naoki
Thermal Energy Engineering

Vice Director, Project Professor
KANEKO Shozo
Advanced Energy Conversion Engineering

Professor
TSUTSUMI Atsushi
Energy Process Engineering

Visiting Professor
MARUYAMA Koki
Global Warming Scenario Analysis

Project Professor
OGIMOTO Kazuhiko
Energy System Integration

Project Professor
HORIE Hideaki
Energy Storage Engnieering

Associate Professor
IWAFUNE Yumiko
Sustainable Energy System

Project Associate Professor
MOCHIDZUKI Kazuhiro
Local Energy Chemical Engineering

Project Associate Professor
KANSHA Yasuki
Process System Engineering

Project Lecturer
HARA Shotaro
Computational Energy Materials Engineering

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ASADA Akira
Underwater Acoustic Systems Engineering

Professor
RHEEM Chang-Kyu
Ocean Environmental Engineering

Visiting Professor
KYO Masanori
Deep Ocean Engineering

Project Professor
TAKAGAWA Shinichi
Subsea Technology

Associate Professor
KITAZAWA Daisuke
Marine Ecosystem Engineering

Associate Professor
MAKI Toshihiro
Underwater Platform Systems

Project Associate Professor
THORNTON Blair
Ocean Perception Systems

Advanced Mobility Research Center (ITS Center)

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Dynamic Systems and Control

Professor
IKEUCHI Katsushi
Computer Vision

Professor
KUWAHARA Masao
Traffic Engineering

Professor
OOGUCHI Takashi
Traffic Management and Control

Visiting Professor
CHUNG Edward
Advanced Transport System

Visiting Professor
TANAKA Toshihisa
Industry-Academia Cooperation

Visiting Professor
FUJITA Akihiro
Science and Technology Policy

Visiting Professor
IWATA Satoshi
Industrial Policy

Associate Professor
SAKAMOTO Shinichi
Applied Acoustic Engineering

Associate Professor
NAKANO Kimihiko
Mechanical and Biological Systems Control

Associate Professor
OISHI Takeshi
Spatiotemporal Media Engineering

Associate Professor
YOSHIDA Hidenori
Transportation Policy

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Micro-Nano Electro Mechanical Systems

Professor
KAWAKATSU Hideki
Applied Scientific Instruments

Professor
FUJII Teruo
Applied Microfluidic Systems

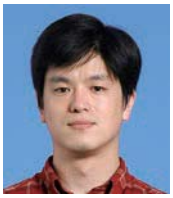
Professor
TAKAHASHI Takuji
Nano-electronics

Professor
TOSHIYOSHI Hiroshi
Micromachine System Engineering

Project Professor
BOSSEBOEUF Alain
Fundamental Micro and Nano Electromechanical Systems Engineering

Project Professor
COLLARD Dominique
Applied Microsystems

Associate Professor
KIM Beomjoon
Micro Components and Systems



Associate Professor
TAKEUCHI Shoji
Micromechanism

Associate Professor
KOHNO Takashi
Biomimetic Microsystems

Associate Professor
NOMURA Masahiro
Integrated Quantum Electronics

Associate Professor
TIXIER Agnes Mita
Integrated Micro Mechatronics

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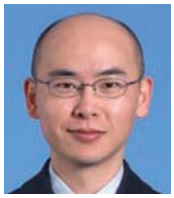
RONDELEZ Yannick
Bio Molecular Micro Engineering

Project Lecturer
MATSUNAGA Yukiko
Medical Biotechnology



Project Lecturer
NISHIDA Shuhei
Ocean Nanosensing

International Research Center for Sustainable Materials

Director, Professor
OKABE Toru H.
Resource Recovery and Materials Process Engineering

Vice Director, Professor
YOSHIE Naoko
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Professor
MAEDA Masafumi
Recycling and Processing of Critical Metals

Professor
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Professor
EDAGAWA Keiichi
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Visiting Professor
SAWADA Kenji
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Visiting Professor
NAKAMURA Takashi
Metal Resources Recycling System

Visiting Professor
OWADA Shuji
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Visiting Professor
YAMAGUCHI Katsunori
Extractive Metallurgy and Resource Recovery

Visiting Professor
SHIBAYAMA Atsushi
Mineral Process Engineering

Associate Professor
YOSHIKAWA Takeshi
High Temperature Sustainable Materials Processing

International Center for Urban Safety Engineering (ICUS)

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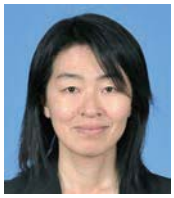
Urban Earthquake Disaster Mitigation Engineering

Professor
OKI Taikan
Global Hydrological System

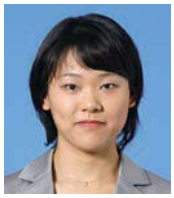
Visiting Professor
YOKOTA Hiroshi
Life Cycle Management of Urban Infrastructure

Project Professor
SAWADA Haruo
Applied Remote Sensing



Associate Professor
KUWANO Reiko
Geotechnical and Geoenvironmental Engineering

Associate Professor
KATO Takaaki
Planning and Engineering for Social Safety System



Associate Professor
OHARA Miho
Integrated Disaster Management Engineering

Associate Professor
NAGAI Kohei
Infrastructure Management for Developed Society

Project Associate Professor
KAWASAKI Akiyuki
Watershed Environmental Change Adaptation Planning

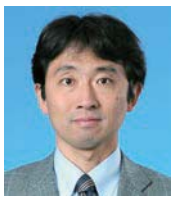
Center for Photonics Electronics Convergence (CPEC)

Director, Professor
ARAKAWA Yasuhiko
Quantum Nanodevices

Vice Director, Professor
SHIMURA Tsutomu
Applied Nonlinear Optics

Professor
HIRAKAWA Kazuhiko
Quantum Semiconductor Electronics

Professor
TATSUMA Tetsu
Advanced Electrochemical Devices



Associate Professor
MACHIDA Tomoki
Quantum Semiconductor Spintronics

Associate Professor
IWAMOTO Satoshi
Nanooptoelectronics

Center for Socio-Global Informatics

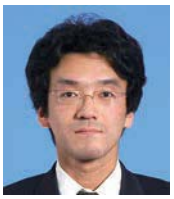
Director, Professor
SATO Yoichi
Visual Media Engineering

Professor
KITSUREGAWA Masaru
Database Engineering

Visiting Professor
ODAKA Toshihiko
Computer Engineering

Visiting Professor
ADACHI Jun
Information Retrieval

Associate Professor
KAMIJO Shunsuke
Applied Multimedia Information Processing



Associate Professor
TOYODA Masashi
Web Engineering

Project Associate Professor
NAKANO Miyuki
Data Architecture Engineering

Center for Research on Innovative Simulation Software (CISS)

Director, Professor
KATO Chisachi
Fluid Flow and Thermal Systems Control

Professor
KATO Shinsuke
Environmental Control Engineering

Professor
YOSHIKAWA Nobuhiro
Multi-scale Solid Mechanics

Professor
SATO Fumitoshi
Computational Biomolecular Science

Professor
OSHIMA Marie
Computational Fluid Dynamics

Project Professor
HATADA Toshio
Knowledge-based Engineering

Associate Professor
UMENO Yoshitaka
Nanostructured Materials Strength and Science

Nanoelectronics Collaborative Research Center

Director, Professor
ARAKAWA Yasuhiko
Quantum Nanodevices

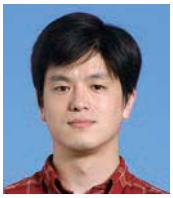
Professor
HIRAKAWA Kazuhiko
Quantum Semiconductor Electronics

Professor
HIRAMOTO Toshiro
Integrated Device Engineering

Professor
TAKAHASHI Takuji
Nano-electronics

Associate Professor
IWAMOTO Satoshi
Nanooptoelectronics

Collaborative Research Center for Bio Nano Hybrid Process



Director, Associate Professor
TAKEUCHI Shoji
Micromechanism

Professor
FUJITA Hiroyuki
Micro-Nano Electro Mechanical Systems

Professor
FUJII Teruo
Applied Microfluidic Systems

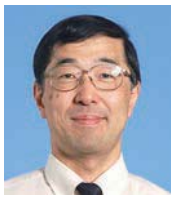
Professor
SAKAI Yasuyuki
Organs and Biosystems Engineering

Project Associate Professor
OKITSU Teru
Medical Engineering for Transplantation

Project Lecturer
MATSUNAGA Yukiko
Medical Biotechnology

Collaborative Research Center for Innovative Mathematical Modelling

Director, Professor
AIHARA Kazuyuki
Biological Information Systems



Professor
TANAKA Hajime
Physics of Complex Fluids

Professor
YOSHIKAWA Nobuhiro
Multi-scale Solid Mechanics

Visiting Professor
TAKAHASHI Yoichiro
Nonlinear Mathematical Science

Visiting Professor
OGATA Yoshihiko
Statistical Seismology

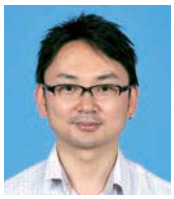
Visiting Professor
CHEN Luonan
Complex Biological Networks Theory

Associate Professor
HATANO Naomichi
Many-Body Physics

Associate Professor
SAKAMOTO Shinichi
Applied Acoustic Engineering

Associate Professor
KOHNO Takashi
Biomimetic Microsystems

Associate Professor
SUZUKI Hideyuki
Biomathematical Sciences



Associate Professor
KOBAYASHI Tetsuya J.
Quantitative Biology

Project Associate Professor
MAKINO Takaki
Mathematical Systems Theory of Communication

Project Associate Professor
HIRATA Yoshito
Nonlinear Time Series Analysis

Collaborative Research Center for Manufacturing Innovation (CMI)

Director, Professor
OBIKAWA Toshiyuki
Fine Machining and Fabrication Systems

Professor
YANAGIMOTO Jun
Hyper Functional Forming

Professor
OKABE Toru H.
Resource Recovery and Materials Process Engineering

Project Professor
HASHIMOTO Akira
Science of Manufacturing

Associate Professor
OKABE Yoji
Smart Material Systems

Associate Professor
TSUCHIYA Kensuke
Applied Micro Manufacturing

International Collaborative Research Center LIMMS/CNRS-IIS (UMI 2820)

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Applied Microfluidic Systems

Co-director, Project Professor
COLLARD Dominique
Applied Microsystem Engineering

Professor
ARAKAWA Yasuhiko
Quantum Nanodevices

Professor
FUJITA Hiroyuki
Micro-Nano Electro Mechanical Systems

Professor
HIRAKAWA Kazuhiko
Quantum Semiconductor Electronics

Professor
KAWAKATSU Hideki
Applied Scientific Instruments

Professor
SAKAI Yasuyuki
Organs and Biosystems Engineering

Professor
TOSHIYOSHI Hiroshi
Micromachine System Engineering

Associate Professor
KIM Beomjoon
Micro Components and Systems

Associate Professor
KOHNO Takashi
Biomimetic Microsystems

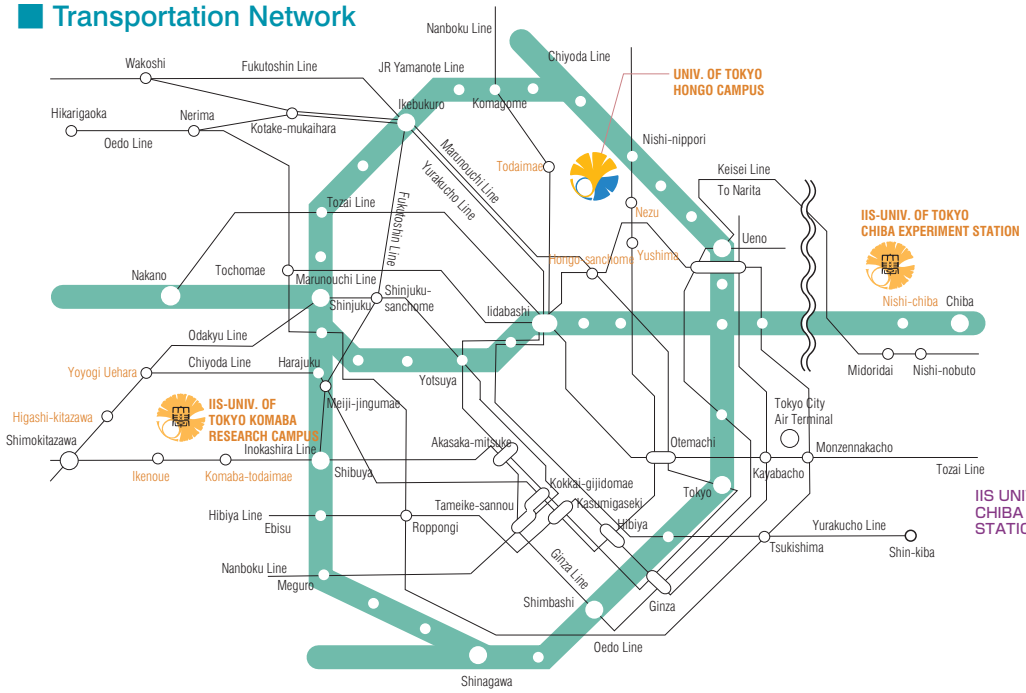
Associate Professor
NOMURA Masahiro
Integrated Quantum Electronics

Associate Professor
TAKEUCHI Shoji
Micromechanism

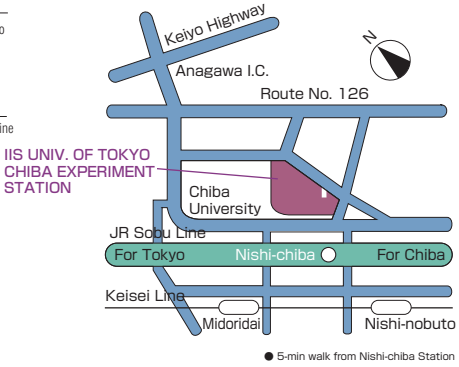
Associate Professor
TIXIER Agnes Mita
Integrated Micro Engineering

IIS Campus Map

Transportation Network



Chiba Experiment Station, Institute of Industrial Science, the University of Tokyo

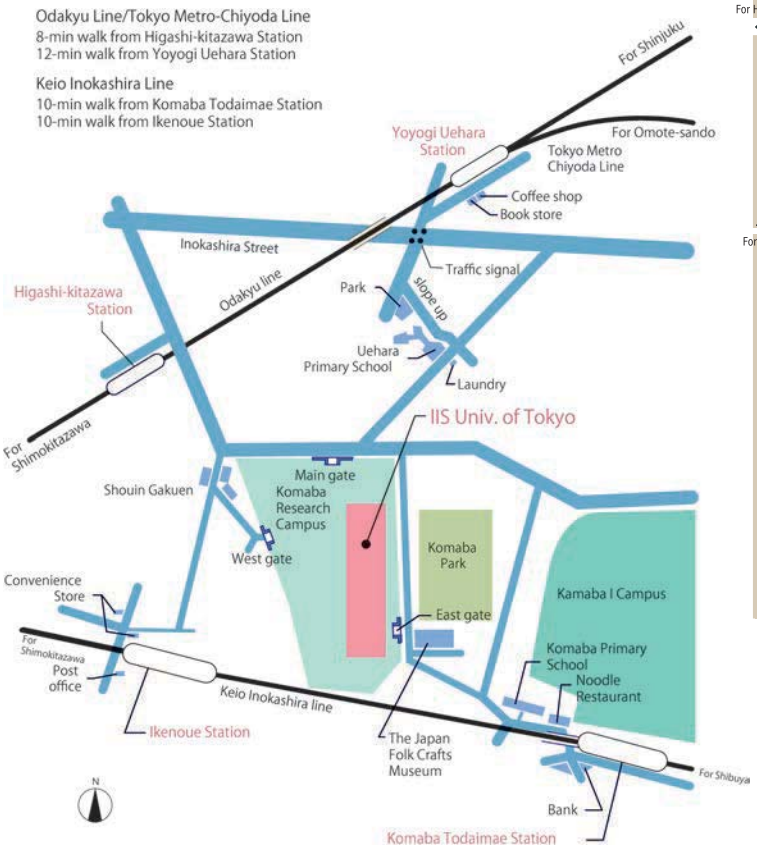


● 5-min walk from Nishi-chiba Station

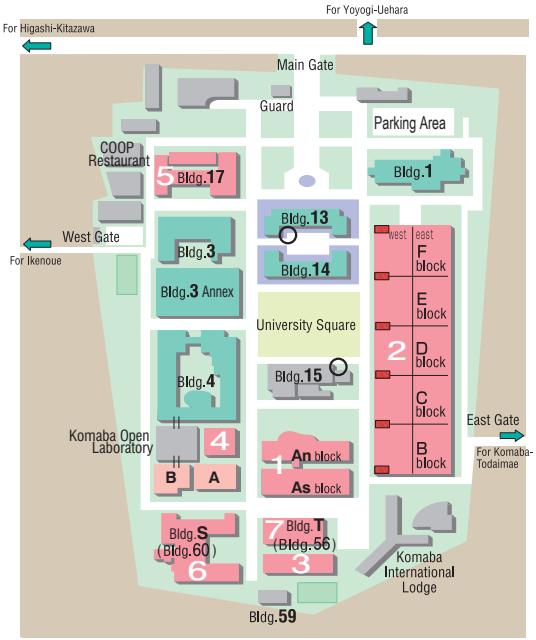
Access to IIS Campus

Odakyu Line/Tokyo Metro-Chiyoda Line
8-min walk from Higashi-kitazawa Station
12-min walk from Yoyogi Uehara Station

Keio Inokashira Line
10-min walk from Komaba Todaimae Station
10-min walk from Ikenoue Station



Map of IIS Campus



Institute of Industrial Science

1. General Research Experiment Bldg. (Convention hall)
2. Research Bldg.
3. Library
4. Restaurant & Meeting Room
5. Central Work Shop
6. Building S
7. Building T

○ Smoking Areas

Research Center for Advanced Science and Technology

Collaborative Research Bldg. (CCR Bldg.)

- Please enter through the main gate when arriving by automobile or motorcycle.
- The main gate is open from 7:30 a.m. - 9:30 p.m.
  The east gate and the west gate are open from 8:00 a.m. - 8:00 p.m. (weekdays).
  Please use your IIS card when the gates are closed.

- The entrance of the General Research Experiment Building (An Block) is located at the north side. Entrances of the Research Building (B - F Block) are located along the west side. 2F in An Block is connected to 3F in As Block.
- All entrances are open from 8:00 a.m. - 8:00 p.m. (weekdays). When the entrances are locked, please contact IIS to arrange access.
- Except for special cases (emergency, business transportation, etc.), no automobiles or motorcycles are allowed on this campus. Please park in the parking area to the east of the main gate. Please park bicycles in the designated areas.
- The elevators and the stairs leading to the laboratory are located only on the west side of each building (B - F Block).

Institute of Industrial Science
The University of Tokyo
(Tokyo Daigaku, Seisan-gijutsu Kenkyusho: SEIKEN)

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http://www.iis.u-tokyo.ac.jp/