ISEE Kyushu University

2011 Graduate School / Faculty of Information Science and Electrical Engineering

KYUSHU
UNIVERSITY

Toward an Advanced Information Society Using "*i & e*" Technologies

Dr. Rin-ichiro Taniguchi
Dean and Professor
Graduate School and Faculty of Information Science and Electrical Engineering

Since the beginning of the 1990s, there has been a great demand for highly educated graduates who are capable of leading an advanced information society in the 21st century. This society is firmly based on the new technologies developed in the fields of electrical and electronic engineering, communication engineering, and computer science. To meet this demand, the Graduate School of Information Science and Electrical Engineering (ISEE), the first graduate school in Japan designed to enable a comprehensive study of both information and electrical–electronics (*i & e*) technologies, was established in 1996 at Kyushu University. In 2000, the school was restructured and a new two-body system was created with Graduate School (the education body) and Faculty (the research body). The new system has provided innovative and unique graduate programs including the Graduate School of Systems Life Sciences and the Graduate School of Integrated Frontier Sciences, in which many of our faculty members are also involved.

At the Center of Excellence (COE), within the ISEE, our faculty members lead many important research and educational activities at Kyushu University, as well as the graduate and undergraduate programs. For example, at the System LSI Research Center, the faculty are the core members of the "Fukuoka Cluster for Advanced System LSI Technology Development: Knowledge Cluster Initiative (The Second Stage)." In addition, the following noteworthy programs are also led at the ISEE: RISS—Research Institute of Superconductor Science and Systems; QITO—the educational program for Information Communication Technology Architect; and E-JUST Center—Center for Japan–Egypt Cooperation in Science and Technology.

In 2006 the Faculty and Graduate School of ISEE moved to a new campus, the "Ito Campus," and this has enabled us to engage in various creative activities to further expand our collaboration within "*i & e*" technologies. A key aim of the ISEE is to cultivate the next generation of researchers and engineers in the field of "*i & e*", that is, those who possess a superior research ability, a broad range of expertise, and international common sense.

May 2011

The Aims of the Graduate School of Information Science and Electrical Engineering

Information science has become an important academic discipline as the fundamentals to provide basic methodology of science, which is comparable to mathematics and physics. The progress of information science, especially the increased applicability of Information and Communications Technology (ICT), has not only raised the productivity of the whole industrial field but also brought about great changes to our economy, society and culture. Meanwhile the discipline of electrical engineering has a long history and embraces a wide variety of industrial fields. It has produced highly functional, complicated and large-scale electrical and electronic systems, which provide the important basis of any kinds of information and social systems. Therefore, it is expected that the electrical and electronic engineering will develop in close cooperation with information science. In order to meet this expectation, the Graduate School of Information Science and Electrical Engineering cultivates researchers and engineers of the next generation in the field of information and electricity-electronics (*i & e*), who have advanced research ability and a broad range of expertise.

The Structure of the Graduate School of Information Science and Electrical Engineering

Graduate School of Information Science and Electrical Engineering (ISEE) consists of the following three departments to achieve the goal mentioned above.

- **The Department of Informatics** studies Information Science from the viewpoints of the theoretical foundations of sciences and tools for sciences, which provide us a deeper understanding of "information."
- **The Department of Advanced Information Technology** aims to realize sophisticated systems to support variety of human social activities by combining computer engineering, communication technology and real-world information processing. To provide effective education of the expertise of this field, we have two different educational courses under this department: Social information systems engineering course and Intelligent information systems engineering course.
- **The Department of Electrical and Electronic Engineering** aims to construct the bases of the industrial and social systems in the advanced information society by combining electrical, electronic and communication engineering. There are two educational courses under this department: Electrical engineering course and Information electronics course.

These three departments cooperate with one another to conduct comprehensive education ranging from the fundamentals to the applications of our new academic discipline, Information Science and Electrical Engineering.

Educational Features of the ISEE

Educational Features of the Graduate School of Information Science and Electrical Engineering

Cutting-edge and Comprehensive Studies of the 21st Century, and Cultivation of Human Resources to Cope with Social Demands

Recently, Information Technology (IT) typified by world-wide computer networks and highly integrated nanometer-scale technologies has been developed rapidly and has attracted considerable attention. The Graduate School of Information Science and Electrical Engineering (ISEE) consolidates the foundations of information science in a new era, leading the information society of the 21st century in various aspects of the industrial world, community, culture and economy. It also cultivates researchers and engineers who will take major roles in electrical, electronics and communication fields, the most important industrial foundation in the world.

The ISEE covers an extremely large field of disciplines and consists of faculty members with comprehensively specialized fields. Students can attend lectures and seminars in multiple departments to acquire profound knowledge. By attending various classes from science, engineering to human science courses, students can acquire a wide range of knowledge from the fundamentals of science to practical studies, the application of engineering and the knowledge of human science.

Thereby, those who graduate from this Graduate School will have a large variety of career options, for instance in electrical, electronics, information, communication and software engineering industries as well as in automobile, heavy machinery, precision machinery, steel, chemical, transportation and media industries. There are high expectations on them from the industrial world and they can receive individual guidance from their respective department heads when they want to obtain jobs.

Shortened Term of Study

The average term of study in the master's program is two years and three years in the doctoral program. Though, the term of students who have achieved satisfactory research results can be shortened.

Skipping-Grade System

High-achieving third-grade undergraduates can skip the fourth year and proceed to the master's program. Making the best use of this system and the above-mentioned Shortened Term of Study system, students can obtain a doctor's degree at the age of twenty-five at the earliest.

Acquisition of Degrees in Extensive Disciplines

As this graduate school covers a wide range of disciplines, students can obtain a degree in engineering, science, or philosophy according to their research field.

Special Selection for Students from Other Universities and Colleges of Technology (KOSEN)

A special selection system for admissions of excellent students from other universities and colleges of technology (KOSEN) has been instituted, where an oral examination is given to the applicants. In the entrance examination for the academic year 2012, the Department of Informatics and the Department of Electric and Electronics Engineering adopt this special selection, which is made in the end of June or the beginning of July.

Special Selection and Re-Education of Working People

A special selection system for admissions of working people has been instituted, which enables them to be enrolled in the doctoral program in April and October. The selection is made in February and August every year. Using this system, working people can obtain credits of the doctoral program and the doctor's degree by attending the graduate courses and studying with a distance education system which involves the use of the internet.

Selection of International Students Aiming to Cultivate International Human Resources

Students from abroad are willingly accepted to cultivate international human resources. The ISEE has a separate quota for international students and a selection system for admissions of them to the master's program other than the ordinary selection examination. Regarding the doctoral program, selection is made for those who wish to be enrolled in April and October.

International Exchanges and Short-Term Travel Overseas

International exchanges are actively promoted through cooperative research with foreign universities and research organizations, as well as hosting international symposiums. Also, our graduate students are encouraged to present research papers at international conferences. There are research grants available that provide travelling expenses to the graduate students attending and presenting at international conferences.

History of Graduate School of Information Science and Electrical Engineering

(ISEE main building on the Hakozaki Campus in 1996-2006)

Graduate School of Information Science and Electrical Engineering (ISEE) was established in May, 1996 to form a new type of organization for research and education aiming to go beyond the existing organizational structure. It was an independent Graduate School consisting of five departments: the Department of Informatics, the Department of Intelligent Systems, the Department of Computer Science and Communication Engineering, the Department of Electrical and Electronic Systems Engineering, and the Department of Electronics. The faculty members were from the departments of Electrical Engineering, Electronics Engineering, and Computer Science and Communication Engineering in Faculty of Engineering, Department of Information Systems in Graduate School of Engineering Sciences, Research Institute of Fundamental Information Science attached to Faculty of Science, the Department of Physics in Faculty of Science as well as Faculty of Literature and Faculty of Education, who were reshuffled and assigned to the above-mentioned five departments. In addition, professors from the University Computer Center, Educational Center for Information Processing, and Research Institute for Superconductivity also joined to support them. This reorganization was in the vanguard of the 'Graduate School Priority Program', which followed the outline of the plan for reorganizing Kyushu University. The ISEE was reorganized in April, 2000 into a dual structure consisting of Graduate School and Graduate Faculty. Then, Research Institute of Superconductor Science and Systems (RISS), which used to be attached to the Faculty of Engineering was attached to the Graduate Faculty. In April, 2009, the ISEE was reorganized again to reflect the recent research issues in the information and the electricity-electronics fields and to adapt to the recent educational needs from the industry and the society. Thereby, presently the Graduate School consists of three departments and the Graduate Faculty consists of four departments. The quota of students is 140 for the master's program and 45 for the doctoral program. Most of the faculty members in this Graduate School serve concurrently as professors of the Department of Electrical Engineering and Computer Science and the others serve as professors of the Informatics Course in the Department of Physics, teaching undergraduates.

Graduate School/
Graduate Faculty System

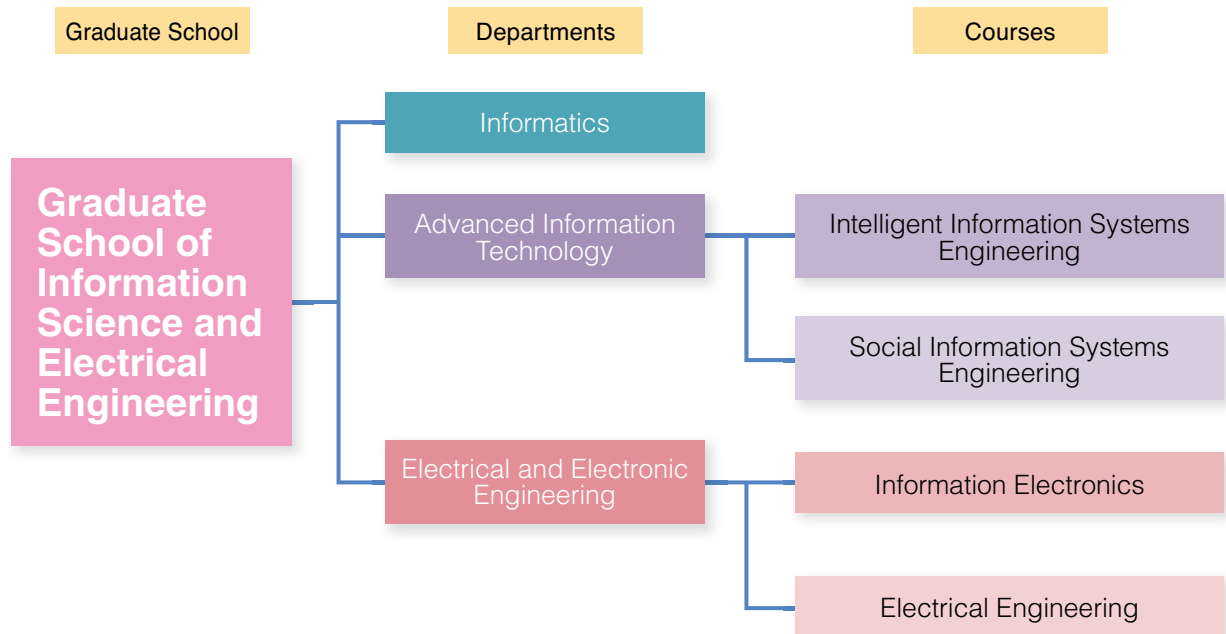## The New Graduate School/Graduate Faculty System

Kyushu University is the first of all Graduate Schools in Japan to adopt this new system in 2000 following the revision of the School Education Law. In splitting the former Graduate School into the Graduate School (the education body) and Graduate Faculty (the research body to which faculty members belong), this reorganization seeks to re-vitalize relationships between the Graduate Faculty and the Graduate School as well as the Graduate Faculty and the Undergraduate School, and in this way contribute to more dynamic and flexible functioning of the Graduate Faculty in its relation to the Graduate School and the Undergraduate School.

Along with the general shift to the Graduate School/Graduate Faculty System, all faculty members under the new structure have been transferred from the Undergraduate Faculty to the Graduate Faculty. In addition, the educational body (Graduate School) and the research body (Graduate Faculty) are technically separated. In doing so, we have created a more flexible administrative mechanism, enabling Graduate Faculty members to participate more easily, in various ways, in the education of both the Undergraduate and Graduate School bodies. In this way, we are able to promote more dynamic relationship between the education bodies (Undergraduate and Graduate Schools) and the research body (Graduate Faculty), and thereby accommodate changes and shifts of pedagogic and research focus as these may occur in the future.

At present, departments in the Graduate School correspond to departments in the Graduate Faculty except for the Department of Electrical and Electronic Engineering. The advantage of separating research from education is to make the Graduate School system more flexible. For example, this flexibility has enabled 'System LSI Research Center' to be established in 2001. It is a new-type of all-university research institute attended by faculty members from this Graduate Faculty as well as the Graduate Faculty of Engineering, the Graduate Faculty of Economics, and the Graduate Faculty of Agriculture. All of these faculty members also hold a post in teaching. Another example is the foundation of new graduate schools, i.e. Graduate School of Systems Life Sciences and Graduate School of Integrated Frontier Sciences. The former consists of four divisions of Bioinformatics, Life Engineering, Medical Molecular Cell Biology, and Molecular Life Sciences and the latter consists of three departments of Kansei Science, Automotive Science, and Library Science. A part of the faculty members of our Graduate Faculty are in charge of education in these new Graduate Schools. Activities of these newly established institutes have attracted attention nationwide.

Organization Structure of Graduate School of Information Science and Electrical Engineering

Departments and Their Quota of Students

Graduate School	Departments	Courses

Graduate School of Information Science and Electrical Engineering

- Informatics
- Advanced Information Technology
  - Intelligent Information Systems Engineering
  - Social Information Systems Engineering
- Electrical and Electronic Engineering
  - Information Electronics
  - Electrical Engineering

〈**Collaborating Graduate Schools**〉

Graduate School of Systems Life Sciences

Graduate School of Integrated Frontier Sciences
- Department of Kansei Science
- Department of Automotive Science
- Department of Library Science

Quota of Students

Departments	Doctoral Course	Master Course
Department of Informatics	14	40
Department of Advanced Information Technology 　(Intelligent Information Systems Engineering Course) 　(Social Information Systems Engineering Course)	15	45 (25) (20)
Department of Electrical and Electronic Engineering 　(Information Electronics Course) 　(Electrical Engineering Course)	16	55 (27) (28)
Total	45	140

Contents of the Graduate School of Information Science and Electrical Engineering

Department of Informatics

- Mathematical Informatics
- Intelligence Science
- Computational Science

● Theoretical Foundation of Information Society
● Practical Aspects of Infrastructure of Information Society
● Foundation of "*i & e*" Industries
   Electrical industry
   Electronics industry
   Information industry
   Telecommunication business
   Information service industry
   Power industry

Department of Advanced Information Technology

Intelligent Information Systems Engineering Course

- Real World Robotics
- Advanced Information and Communication Technology
- Advanced Distributed Processing Systems
- Advanced Software Engineering
- Embedded Software and Systems

Social Information Systems Engineering Course

Department of Electrical and Electronic Engineering

Information Electronics Course

- Electronic Devices
- Integrated Electronics

Electrical Engineering Course

- Measurement and Control Engineering
- Applied Energy Engineering
- Superconductive Systems Engineering

Department of Informatics

Department of Informatics

"Information" is the origin of human intellect and sensibilities, and plays a central role in natural and artificial systems. Informatics is the study of "information", from the viewpoint of the foundations of sciences. Through systematic education and research in this new fundamental science and by supporting not only science and engineering but humanities from the viewpoint of informatics, the Department of Informatics aims to nurture researchers and engineers who have advanced expertise and are capable of contributing to the information society.

To achieve this goal, the department comprises three divisions : the Division of Mathematical Informatics, the Division of Intelligence Science, and the Division of Computational Science. The Division of Mathematical Informatics studies, in the field of Informatics, especially the construction and analysis of mathematical models related to information. The Division of Intelligence Science studies cognitive science, as well as fundamental theories in information theory and their applications to intelligent systems, with an aim to explore the principles of human intellectual information processing. The Division of Computational Science (operating in cooperation with the Research Institute for Information Technology at Kyushu University) studies foundations of computational science that span the field of simulation.

Informatics is an emerging synthetic science regarding information, that encompasses traditional information science as well as humanities with foundations in information science. With these divisions, the department aims to explore new methodologies and perspectives in informatics, and establish the basis for the creative development of informatics.

Mathematical Informatics

The Division of Mathematical Informatics studies, in the field of informatics, especially the construction and analysis of mathematical models related to information. By capturing various phenomena in the field of science and technology from the viewpoint of informatics, and by constructing and analyzing information models, making full use of mathematical methods, the division aims to promote the application of information systems to the field of science and technology, and to educate students so that they may contribute to the development of the field of science and technology.

More specifically, while emphasizing educational foundations such as algebra, geometry, and probability, the division also provides education on chaos theory, information theory, computational theory, algorithms, numerical analysis, cryptography, and distributed systems, which are essential for the construction and analysis of mathematical informatics models. This allows for the fostering of abilities that actively working engineers and researchers must possess, that is, the ability to find, formulate (model), and solve problems.

Intelligence Science

The Division of Intelligence Science scientifically pursues human intellect and behavior, and at the same time aims to establish fundamental technologies of information science for assisting intellectual activities of human beings, as well as plan their application and development.

More specifically, the division aims to construct a human friendly environment from a cognitive science viewpoint, through education and research on the elucidation and application of the characteristics of human sensation, cognition, and behavior. Also, the division aims to provide information scientific assistance for human intellectual activities through education and research of: data/web/text mining, information visualization, automated recognition technologies, on-line decision making, machine learning, complexity of knowledge representations, editing, generating, and searching of multimedia contents, with bases in basic theories of machine discovery and theory of computation.

Computational Science

The Division of Computational Science aims to establish fundamental technologies in modeling, parallel algorithms, and high precision computation, as foundations of computational science that spans various fields of computer simulation.

More specifically, the division will focus on education and research on high performance computing, covering topics such as methods and algorithms for projecting and abstracting Multi-Scale Multi-Physics phenomena into mathematical models, massive parallelization of applications, and the quality and precision assurance of numerical computations. The main area of application and development will be in the field of molecular science and high precision eigenvalue analysis.

The Structure of the Department of Informatics

Divisions	Faculty Members
Mathematical Informatics	**Professor** Seiji Fujino, Kouichi Sakurai, Masayuki Takeda, Jun'ichi Takeuchi, Masafumi Yamashita **Associate Professor** Hideo Bannai, Yoshiaki Hori, Shunsuke Inenaga, Yutaka Jitsumatsu, Shuji Kijima, Takayoshi Shoudai, Norikazu Takahashi **Assistant Professor** Kohei Hatano, Masanori Kawakita, Takashi Nishide, Yukiko Yamauchi
Intelligence Science	**Professor** Ryuzo Hasegawa, Keiji Iramina*, Shuji Mori, Kazunori Shidoji, Einoshin Suzuki, Eiji Takimoto, Yoichi Tomiura, Makoto Yokoo **Associate Professor** Hiroshi Fujita, Daisuke Ikeda, Yoshihiro Okada, Yuko Sakurai **Assistant Professor** Nobuyuki Hirose, Atsushi Iwasaki, Yoshinori Katayama, Miyuki Koshimura, Shigeru Takano
Computational Science	**Professor** Mutsumi Aoyagi

* Professor Iramina takes charge of education in the Graduate School of Systems Life Sciences.

Department of Informatics

Supercomputing Laboratory

We are highly concerned with the preconditioning and iterative solvers for solving efficiently linear systems on a variety of supercomputers.

Prof. Seiji Fujino

Circuits and Communication Networks Laboratory

This group is studying several fundamental problems related to modern digital communication systems, based on nonlinear theory, probability theory, information theory, and communication theory. The main research interests of this group include random number generation from nonlinear dynamics and its applications to digital communications, such as spread spectrum communications, secure image transmission, and cryptography. The following subjects are currently studied: 1) design of chaotic maps with guarantees to generate independent and identically distributed random sequences; 2) analysis of block ciphers from the information theoretical point of view; 3) analysis and synthesis of robust analog-to-digital (A/D) converters from the viewpoint of chaotic dynamic systems; 4) design of chip waveform and its associated pseudorandom codes for CDMA communication including multicarrier systems; 5) multiuser detection (MUD) receivers and their relation to spin-glass theory and random matrix theory.

Assoc. Prof. Yutaka Jitsumatsu

Information Technology and Multimedia Security Laboratory

Security and privacy of electronic commerce are significant subjects by the spread of the Internet. Our main subject of research is to solve problems of the security and the privacy by using cryptography technology. Cryptography technology is not able to solve all the problems. Thus one of our themes is to make the limitation of cryptography technology clear. Besides, we study the solution of the problems. In current computer networks, reliability and security are significant subjects. Especially, countermeasures against threats on wired and wireless computer networks are required. Therefore our main research subject also includes reliability and security for computer networks.

Prof. Kouichi Sakurai, Assoc. Prof. Yoshiaki Hori, Assist. Prof. Takashi Nishide

String Data Processing Laboratory

Our laboratory studies the following topics: string algorithms, machine learning, machine discovery, and bioinformatics.

Prof. Masayuki Takeda, Assoc. Prof. Hideo Bannai, Assoc. Prof. Shunsuke Inenaga, Assist. Prof. Kohei Hatano
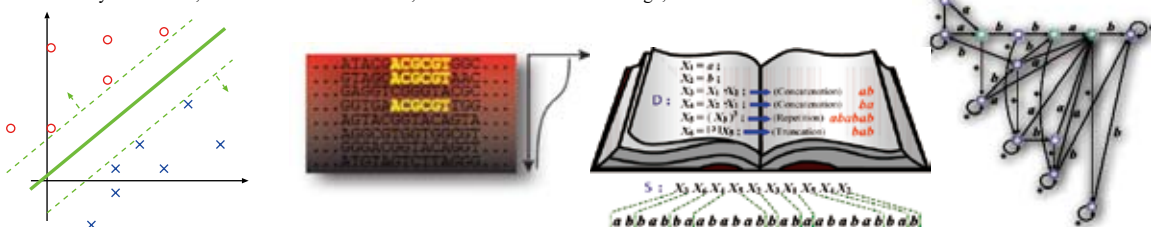
Learning Theory and Nonlinear Systems Laboratory

We are studying the mathematical engineering, mainly on learning theory and nonlinear systems theory. The purpose of learning theory is to establish foundations for knowledge acquisition technology. In particular, our concern is on stochastic complexity, model selection, information geometry, ensemble learning (e.g. boosting), kernel method (e.g. support vector machine), time series analysis, and their application to network security, pattern recognition, image processing, etc. The purpose of nonlinear systems theory is to understand various nonlinear models arising in engineering and computer science. We are currently working on recurrent neural networks, large-scale optimization techniques, complex networks, and their application to signal processing, pattern recognition, etc.

Prof. Jun'ichi Takeuchi, Assoc. Prof. Norikazu Takahashi, Assist. Prof. Masanori Kawakita
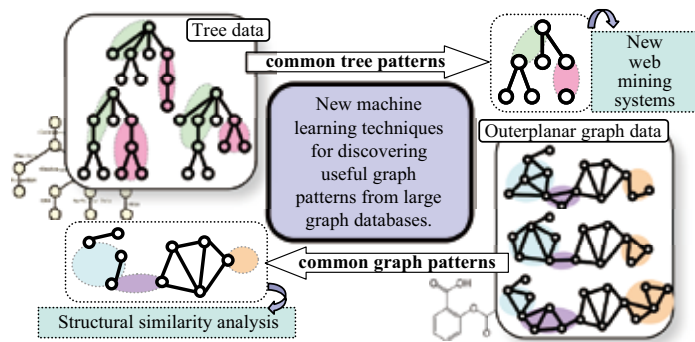
Algorithm Science Laboratory

This research group is dedicated to foundations of computer science. Modern society produces many computational problems to be solved under a variety of constraints on resources (e.g., time, space, communication, and so on) using a variety of computer environments, and hence correct and efficient algorithms for them a re always looked for. Our main research theme is to establish the amount of resource necessary and sufficient to solve a given problem under a given constraint using a given computer environment. Main research keywords include approximation / heuristic / randomized / online/ distributed / parallel / quantum algorithms, combinatorial optimization, graph theory, computational complexity, probabilistic methods, and data structures.

Prof. Masafumi Yamashita, Assoc. Prof. Shuji Kijima, Assist. Prof. Yukiko Yamauchi

Algorithmic Graph Theory Laboratory

Graphs provide a general way to model a variety of relations among data. Our research interests include: graph theory, graph and network algorithms, graph pattern mining, graph grammars, and learning of graph languages.
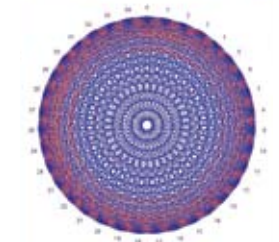
Assoc. Prof. Takayoshi Shoudai

Tree data

common tree patterns

New web mining systems

New machine learning techniques for discovering useful graph patterns from large graph databases.

Outerplanar graph data

common graph patterns

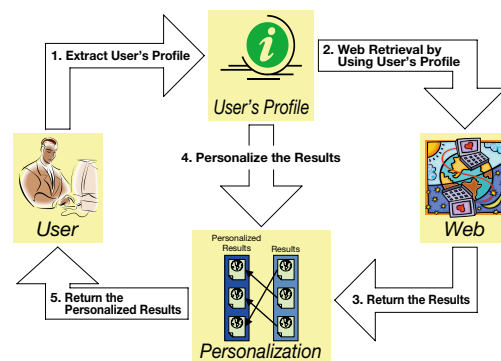Structural similarity analysis

Automated Reasoning and Intelligent Systems Laboratory

Our laboratory is conducting research on automated reasoning and intelligent systems. Currently, we are focusing on developing high performance reasoning systems including SAT solvers, aiming at solving hard problems such as those on Ramsey number and on job shop scheduling. We are also developing user-friendly Web retrieval systems based on machine learning and inductive logic programming.

Prof. Ryuzo Hasegawa, Assoc. Prof. Hiroshi Fujita, Assist. Prof. Miyuki Koshimura


A solution to Ramsey problem

1. Extract User's Profile
2. Web Retrieval by Using User's Profile
User's Profile
4. Personalize the Results
User
Web
Personalized Results
Results
5. Return the Personalized Results
3. Return the Results
Personalization

An intelligent Web retrieval system

Neuroimaging and Neuroengineering Laboratory

Our laboratory specializes in non-invasive functional brain imaging, which includes **EEG**, **NIRS** and transcranial magnetic stimulation(**TMS**) of the brain. We develop, integrate, and apply new ideas through innovative interdisciplinary research approaches. We also develop the brain computer interface (**BCI**) or brain machine interface (**BMI**) using our measurement and analysis techniques.

Prof. Keiji Iramina, Assist. Prof. Yoshinori Katayama

<Professor Iramina takes charge of education in the Graduate School of Systems Life Sciences.>

Transcranial Magnetic Stimulation

MEG, EEG

Functional Dynamics Imaging
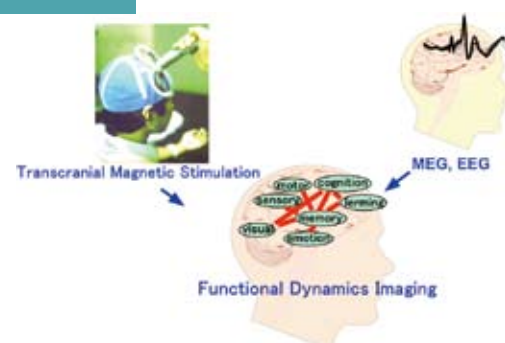
Department of Informatics

Cognitive Science Laboratory

This laboratory conducts research on human cognitive systems with topics including sensory psychophysics, human interface, virtual reality, sport-scene perception, kansei engineering and traffic accident prevention.

Prof. Shuji Mori, Prof. Kazunori Shidoji, Assist. Prof. Nobuyuki Hirose

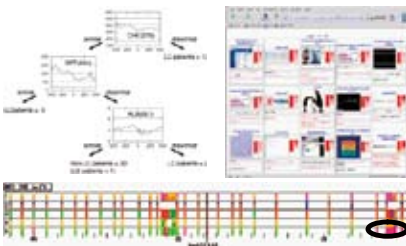Biological motion of tennis forehand stroke   Driving simulator   Favorite color of fruits   Virtual reality

Data Mining Laboratory

Our laboratory studies the following topics: data mining, knowledge discovery in databases, machine learning, text/Web mining, and swarm robotics.

Prof. Einoshin Suzuki, Assist. Prof. Shigeru Takano

Data mining for hepatitis/Web data (classification, visualization)   Swarm robots for patrol, formation control, foraging, etc.

Computation Theory Laboratory

Our laboratory seeks a deep understanding of the notion of "computation" from the view points of algorithms and complexity. Our research interests include: computational learning theory, online decision making, circuit and formula complexity, harmonic analysis of Boolean functions.

Prof. Eiji Takimoto, Assist. Prof. Kohei Hatano
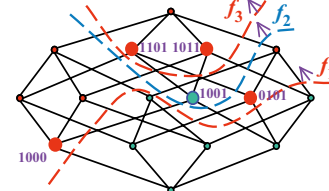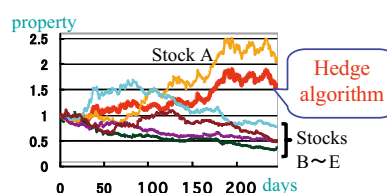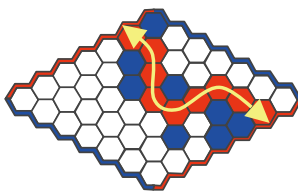
Multi-agent Systems Laboratory

Our research topics with multiple agents include: distributed constraint satisfaction, mechanism design, such as developing auction protocols that is not manipulated by false-name bidding, coalition formation problems that involves how to divide the value that a coalition among agents produces, and repeated games with imperfect private monitoring where each player privately receives a noisy observation of the opponent's action.

Prof. Makoto Yokoo, Assoc. Prof. Yuko Sakurai, Assist. Prof. Atsushi Iwasaki

A single person submits bids from multiple identifiers such as multiple e-mail addresses.
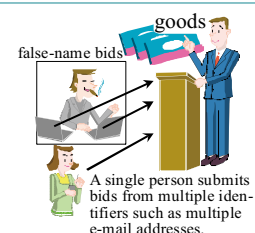
Natural Language Processing Laboratory

Our laboratory studies the following topics: organization of documents on the web, knowledge acquisition for NLP such as case-frames, classification of words' meanings and relations between events, and support system for writing English documents.

Prof. Yoichi Tomiura
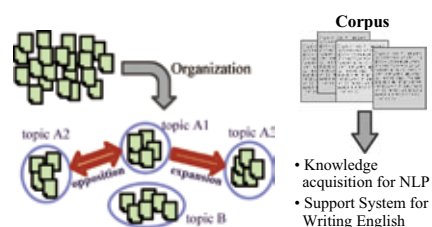
Scholarly Communication and Contents Mining Laboratory

Our laboratory studies the following topics: institutional repositories, digital library, information retrieval, search engine, authN/authZ, mining from text/Web/time series data, usage analysis, spam detection

Assoc. Prof. Daisuke Ikeda

We are developing a platform to share materials safely among colleagues, to publish our academic works, and to mine useful information from them.

3D Multimedia Software Laboratory

Research topics: 3D Multimedia systems, 3D graphics, computer animation, network collaboration, human-computer interface/interaction, virtual reality, information visualization, image processing/retrieval

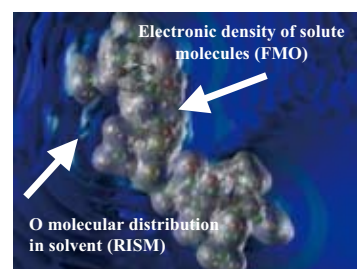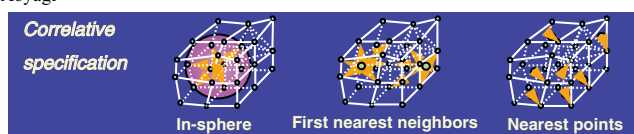Assoc. Prof. Yoshihiro Okada, Assist. Prof. Shigeru Takano

Computer Animation

Information Visualization

Network Collaboration   **Entertainment**

Wavelet transform

Multimodal Interfaces

Image retrieval
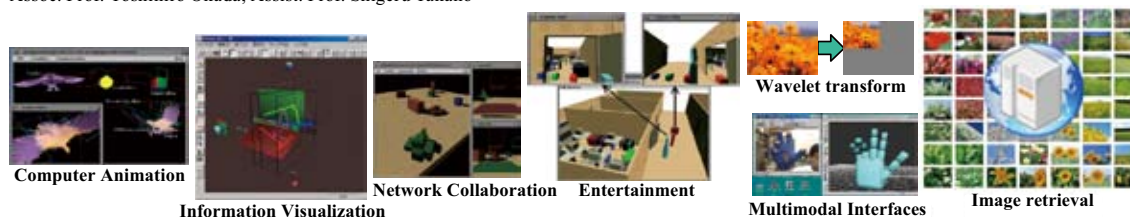
Computational Science Laboratory

Interdisciplinary research on Computer Science and Computational Science
To analyze multi-scale and multi-physics problems in Nano- and Bio-science, in which complex physical phenomena in different spatial and temporal scales are inter-related, we are developing a new middleware that allows various kinds of scientific simulations to be coupled efficiently over distributed computing environments. We also study modeling, parallel algorithms, and high precision computation, as foundations of computational science.

Prof. Mutsumi Aoyagi

Correlative specification

In-sphere   **First nearest neighbors**   **Nearest points**

Electronic density of solute molecules (FMO)

O molecular distribution in solvent (RISM)

Department of Advanced Information Technology

Department of Advanced Information Technology

The Department of Advanced Information Technology investigates computer technology, information and communication technology, and real-time information processing technology for the realization of an advanced information society.

The divisions in this department are: Advanced Information and Communication Technology, Advanced Software Engineering, Real World Robotics, Advanced Distributed Processing Systems, Information Communication Engineering (E-JUST), and Practical Embedded Software Development Engineering.

The Department of Advanced Information Technology offers two courses with different curriculum policies: Intelligent Information Systems Engineering Course and Social Information Systems Engineering Course. The aim of Intelligent Information Systems Engineering Course is to provide students who can research and develop frontier technologies for the advanced information society. For this aim, this course deals with a wide range of knowledge and skills on hardware, software, communication technology, and real-time information processing. The aim of Social Information Systems Engineering Course is to provide students who can carry out practical projects for developing (namely, planning, designing, building, and managing) various advanced information systems. For this aim, this course fully utilizes project-based learning (PBL).

Advanced Information and Communication Technology

This division performs the research and education in the fundamental and application areas of new emerging ICT (information & communication technology), ranging from the high-speed and dependable communication technologies to the architectures and design methodologies of next-generation computer systems. The division particularly focuses on the following topics: novel satellite communication systems, RFID (radio frequency identification) systems, advanced wireless mesh networks as a range extension method of WLAN spots focusing on pursuing a mesh network empowered by low complexity MIMO (multiple inputs multiple outputs) modem, EDA (electronic design automation) and CAD (computer aided design) technologies for dependable SoC (system-on-a-chip), adaptive and customizable many-core or reconfigurable SoC architectures, dependable and low-power 3D integration, and so on.

Advanced Software Engineering

This division conducts research and education regarding advanced software and is composed of the following research groups. Formal software engineering group employs multi-aspect formal method approaches by using different kinds of specification languages, such as VDM languages, CSP, and functional programming languages for real-world software development process. Advanced system software group studies issues related to system software such as multithreading and cloud computing. Embedded computing research group researches software product line development methodologies and tools. Ubiquitous computing research group researches wireless LAN based positioning and context aware computing infrastructure. Pervasive computing research group studies personalized and community-based information sharing/retrieval/recommendation mechanism, and secure agent-community-network-based systems based on multi-agent Kodama framework.

Real World Robotics

This division conducts education and research on wide range of subject ranging from real world data acquisition to human interaction with an embedded robot.

For creating an advanced information processing system which closely coexists and collaborates with human beings, it is indispensable to realize a practical processing loop from data acquisition and recognition to active interaction with human. This system has to be robust and reliable for uncertainties and diversity in the real world environment. To fulfill this goal, the division particularly focuses on the following topics: robotics, real world sensing, artificial intelligence, pattern recognition, computer vision and graphics, media processing, intelligent human- computer interface, and virtual reality.

Advanced Distributed Processing Systems

To meet the demands of various up-to-date decentralized applications on network, this division conducts education and research on the latest technologies for processing large amount of data, which are distributed on wide range of network. The subjects of this division ranges from search engine technologies, web service technologies, distributed grid computing systems and next generation internet. The practice with the real and concrete data as well as the basic theories are treated as theme of education and research.

Information Communication Engineering (E-JUST)

The division of Information Communication Engineering carries out educational and research activities mainly on the field of integrated circuits and digital communication systems. It also provides educational and research supports for the Department of Electronics and Communications Engineering (ECE) in Egypt-Japan University of Science and Technology (E-JUST) in Egypt.

Practical Embedded Software Development Engineering

The Division of Practical Embedded Software Development Engineering deals with education and research on embedded software. This division is in collaboration with Renesas Solutions Corporation and aims at bringing up engineers wuth high quality of skills embedded software through practical education.

The Structure of the Department of Advanced Information Technology

Divisions	Faculty Members
Advanced Information and Communication Technology	**Professor** Kazuaki Murakami, Hiroto Yasuura, Hiroshi Furukawa **Associate Professor** Kouji Inoue, Yuuske Matsunaga, Kiyotaka Fujisaki, Makoto Sugihara, Ahmed Ashir Uddin **Assistant Professor** Masayosi Yoshimura, Norimasa Nakashima
Advanced Software Engineering	**Professor** Keijiro Araki, Akira Fukuda, Naoyasu Ubayashi **Associate Professor** Shigeru Kusakabe, Tsunenori Mine, Tsuneo Nakanishi, Kenji Hisazumi **Assistant Professor** Yoichi Omori, Yutaka Arakawa, Yasutaka Kamei
Real World Robotics	**Professor** Tsutomu Hasegawa, Rinichiro Taniguchi, Ryo Kurazume, Seiichi Uchida **Associate Professor** Kunihiko Kaneko, Hajime Nagahara, Ken'ichi Morooka **Assistant Professor** Tokuo Tsuji, Yumi Iwashita, Atsushi Shimada, Yaokai Feng
Advanced Distributed Processing Systems	**Professor** Sachio Hirokawa, Koji Okamura **Associate Professor** Hirofumi Amano, Eisuke Ito
Information Communication Engineering (E-JUST)	**Associate Professor** Osamu Muta, Mehdipour Farhad, Victor Mauro Goulart Ferreira
Practical Embedded Software Development Engineering	**Professor** Naoshi Sakamoto

Computer Architecture Laboratory

Research goals : We explore "next-generation computer architectures" to improve performance, energy efficiency, and dependability, for advanced computer systems. The targets include supercomputers, laptop/desktop PCs, and also embedded systems. (http://ngarch.isit.or.jp/)

Main Topics : Multi-Core Processors, 3D-IC Architectures, Reconfigurable Processors and Compiler Optimizations, Energy Efficient Accelerators, Performance Predictions, Architecture Explorations, Biometrics Authentication, Homology Search Algorithms

Prof. Kazuaki Murakami, Assoc. Prof. Koji Inoue
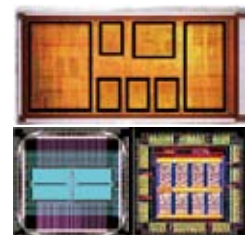
SoC Design Laboratory

Prof. Hiroto Yasuura, Assoc. Prof. Yusuke Matsunaga, Assist. Prof. Masayoshi Yoshimura


http://soc.ait.kyushu-u.ac.jp/SOC/index.html
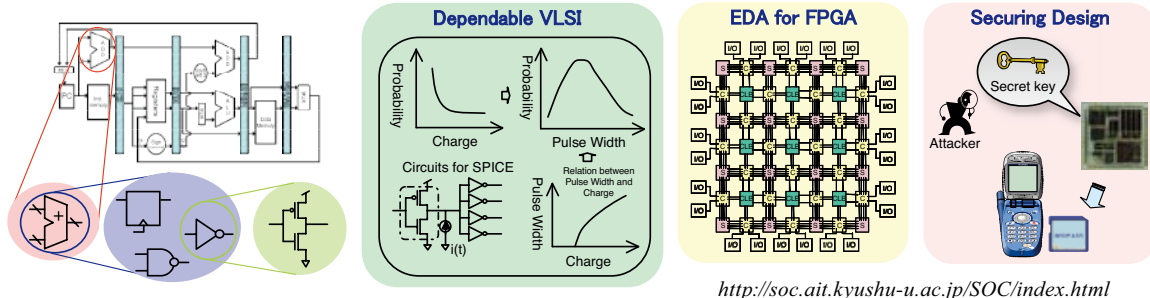
Communications Technology Laboratory

This laboratory studies the wireless communications technology and its related fundamentals. Main research topics are as follows.

∗ Satellite communication systems
∗ Radio frequency identification (RFID) systems
∗ Wave radiation, propagation, and scattering in random media
∗ Large-scale computer simulations
∗ Analytical and numerical techniques in electromagnetics

Assoc. Prof. Kiyotaka Fujisaki, Assist. Prof. Norimasa Nakashima

High Reliable Satellite Communicatoin Systems
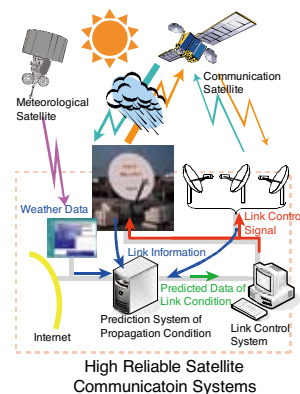
Mobile Communication Systems Laboratory

Our laboratory studies next generation mobile communication systems with high capacity and high throughput. Emphasis is placed on studies of wireless backhaul as an enabler of picocell based high capacity system. PicoMESH, a trademark of our original wireless backhaul system, is the world's first WiFi access point with capability of organizing an over 10hop network being free from any wired connections.

Prof. Hiroshi Furukawa, Assoc. Prof. Osamu Muta

PicoMESH
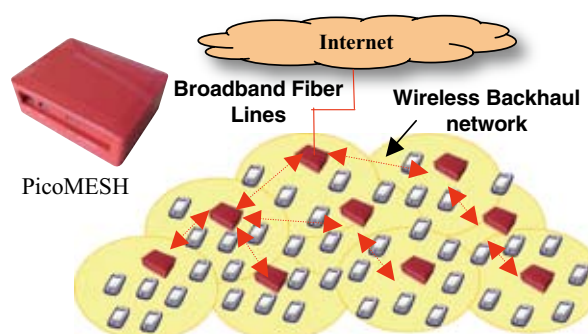
Software Engineering Laboratory

(1) Formal Approaches to Software Development : In order to establish advanced software development methods, we employ multi-aspect formal method approaches. For real-world software systems, we use different kinds of specification languages, such as VDM languages, Z, Statecharts, UML, and CSP, and devise sophisticated methods to integrate them. We also use functional languages and domain specific languages as executable specification languages. Our interests also include software development process issues to maximize the benefits of formal approaches.

(2) Formal Approaches for Parallel and Distributed Processing : We use parallel and distribute processing, such as multithreading and MapReduce in cloud computing, to accommodate computational power required for Verification & Validation in formal approaches. We also use formal approaches to configure such parallel & distributed platforms.

Prof. Keijiro Araki, Assoc. Prof. Shigeru Kusakabe, Assist. Prof. Yoichi Omori

Embedded & Ubiquitous Computing Laboratory

Embedded & Ubiquitous Computing Lab researches technologies and development methodologies for embedded & ubiquitous computing systems including wireless LAN based positioning, context aware computing infrastructure, automotive software, product line software engineering, and generative software development.

Prof. Akira Fukuda, Assoc. Prof. Tsuneo Nakanishi, Assoc. Prof. Kenji Hisazumi, Assist. Prof. Yutaka Arakawa

Software Language Laboratory

Our laboratory studies next generation software languages, software verification, and software development environment. Main research topics include aspect-oriented programming, reflection, modeling languages, architecture description languages, domain-specific languages, formal methods, formal verification, and software repository mining.

Prof. Naoyasu Ubayashi, Assist Prof. Yasutaka Kamei

Archface

Archface: architectural interface for bridging a gap between design modeling and implementation
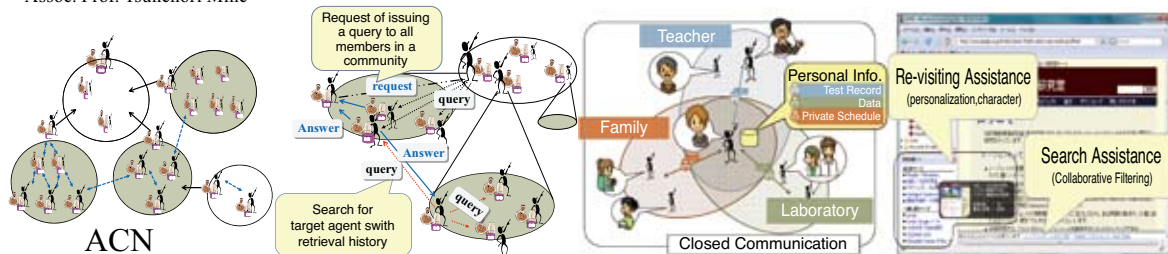
Architectural information is encapsulated in interfaces

Pervasive Computing Laboratory

Our research topics include: multi-agent systems, Agent-Community-Network(ACN), peer-to-peer network, information sharing/retrieval/recommendation and personalized technologies.

Assoc. Prof. Tsunenori Mine

Intelligent Robotics and Vision Systems Laboratory

Our lab's main research goal is to realize human-symbiotic intelligent robots which can robustly work in complex real world to support human daily activities. Our research projects include a wide range of new technologies in human-symbiotic robotics and informationally structured large scale daily life environment.

Prof. Tsutomu Hasegawa, Assoc. Prof. Ken'ichi Morooka, Assis. Prof. Tokuo Tsuji

Image and Media Understanding Laboratory

The goal is to establish higher level of multimedia information processing technologies, and the important issue is to develop frameworks assisting people's activities in various situations.

Prof. Rin-ichiro Taniguchi, Assoc. Prof. Hajime Nagahara, Assist Prof. Atsushi Shimada
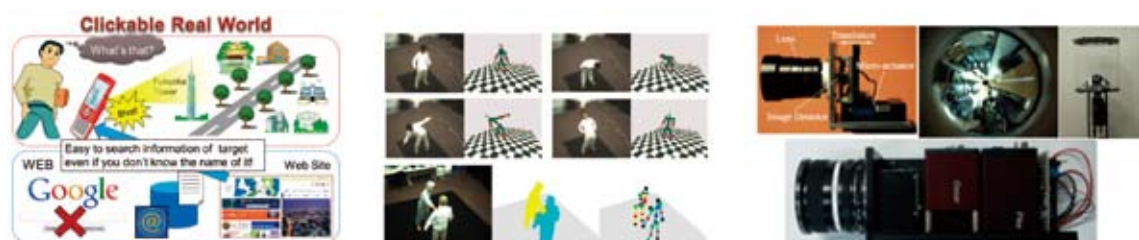
Real World Information Robotics Laboratory

We have been challenging to develop intelligent robot systems which are applicable to real-world problems. Our research field includes multiple mobile robots, legged and wheeled robot, laser-based 3D modeling, human sensing and recognition, and medical imaging.

Prof. Ryo Kurazume, Assit. Prof. Yumi Iwashita
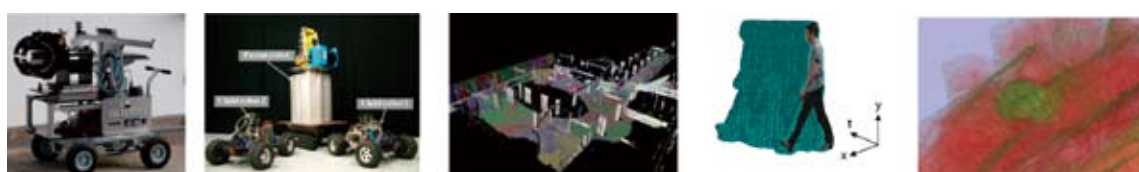
Human Interface Laboratory

Our research topics include: image pattern recognition, human activity recognition, character recognition, optimization techniques for pattern recognition, video/still image processing, and searching and indexing technologies for multidimensional data.

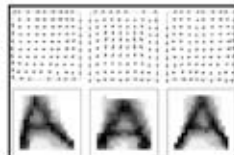Prof. Seiichi Uchida, Assist Prof. Feng Yaokai

| image pattern recognition | image processing | activity recognition | multi-sensor integration |

Data Engineering Laboratory

Our research topics include: three dimensional geographic information, database system for medical applications, Web database system, spatial and image data management, time series data management, and database for human motion and animation.

Assoc. Prof. Kunihiko Kaneko
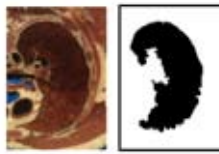
| Medical Image Management | Spatial Models for Digital Human | Time Series Data Management | Skelton and Bone Models for Motion Analysis and Control |
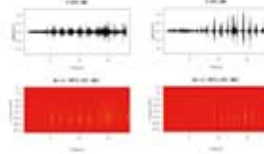
Search Engine and Text Mining Laboratory

The laboratory works on search engine and text mining. We are analyzing real text documents such as web files, patents and annual reports of enterprises.

Prof. Sachio Hirokawa

Concept Graph Construction from document files

Given a document set D.

D

Traditional IR Techniques

$tf(w_i, D)$: Term Frequency.
$df(w_i, D)$: Document Frequency.
(Num. of non-zero Cells)

Concept Graph

A facet analysis tool.

Structured Documents

XML

Query

Select 2 attributes

Data Matrix

zooming

Clustering
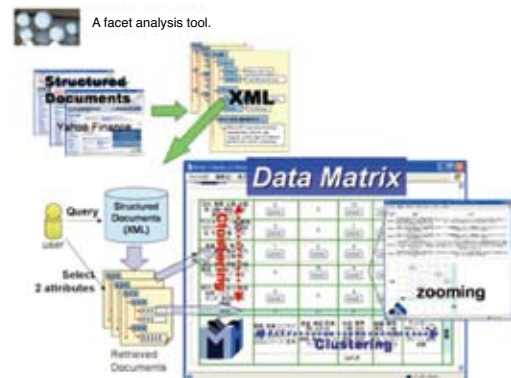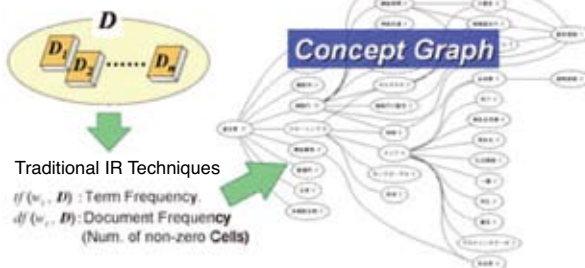
Grid Computing Laboratory

This laboratory works on grid computing technology, such as grid middleware, grid portals, or high-performance data transfer mechanisms for distributed parallel programs.

Assoc. Prof. Hirofumi Amano

Web Information Service Platform Laboratory

To support secure Web information services, we research digital certificate, user identity management, and convenient authentication/authorization system. We also consider to apply our developed platform to practical services, such as e-Learning system, SNS service, and repository of library. Finally, we develop web mash up mechanism to combine services.

Assoc. Prof. Eisuke Ito

IdP: Identity Provider   SP: Service Provider

IdP

SP

Secure and Trustful Platform

UA: User Agent

Single Sign-on, Shibboleth Federation for services   Web Mash up
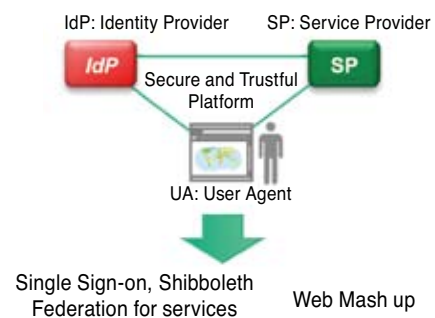
Advanced Internet Technologies Laboratory

This laboratory studies the following topics: Key Technologies for Future Internet such as OpenFlow and Virtual Networking, advanced techniques for Network Operations based on Power Consumption and Green Technologies, Measurement Technique and Practical case studies using those new technologies with various Internet researchers over the world.

Prof. Koji Okamura

DV Quatre

Site A

DVTS

Site B

DVTS

Site C

DVTS

Site D

DVTS

Internet

Quatre4
Quatre16

Unicast
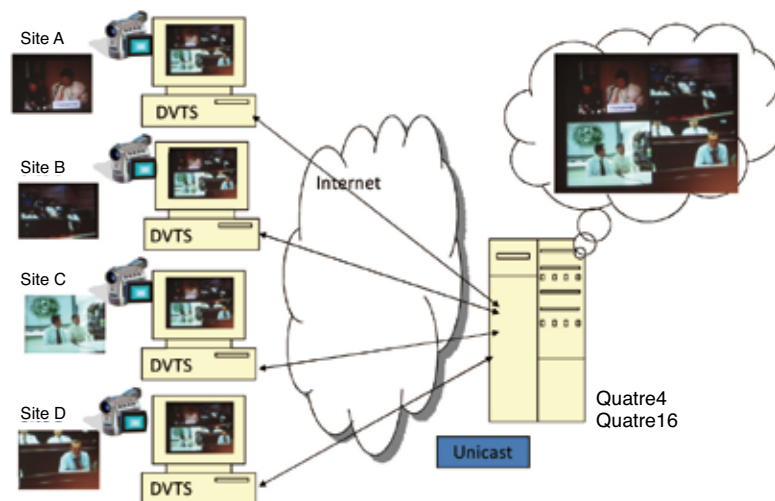
Course Philosophy and Admission Policy

"Social Information Systems Engineering Course" has been established within the "Department of Advanced Information Technology".

In the late 20th Century, Information Communication Technology (ICT) progressed rapidly and had several breakthroughs, which brought the fundamental changes to the way how various organizations (corporations, government, educational institutions) operate. It has big influences on our society, like product design, manufacturing, service offerings, education systems, etc. It is going to create the fundamental changes in our social system and social structure. ICT, as a basic technology, has become the core of social infrastructures, which underpins the various social systems (government administration, economy, finance, communication, transportation, logistics, education, and so on). On the other hand, there is a serious shortage of skilled personnel who can lead the next generation of Japanese information communication industry. With the joint efforts of industry, government and academia group, this course will provide education and training programs to foster engineers who will lead the information society in the future. In this course, we will nurture engineers who will understand the positioning of ICT in the society and will have the wide breadth of knowledge, high ethical standards and outstanding technical capabilities. To be more specific, a graduate of this course will have; 1) technical skills that are immediately required in software research and development, 2) insight to assess long-term changes of social environment and to transform ICT accordingly, 3) flexibility to develop software accommodating such changes, and 4) qualified capabilities to take a leadership in business communities and various social organizations.

Course Overview

Ministry of Education, Culture, Sports, Science and Technology (MEXT) has selected Kyushu University as one of six hub universities of "Promotion program to foster leading IT specialists". Kyushu University was also selected as one of two critical alliance universities by Japan Federation of Economic Organizations. Our partners are Japan Federation of Economic Organizations, many corporations that support this program, Kyushu Institute of Technology, Fukuoka University, Kumamoto University and University of

Master Thesis

Courses for technology and theory

Knowledge for ICT, like software, hardware and network area

Embedded system   Enterprise system

Courses for practical subjects

Real PBL

PBL on System Development
PBL on Real
PBL on Advanced System

(Example)
• Prototype of electronic key rental system
• One village one portal hosting system
• Tools for hardware design integration

Internship

Courses for ICT sophistication

Insight into cutting-edge ICT and its impact on our future society
(Example): Advanced Topics on ICT

Courses for ICT human skill

Training for leadership and communication skills
(Example): Advanced Topics on Leaders of Information Society
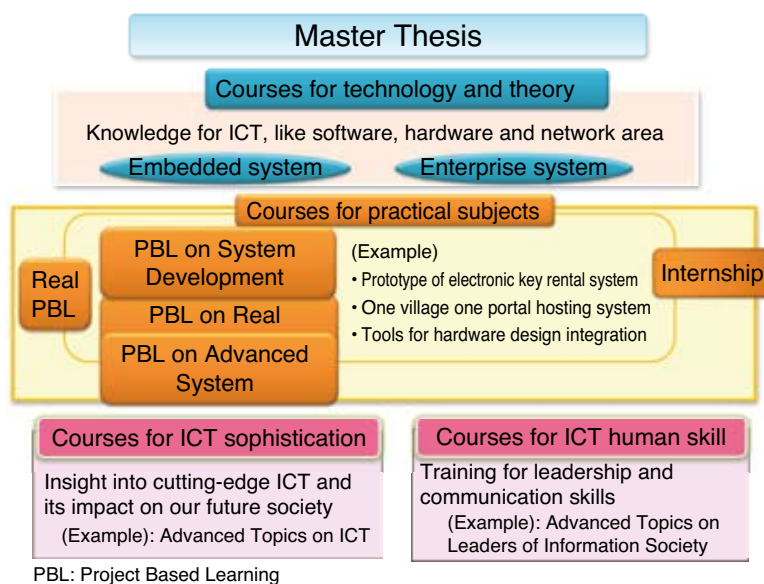
PBL: Project Based Learning

Figure 1 : Framework of curriculum

Course Overview

Miyazaki. The purpose of this course is to have the students acquire the following state-of-the-art IT knowledge and skills which are said to be insufficient in the current education program;

1) Skills and knowledge to plan, design, develop and manage the technology in the society
2) Skills to develop the large-scale systems
3) Leadership and Communication Skills

In particular, Real Project-Based Learning (PBL) is the focus of this course so that the students can experience the real system development projects with the help from various supporting companies. ICT sophistication classes and ICT human skill classes are also put in place as well as practical classes in order to foster self-motivated and well-structured personnel. Internship, in which students can learn and experience real jobs in the corporations, and the mentoring program, in which staffs from business communities will provide consultation on the career path or how to learn, are also provided in this course

Figure 2 : Special Lectures on Advanced Topics on Information Systems

Figure 3 : Project Based Learning

Teaching Staffs and Cooperating Companies

Department of Advanced Information Technology

All the professors, associate professors and assistant professors in "Department of Advanced Information Technology" participate as the teaching staffs of "Social Information Systems Engineering Course".

Cooperating Companies (as of May, 2011)

Center for Future ICT Leaders, Software Research Associates, Nomura Research Institute, Hitachi, Ltd., TOYOTA MOTOR CORPORATION, NEC Corporation, FUJITSU LIMITED, Nihon Unisys, NTT DATA CORPORATION, TOYO Corporation, FUJITSU KYUSHU NETWORK TECHNOLOGIES, NIPPON TELEGRAPH AND TELEPHONE WEST CORPORATION, Tokio Marine & Nichido Fire Insurance, Geisha Tokyo Entertainment Inc., APPRESSO K.K., Microsoft, Ministry of Economy, Trade and Industry (METI), KPMG AZSA LLC, IBM Japan, CATS, Japan Aerospace Exploration Agency, Kyushu Hitachi Maxell, Runesas Solutions, DIGITAL PROCESS LTD.

Department of Electrical and Electronic Engineering

Department of Electrical and Electronic Engineering

Department of Electrical and Electronic Engineering provides education programs which help students to systematically understand the basics and advanced knowledge of electrical engineering, electronics, communication technology. The purpose of this department is to eduate research engineers who possess the ability to create new values for the future based on the certain knowledge of information and communication technology and electrical systems. These are, for example, an engineer who creates low-energy consuming electrical system that contributes to solve the global warming issue and an engineer who creates new information-technology-based social-systems that provide safety and comfort for human life. To complete the purpose, the department offers the following two education courses:

(1) Information Electronics Course

is aiming at growing researchers and highly skilled engineers who are able to lead the creation of next generation electronics and new applications and those who contribute to sustainable growth of electronics related industry through research and development of advanced electronic devices and integrated electronics. The education program of this course is managed by the faculty members of Department of Electronics, Faculty of Information Science and Electrical Engineering.

(2) Electrical Engineering Course

The field of electrical and electronic systems based on the electro magnetic phenomena is the most fundamental and key technology to support our society and its infrastructure. Nowadays, the field is rapidly advancing and diversifying its applications by merging with splendid high technologies including superconductivity, information and control technologies based on a new paradigm, and digital technologies aiming at advanced intelligent systems. The department is composed of four divisions of Measurement and Control Engineering, Applied Energy Engineering, Superconductive Systems Engineering and Energy and Environment. Under the above situation, the department offers advanced education and research programs in each division, not only for Master and Doctor course students but also for professional engineering trainees entrusted by industries and foreign countries.

【Information Electronics Course】

Electronic Devices

Innovative creation of highly functional electronic devices is the engine of the development of future information and communication society. This division provides research and education programs to students who are interested in electronic properties of semiconductors, magnetic material, dielectric material, and organic materials and their application to electron, magnetic, optical, and bio devices and nanotechnology to produce device functions.

Integrated Electronics

As we learn from LSI (large scale integrated circuit) it is necessary to produce integrated electronic systems to create social values from the elemental function of electronic devices. This division provides research and education programs to students who want to learn design and process technology of LSI, information communication using radio frequency (RF) electromagnetic waves, information display, and opto-electronic systems in terms of the five elemental composites of information systems, sensing, processing, memory, communication, and display.

Electronics and Communication Engineering (E-JUST)

This division of Electronics Communication Engineering aims to provide the fundamental concepts and techniques to conduct independent research in the advanced RF and analog integrated circuits, integrated antennas and filters in CMOS technology. We do extend our resaerch beyond Moore era for next generation microwave and millimeter wave wireless communication systems. It also provides educational and research supports for the Department of Electronics and Communications Engineering (ECE) in Egypt-Japan University of Science and Technology (E-JUST) in Egypt.

【Electrical Engineering Course】

Measurement and Control Engineering

Measurement and Control Engineering takes charge of education and research on next-generation measurement and control systems aiming at the integration of the electrical and electronic systems, the control technology, and the information technology. It provides education and conducts research on: (1) a modeling method for electrical machine control systems, a power electronics control technology; (2) measurement technology, such as a new functional sensor based on the Josephson quantum effect; (3) motion and vibration control, control methodology for hybrid system, learning and optimization and their applications to power system control and operations; and (4) modeling and identification of an electronic system composed of various electronic equipments as well as the performance assessment based on a numerical system modeling.

Applied Energy Engineering

An electric power and energy system is one of the key infrastructures that support our lives and various industries including information technology. *Applied Energy Engineering* provides education and research concerning systems of generation, transmission, storage, control and effective use of electric and electromagnetic energy. It deals with the development, application and protection of electric and electromagnetic energy systems for the next generation including a new power generation system, a superconducting electric power system, an electromagnetic energy system, a high-voltage pulsed power system, a high-power laser system, high-density and high-temperature plasma system and applied discharge system. In addition, it targets to limit the power consumption of power electronic systems, while preserving their high performance at low EMI emissions using high technology of analog/digital mixed electronic circuits.

Superconductive Systems Engineering

Superconductivity leads to the key technology for the advanced electric power machines and devices, which provide new energy generation, energy transmission and energy storage systems with a high efficiency and a high energy density in the future highly intelligent society. In addition it will play an important role in the magnetic sensors with extremely high sensitivity and in the mobile communication with a high performance. Superconductive *Systems Engineering* offers education and research on superconductivity focusing on the basic material science, the analysis and evaluation technique of the electromagnetic properties and the application technology of superconducting films, wires and cables.

Energy and Environment

Rising public awareness for environmental protection and continuously increasing energy consumption have created an interest in renewable sources. Due to utilizing useful for renewable sources as a substitute for fossil fuels, the study of renewable power generation systems are being executed. However, it is possible that integration of renewable power generation systems leads to ill conditions of electric power systems. In order to maintain power system stability and quality, the purpose of our research is a clarification of power system dynamics and an establishment of power system control method by distributed generations using renewable sources.

Information Electronics Course

Divisions	Faculty Members
Electronic Devices	Professor 　Kiyoshi Toko, Kimihide Matsuyama, Masaharu Shiratani, Kenshi Hayashi Associate Professor 　Taizoh Sadoh, Hisao Kuriyaki, Kazunori Koga, Noho Itagaki Assistant Professor 　Takeshi Onodera, Giichiro Uchida, Terumitsu Tanaka
Integrated Electronics	Professor 　Keiji Yoshida, Tanemasa Asano Associate Professor 　Haruichi Kanaya, Yuji Oki, Kohei Hamaya Assistant Professor 　Akihiro Ikeda, Hirofumi Watanabe, Daisuke Kanemoto
Electronics and Communication Engineering	Professor 　Kuniaki Yoshitomi, Ramesh K. Pokharel Associate Professor 　Hongting Jia

Electrical Engineering Course

Divisions	Faculty Members
Measurement and Control Engineering	**Professor** Kiyoshi Wada, Taketoshi Kawabe, Takanobu Kiss, Junichi Murata **Associate Professor** Katsumi Kesamaru, Masayoshi Inoue **Assistant Professor** Tatsuya Kai, Masakazu Mukai, Kohei Higashikawa, Hirotaka Takano
Applied Energy Engineering	**Professor** Tatsuo Okada, Junya Suehiro, Masahito Shoyama **Associate Professor** Nobuo Fujii, Daisuke Nakamura **Assistant Professor** Michihiko Nakano
Superconductive Systems Engineering	**Professor** Kazuo Funaki, Keiji Enpuku **Associate Professor** Masataka Iwakuma, Kazuhiro Kajikawa **Assistant Professor** Takashi Yoshida
Energy and Environment	**Professor** Tadahiro Goda **Assistant Professor** Takuhei Hashiguchi

Bio Electronic Device Laboratory

■**Research field** : Taste and odor sensor

Ultrahigh performance sensing system for security and safety; Detecting landmine, drug, fire, bad smell .

Functional sensor surfaces using nanotechnology and biotechnology Information technology based on food quality database.

Prof. Kiyoshi Toko, Prof. Kenshi Hayashi and
Assist. Prof. Takeshi Onodera
URL: http://ultrabio.ed.kyushu-u.ac.jp/

Taste sensor TS-500Z

Taste sensor chip

Odor code sensor chip

Odor molecules

Portable SPR sensor

Sensor surface recognizing substructure

Odor sensor chip surface

Magnetic Functional Devices Laboratory

Our research group investigates fundamental physics of the electron spin in nano-structures. Practical applications of spin freedom to various functional devices are our main research issue.

Prof. Kimihide Matsuyama, Assist. Prof. Terumitsu Tanaka

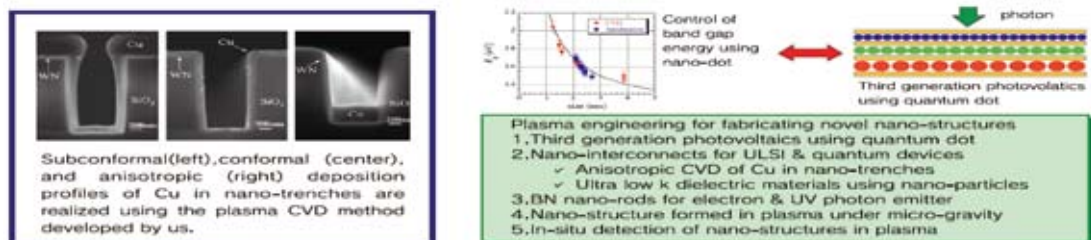| Spin data storage | Nano structures | Micromagnetics | Spin dynamics |
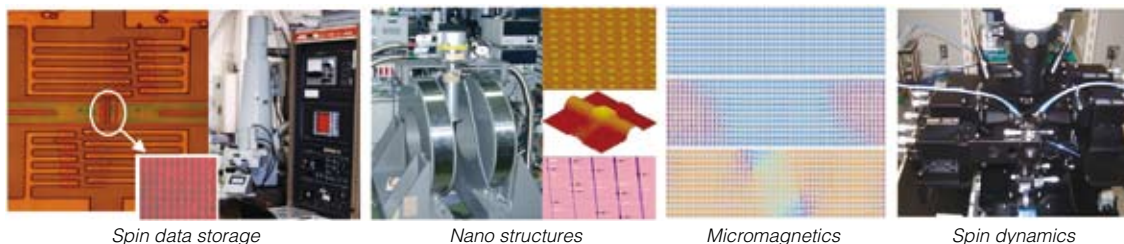
Si-Nanotechnology Laboratory

We have been investigating novel crystal growth of SiGe-based heterostructures for multi-functional LSIs and system-in-displays.

Assoc. Prof. Taizoh Sadoh, Assist. Prof. Kohei Hamaya

SiGe on Insulator for MOSFET

Fe_3Si for spin transistors

$FeSi_2$ for opto devices
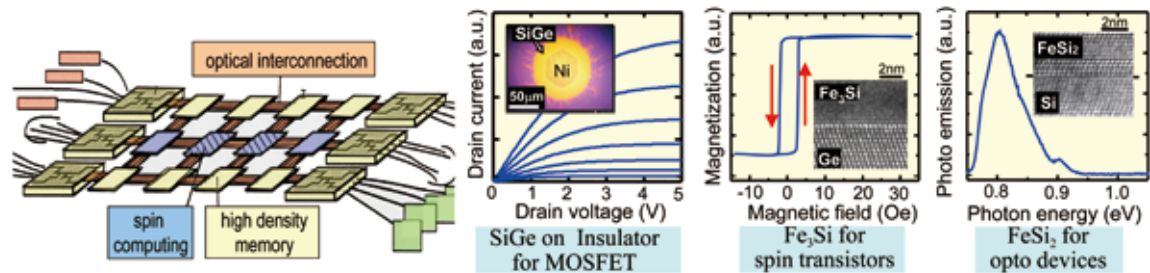
Plasma Nanosystem Laboratory

Prof. Masaharu Shiratani, Assoc. Prof. Kazunori Koga, Assist. Prof. Giichiro Uchida

Subconformal(left), conformal (center), and anisotropic (right) deposition profiles of Cu in nano-trenches are realized using the plasma CVD method developed by us.

Control of band gap energy using nano-dot

Third generation photovolatics using quantum dot

Plasma engineering for fabricating novel nano-structures
1. Third generation photovoltaics using quantum dot
2. Nano-interconnects for ULSI & quantum devices
   ✓ Anisotropic CVD of Cu in nano-trenches
   ✓ Ultra low k dielectric materials using nano-particles
3. BN nano-rods for electron & UV photon emitter
4. Nano-structure formed in plasma under micro-gravity
5. In-situ detection of nano-structures in plasma

RFIC & Microwave Communication Devices Laboratory

■**Research Fields** : RF-CMOS front-end, LNA (Low-noise amplifier), PA(Power amplifier), VCO(Voltage-Controlled Oscillator), mixer, Advanced matching circuit, Microwave filter, Miniaturized antenna, DA/DA converter
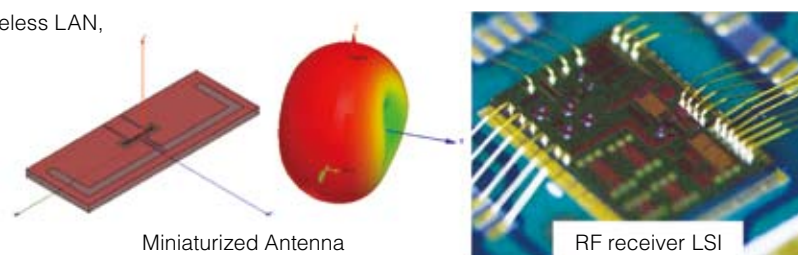
■**Applications** : Cellular Phones, Wireless LAN, Bluetooth, Ultra Wideband(UWB), Satellite communication, Broadband transmission

Prof. Keiji Yoshida
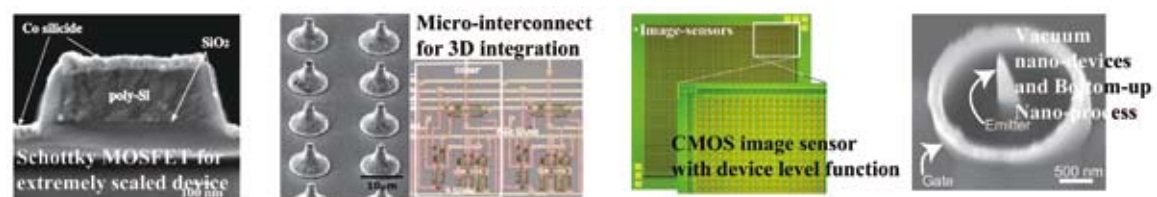Assoc. Prof. Haruichi Kanaya
Assist. Prof. Daisuke Kanemoto

URL: http://yossvr0.ed.kyushu-u.ac.jp/

Miniaturized Antenna
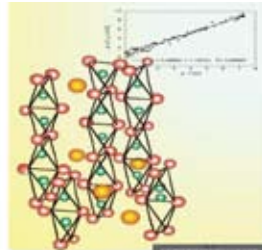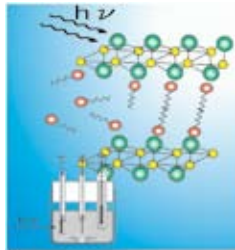
RF receiver LSI

Functional Device and Integration Laboratory

Prof. Tanemasa Asano leads the research works on micro- and nano-devices and their integration process technology, covering silicon LSIs, thin-film transistors (TFTs), MEMS, and 3D devices.

Schottky MOSFET for extremely scaled device

Micro-interconnect for 3D integration

CMOS image sensor with device level function

Vacuum nano-devices and Bottom-up Nano-process

Functional Materials Laboratory

Low-dimensional electronic materials
Organic/inorganic nano-composite materials
Photo-rechargeable battery
Microfabricated oxygen sensor
Assoc. Prof. Hisao Kuriyaki

Oki Laboratory

-Lasers and laser applications
-Organic and inorganic phonic devices

Organic Film Lasers

Microchip DPSS

System Identification and Signal Processing Laboratory

In System Identification and Signal Procssing Laboratory, researches on advanced issues of theories and technologies of system control and signal processing are carried out extensively. Our research interests include identification of multi-input multi-output systems; model validation from time domain data; applications of system identification and signal processing, learning algorithms; identification and adaptive control of nonlinear systems via soft computing techniques.

Prof. Kiyoshi Wada, Assist. Prof. Tatsuya Kai

Disturbance

Input

System Identification from Input-Output Data Output
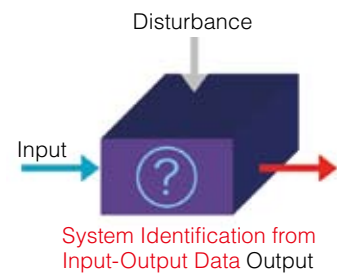
System Design Laboratory

Our aim is to understand, design and control various systems ranging from microscopic to macroscopic systems. Especially, emphasis is placed on the macroscopic systems or collections of systems interacting with each other (e.g. automotive traffic flow, power systems and social systems). To achieve the aim, research is being conducted on predictive control, motion and vibration control, control methodology for hybrid systems (continuous dynamics governed by discrete events), and learning and optimization techniques.

Prof. Taketoshi Kawabe, Prof. Junichi Murata
Assist. Prof. Masakazu Mukai, Assist. Prof. Hirotaka Takano
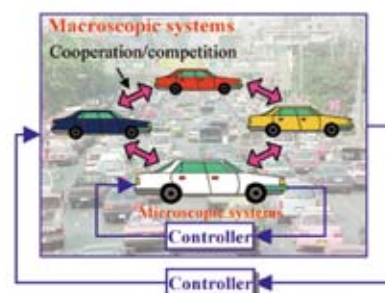
Instrumentation Engineering Laboratory

Our studies focus on the understanding and resolving key performance issues of superconducting forefront materials and systems based on the advanced instrumentation and measurement technologies. Perspective of these studies are to lead breakthrough to the energy-efficiency solutions to electric power grid reliability, power quality and the environment challenges.

Prof. Takanobu Kiss (a member of RISS: p. 34-35),
Assoc. Prof. Masayoshi Inoue, Assist. Prof. Kohei Higashikawa
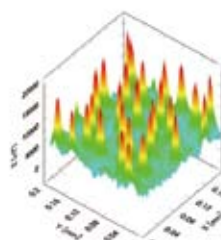
SQUID microscopy of Vortex dynamics
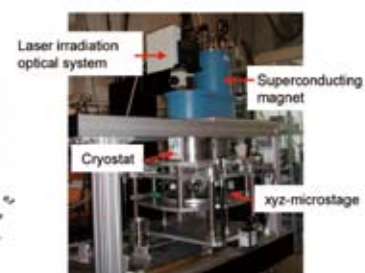
Development of novel laser microscope

Electromechanical Energy Conversion Laboratory

Our laboratory studies the following topics: FEM Analysis, PM Motors, Electric Vehicle, Wind generator, and PM generator.
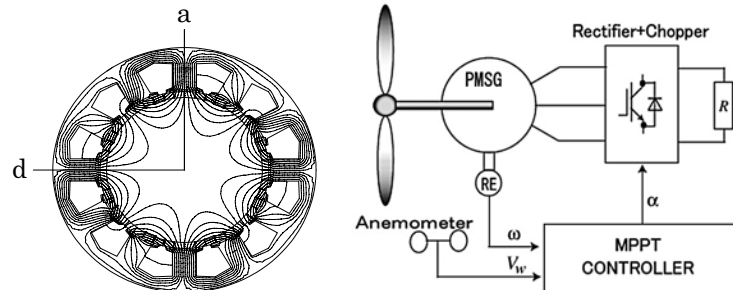
Assoc. Prof. Katsumi Kesamaru

Laser and Electromagnetic Energy Laboratory

The Prof. Okada's group is mainly working on the development of various types of lasers and light sources, including fluoride-based fiber lasers, tunable lasers, VUV-EUV light sources, and on their application to material processing such as optically functional thin film deposition, synthesis of nanostructured materials and so on.

Prof. Tatsuo Okada, Assoc. Prof. Daisuke Nakamura, Assoc. Prof. Nobuo Fujii
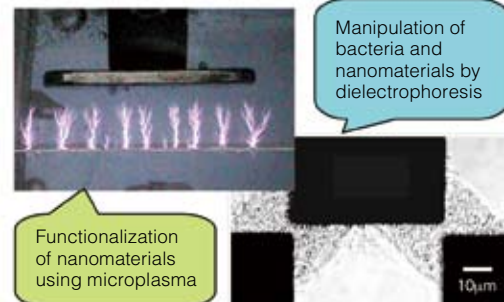
Experiment on laser

Test Facility of Linear Induction Motor with End-Effect Compensator for Urban Transit. (FUJII Lab.)

Micro-Nano Electrostatics Laboratory

We are involved in research subjects based on pplied electrostatics for the cross-disciplinary area such as bio and nanotechnology. Especially, we currently focus on applications of electrokinetic phenomena and pulsed power technology to manipulation and processing of micro and nanoscaled materials.

Prof. Junya Suehiro
Assist. Prof. Michihiko Nakano

Manipulation of bacteria and nanomaterials by dielectrophoresis

Functionalization of nanomaterials using microplasma

Green Electronics Circuits Laboratory

Our research topics are related to Switched-Mode Power Converter which is "the heart of any electronic equipment". Circuit topologies, control strategies, simulation techniques, EMC issues, and so forth are investigated. Miniaturization, high efficiency, and low noise are prominent features, which can be obtained through high technology of analog/digital mixed electronic circuits. All levels of investigation are covered including both technology and system levels.

Prof. Masahito Shoyama
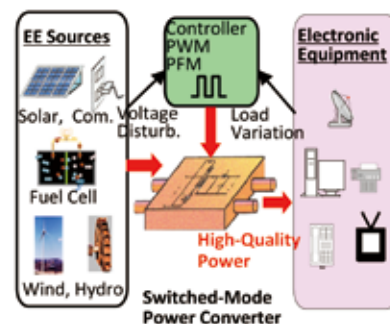
Applied Superconductivity Laboratory

We mainly study the electromagnetic properties of superconducting wires and cables with the aim at the wide application of superconducting devices and systems. We take the lead in the development of advanced oxide superconducting power devices, e.g. a liquid-nitrogen-cooled superconducting transformer and motors. We also join the national project for the research and development of such devices. In addition we support the development in the next-generation oxide superconducting wires making free use of our ac loss evaluation technique with high accuracy.
(see the Research Institute of Superconductor Science and Systems.)

Prof. Kazuo Funaki, Assoc. Prof. Masataka Iwakuma

Characteristic test of a 15kW superconducting motor in water

Superconducting Sensing System Laboratory

Main research topic is the development of advanced sensing systems based on superconducting sensors, such as biosensing system using magnetic marker and SQUID, Nondestructive Evaluation system and high precision Picovoltmeter. We are also carrying out basic researches toward realization of the large-scale application of superconductivity from various perspectives.

Prof. Keiji Enpuku, Assoc. Prof. Kazuhiro Kajikawa
Assist. Prof. Takashi Yoshida

SQUID sensor and bio-sensing system (Enpuku Lab.)
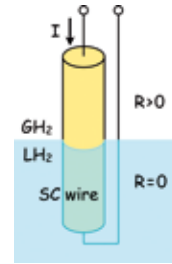
Level sensor for liquid hydrogen with superconducting wire (Kajikawa Lab.)

Energy and Environment Technology Laboratory

Our Research Topics
・Voltage Control by Distributed Generations.
・Construction and System Analysis of Smart Grid
・On Line Analysis of Power System Stability.
・Clarification of Power System Dynamics Based on Phasor Measurement.

Prof. Tadahiro Goda, Assist. Prof. Takuhei Hashiguchi, and Takashi Mitani
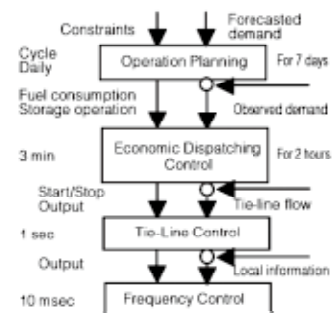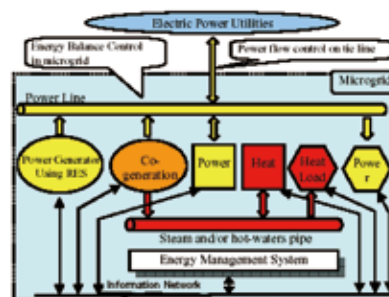
System LSI Research Center (SLRC)

The Goal of SLRC

System LSI Research Center (SLRC) was founded in 2001 to develop the design and application technologies of System LSIs. Due to the rapid progress of semiconductor integrated circuit technology, we can now implement a complicated system which is composed of more than tens of millions of transistors on a tiny silicon chip. A system LSI, which is also called an SoC (System-on-a-Chip), is an integrated circuit consisting of various components such as processors, memories, digital circuits, analog circuits, sensors, radio frequency interface and software. System LSIs have been used in mobile phones, portable computers, digital still cameras, and TV game machines and the application area will be spread to various social systems.

System LSI as Social Information Infrastructure

SLRC is in the second period of which aim to create novel values of System LSIs and to construct next generation social information infrastructure based on achievements of the first period. Design technology of System LSIs itself is important. However social information infrastructure employing System LSIs is shifting its paradigm among the world. We are researching novel social information system employing them as follows:
(1) Electronic Economic Systems
(2) Green Energy Technology
(3) Robot Engineering
(4) Economic Management System
(5) Agricultural System
SLRC is promoting Kyushu University Campus IC Card project and Silicon Sea Belt Fukuoka with Fukuoka prefecture. We have two satellite campuses; Fukuoka System LSI Design and Development Center at Momochihama area which has many LSI design industries since 2004, and Social System Demonstration Center in Itoshima Research Park since 2011.

The Role of SLRC

In Japan, there are several research and education centers for LSI such as VDEC (VLSI Design and Education Center) in the University of Tokyo and Centers in Tohoku University, Hiroshima University, and Kyushu Institute of Technology. The main research subjects of these centers are LSI design methodology, fabrication technology, and testing. The principal question of the research of SLRC is "What are implemented on System LSIs ?" SLRC provides a bridge between requirements of application areas and System LSI technology.
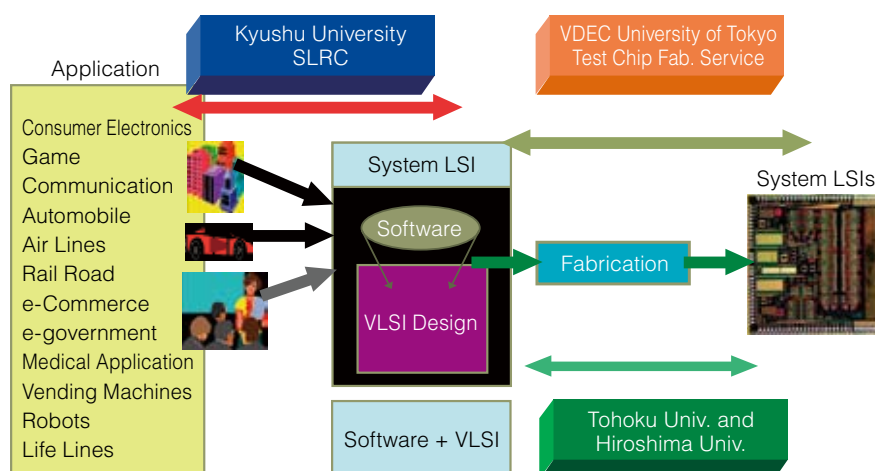
Silicon Sea Belt

Eastern Asian countries are one of the most active areas of the semiconductor industry in the world. We call this area as "Silicon Sea Belt", which includes Korea, Kyushu, Okinawa, Taiwan, Shanghai, Hong Kong, Malaysia and Singapore. More than 60% of LSIs are produced in this area. We are working to establish the collaboration network of technology and business on System LSIs in this area. Fukuoka prefecture started a new project to construct COE of SoC design, named Silicon Sea Belt Fukuoka. We have tight collaboration with Kumamoto, Okinawa and Asian countries.

・Silicon Sea Belt is a center of
  semiconductor fabrication.
・This area is also the world's
  largest market of IT industries.
・More than 50% of production and
  consumption of LSI is done in this area
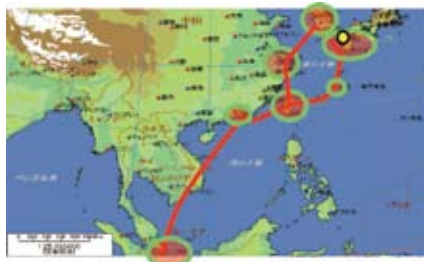
・Collaboration in Silicon Sea Belt objectives:
  – Pipelining for SoC products
  – Marketing and system planning
  – SoC Design (SW and HW)
  – Fabrication (Silicon and board)
  – Testing (from chips to systems)

Divisions and Members of SLRC

Divisions	Faculty Members		
Director	Akira Fukuda	Professor	[Department of Advanced Information Technology]
Social Information Infrastracture	Hiroto Yasuura	Professor (Exective Vice President)	[Department of Advanced Information Technology]
	Ashir Ahmed	Associate Professor	[Department of Advanced Information Technology]
Foundation System Techonlogy	Hiroshi Furukawa	Professor	[Department of Advanced Information Technology]
	Yusuke Matsunaga	Associate Professor	[Department of Advanced Information Technology]
	Koji Inoue	Associate Professor	[Department of Advanced Information Technology]
	Makoto Sugihara	Associate Professor	[Department of Advanced Information Technology, SLRC]
	Haruichi Kanaya	Associate Professor	[Department of Electronics]
Energy Technology	Masahito Shoyama	Professor	[Department of Electrical Engineering]
	Daisuke Nakamura	Associate Professor	[Department of Electrical Engineering]
Embedded Software Technology	Akira Fukuda	Professor	[Department of Advanced Information Technology]
	Tsuneo Nakanishi	Associate Professor	[Department of Advanced Information Technology]
	Kenji Hisazumi	Associate Professor	[Department of Advanced Information Technology, SLRC]
	Yutaka Arakawa	Assistant Professor	[Department of Advanced Information Technology]
Application Systems	Motoji Yamamoto	Professor	[Department of Mechanical Engineering, Faculty of Engineering]
	Masao Nakata	Associate Professor	[Department of Economic Engineering, Faculty of Economics]
	Takashi Okayasu	Associate Professor	[Department of Agro-environmental Sciences, Faculty of Agriculture]
Demonstration of the Social Information Infrastructure	Koji Ishida	Visiting Associate Professor	(Fukuoka Industry, Science & Technology Foundation)

Research Institute of Superconductor Science and Systems (RISS)

Applications of superconductivity to prospective systems of energy transforming and information processing will be based on creative scientific efforts and the accumulation of innovative technology. **The Research Institute of Superconductor Science and Systems (RISS)** has been initiated in 2003 as the joint-use research center of Kyushu University for the basic science and the near-future application of superconductors. Research & Education in **RISS** covers basic phenomena and new concepts in superconductors, improvements in electromagnetic properties of superconducting wires and films, applications to superconductive devices and systems in cooperation with the Graduate Schools/Faculties of Information Science and Electrical Engineering, Engineering, Engineering Sciences, Sciences, and so on.

RISS consists of four divisions: Basic Science, Material Science, Information Systems Engineering and Energy Systems Engineering for Superconductivity. The characterized points are related with intimate connections between superconductor science and the system engineering. Using the unique properties of the superconductors, we can develop high performance in electronic and electrical devices and their systems. They are indispensable for many application fields, e.g., medical and biological science, material science, communication and information processing, energy transforming and industrial structure reforming.

Superconducting transformer for a Shinkansen rolling stock developed in collaboration with Railway Technical Research Institute.

Image of a future society with superconductor technologies

Test scene of a YBCO super-conducting motor installed into a Ship propulsion system in the shipyard of Mitsubishi Heavy Industry. It was partly supported by NEDO.

Superconductor science and Vortex engineering are basic concepts in **RISS** for developing wide application of superconductivity to near-future systems of Information and Energy.

Strategic Activities of RISS
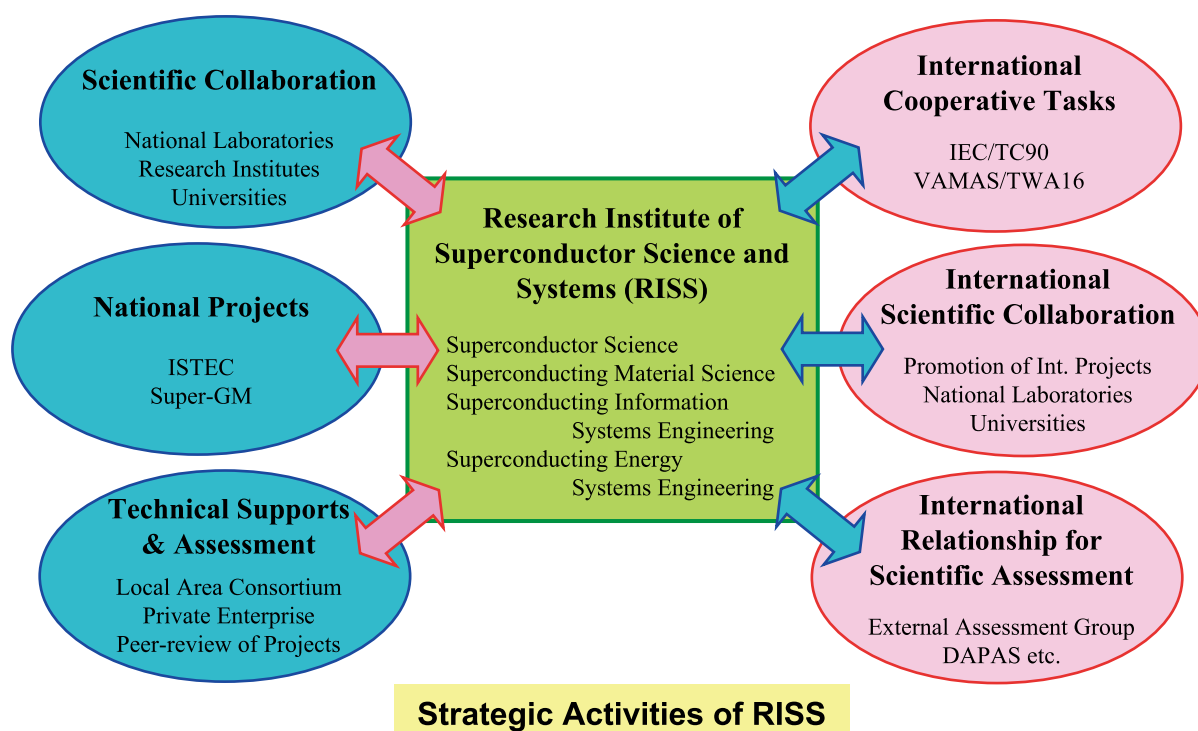
Divisions	Faculty Members	Education and Research Areas
Director		Prof.Keiji Enpuku

Superconductor Science	Professor
	  Kazuo Funaki
	Associate Professor
	  Masataka Iwakuma
		● Fundamental study on the high performance
		● Vast frontiers of the near-future applications

Superconducting Material Science	Professor
	  Masashi Mukaida
	  (Faculty of Engineering)
		● Appraisal methods of the structural performances
		● Advanced structure control for the high performances

Superconducting Information Systems Engineering	Professor
	  Keiji Enpuku
	Professor
	  Takanobu Kiss
		● Basic study on next-generation of the information systems
		● System engineering for advanced sensing and processing

Superconducting Energy Systems Engineering	Professor
	  Ichiro Sasada
	  (Faculty of Engineering Sciences)
	Associate Professor
	  Kazuhiro Kajikawa
		● Basic study on next-generation of energy systems
		● System engineering for new performance and saving

Research Institute for Information Technology (RIIT)

RIIT (Research Institute for Information Technology) is an institute for research and development on wide variety of topics in computer science field such as computation, network, security and education. On the other hand, as a member of Information Infrastructure Initiative in Kyushu University, it is playing an important role in efficient management of information technologies in the university. Moreover, as one of the centers for academic computing, it provides resources for high-performance computing for researchers in Japan.

1. Academic information section

Academic Information Section studies multimedia academic information such as Web data, scientific articles, observational data and social system data. The section researches and develops method and system for collecting, searching and analyzing those data. The section studies cloud computing as basis for information services.

2. Language Education Environment Section

Language Education Environment Section is to explore new research areas between foreign language education and information science. We study and develop ICT based foreign language learning systems as well as teaching methods and materials for language classes. We're now focusing on developing mobile learning systems with smart phones.

3. Learning Spaces Design Section

This section studies on development of information infrastructure for higher education, such as e-learning or distance learning systems. And also studies, analyzes and shares technical and practical knowledge of learning environments, through the support for introduction of e-learning.

4. Next Generation and Future Network Section

Students can study following topics: Key Technologies for Future Internet such as Open Flow and Virtual Networking, advanced techniques for Network Operations based on Power Consumption and Green Technologies, Measurement Technique, Security and Practical case studies using those new technologies with various Internet researchers over the world.

5. Interdisciplinary Computational Science Section

Interdisciplinary Computational Science Section promotes cross-frontier research and development between computational science applications and computer science studies. In particular, it focuses on sophisticated analyses coupling multiple simulations, and advanced e-science studies utilizing grid/cloud computing technologies.

6. Advanced Computing Infrastructure Section

The central topic of the research group is the development on advanced computing infrastructure and its programming for large scale numerical simulations. Especially, it studies technologies for high-performance and high-precision computing on linear problems.

Sections	Faculty Members		
Director	Mutsumi Aoyagi	Professor	Department of Informatics
Deputy Director	Naomi Fujimura	Professor	
Academic Information Section	Sachio Hirokawa	Professor	Department of Advanced Information Technology
	Takahiko Suzuki	Associate Professor	Department of Informatics
	Eisuke Itoh	Associate Professor	Department of Advanced Information Technology
	Tetsuya Nakatoh	Assistant Professor	
Language Education Environment Section	Yoshiyuki Tabata	Professor	
	Chengjiu YIN	Assistant Professor	
Learning Spaces Design Section	Naomi Fujimura	Professor	
	Hitoshi Inoue	Associate Professor	
	Takahiro Tagawa	Assistant Professor	
	Keiichiro Fukazawa	Assistant Professor	
Next Generation and Future Network Section	Koji Okamura	Professor	Department of Advanced Information Technology
	Yoshiaki Kasahara	Assistant Professor	
Interdisciplinary Computational Science Section	Mutsumi Aoyagi	Professor	Department of Informatics
	Hirohumi Amano	Associate Professor	Department of Advanced Information Technology
	Toshiya Takami	Associate Professor	Department of Informatics
	Taizo Kobayashi	Project Associate Professor	
Advanced Computing Infrastructure Section	Seiji Fujino	Professor	Department of Informatics
	Yoshitaka Watanabe	Associate Professor	Department of Informatics
	Takeshi Nanri	Associate Professor	Department of Advanced Information Technology
Research Staff for Computational Science	Akira Nishida	Project Associate Professor	
	Yuichi Inadomi	Project Associate Professor	

Information Technologies in Kyushu University Powered by RIIT

Supercomputing

RIIT is one of the national academic supercomputer centers in Japan. It has large and fast computer systems and offers advanced computing services to university and non-university users. In addition to that, as a member of HPCI in Japan, it is constructing an HPC Infrastructure, centered upon the "K-computer".

RIIT promotes the formation of specialized research clusters of active researchers by code-tuning support tailored to cater to their individual computing needs, and accumulating the latest know-how on computational science for common use. Furthermore, the institute is forming a computing service alliance with the computer centers of neighboring universities and investing collectively on efficient computing resources.

RIIT supports researchers of computational science by hosting events such as forums and tutorials, fulfilling requirements for specific applications, and maintaining user-developed software.

Computer for Education

An important mission within our organization is to offer the ICT environment utilizing computers and networks in ICT education, language education, medical education, and so on. For this purpose, we have installed several PCs throughout our campuses. Moreover, to support learning outside the class and university, we have built an e-learning environment using a web-based learning system and video-on-demand systems. Some course materials and videos on the web learning system are open to the public and are collectively known as Kyushu University Open Course Ware (QOCW) and Kyushu University YouTube. We are actively promoting the QOCW and YouTube project.

Since Kyushu University comprises five major campuses, we also offer iClass (inter Campus Learning ASsistant System) to provide support to classroom students on several campuses.

ID Management and SSO

To provide more security for IT services, the Information Infrastructure Initiative (iCube for short) constructed the campus authentication platform, and have been issuing "SSO-KID" for staff and issuing student ID for students. The iCube is an integrating user authentication platform, and it can deliver user-friendly, trustworthy, and secure protected services. The iCube has the ID management system of all university staff and students. The iCube manages LDAP server, matrix password authentication server, and Shibboleth IdP server. The Shibboleth IdP is not only the university SSO platform but also the world wide academic SSO platform

Educational Computer Room

IC staff ID card

ID and Matrix password (back of IC-staff card)

Hitachi SR16000 L2   **Fujitsu PRIMERGY RX200S6**

Campus Networking

The Kyushu University Integrated-information Transmission Environment (KITE), the university campus network, provides advanced, fast, internet services to university members for e-mail usage, accessing the world wide web, and collaborating with others in relation to their education and research.

Fast Campus Backbone Network and Advanced Gateway Operation

KITE provides 10Gbps Back-bone networking services for the five main campuses (Hakozaki, Ito, Hospital, Kasuga and Ohashi). KITE connects to the Internet by 10Gbps with BGP operation, and provides fast speed and flexible gateway services. Any security incidents are monitored using IDS and detected in real-time by a commercial service

Campus Wide Wireless Service: kitenet

kitenet, which is Kyushu University's wide wireless service, provides wireless Internet services to all of the members in Kyushu University with 802.1x standard and SSO-KID. The users who belong to Kyushu University can get access to the campus network directly but any guest users are provided for on commercial based Internet services on a feature of kitenet based on the security policy of Kyushu University.

Contribution to the Local/National Network Community

We have organized the Information Network Consortium for representatives from universities in Kyushu, Chugoku, and Shikoku. Through promotional activities such as seminars on the latest topics, we help network administrators in these regions improve their skills. We also participate in the operations of SINET (organized by the National Institute of Informatics) and JGN (organized by the National Institute of Information and Communications Technology).

Center of Plasma Nano-interface Engineering (CPNE)

This center was established in October 1st 2010 to promote innovative researches, collaborations with researchers in industry, and worldwide networks for plasma engineering. It consists of four divisions: 1) fundamental plasma engineering, 2) plasma electronics, 3) plasma environmental engineering, and 4) plasma bio-engineering.

The Purpose of CPNE

Plasma-based fabrication of nanomaterials and nanostructures is widely employed for top-down processes such as ULSI processing as well as bottom-up processes such as carbon nanotube production. CPNE explores frontier science of interactions between plasmas and nano-interfaces by focusing on novel features such as fluctuations of interactions due to the nanometer scale. Plasma processing based on the science realizes highly precise top-down processes by suppressing fluctuations and well controlled self-organized bottom-up processes by controlling fluctuations. CPNE aims to bring about an explosive development of fabrication technologies of nanomaterials and nanostructures. We are carrying out international collaborations with Germany and Korea as well as companies.

Divisions and Members of CPNE

Divisions	Faculty Members		
Director	Masaharu Shiratani	Professor	[Department of Electronics]
Fundamental plasma engineering	Kunihiro Kamataki	Assistant Professor	[Center for Research and Adcancedment in Higher Educaton]
	Seo Hyunwoong	Assistant Professor	
Plasma electronics	Naho Itagaki	Associate Professor	[Department of Electronics]
Plasma environmental engineering	Masaharu Shiratani	Professor	[Department of Electronics]
	Giichiro Uchida	Assistant professor	[Department of Electronics]
Plasma bio-engineering	Junya Suehiro	Professor	[Department of Electrical Engineering]
	Kazunori Koga	Associate professor	[Department of Electronics]
	Michihiko Nakano	Assistant professor	[Department of Electrical Engineering]

An Introduction to
Center of Plasma Nano-interface Engineering (CPNE)

Overview: This center was established in October 1st 2010 to promote innovative research, collaboration with researchers in industry, and worldwide networks for plasma engineering. It consists of four sections: 1) fundamental plasma engineering section, 2) plasma electronics section, 3) plasma environmental engineering section, and 4) plasma bio-engineering section.

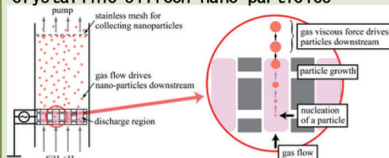## I. Nano-particles produced due to plasma surface interaction

Small spherical dust particle 1 nm-1 μm in size spherical

Large flake irregular shape

Agglomerate above 1 μm in size

Two important growth mecanisms

CVD

radical

deposit of radicals on the surface of nano-blocks

spherical shape

agglomeration

UV photon

first electron

charging processes

agglomeration between a small dust particle charged positively and a large dust particle charged negatively

Y. Watanabe, M. Shiratani, K. Koga, et al., J. Vac. Sci. Technol., A14, 540 (1996).
S. Nunomura, M. Shiratani, K. Koga, et al., Phys. Plasmas, 15, 080703 (2008).

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1. Fundamental plasma engineering section
Staff: Assistant Professor Kunihiro Kamataki

I. Deposition profile control using plasma anisotropic CVD method

Independent control
1. Radicals are generated in main discharge.
2. H atoms are generated in ICP discharge.
3. Ions are accelerated with RF bias voltage.

Sub-conformal — Conformal — Anisotropic

We have realized profile control of C films in fine trenches using a hydrogen assisted plasma CVD.

5/14

II. Nano-particle composite films for Ultra Low-k films

A manipulator with an arm and fingers does not work well in nano scale; because once a nano-block sticks to the fingers, it is difficult to remove it from the fingers due to large surface to volume ratio (a kind of agglomeration).

Nano-block

3 advantages of plasmas for fabricating nano-systems:
1. agglomeration control of nano-blocks,
2. transport control of nano-blocks,
3. parallel processing.

With AM agglomeration can be suppressed due to two effects:
1. Transport takes place during the modulation and nano-blocks are charged negatively.
2. A high transport velocity.

Nano-blocks grew due to their thermal agglomeration.

Porous low k films having Young's modulus above 10 GPa and k value down to 1.5 are obtained using the nano-block manipulation.

2. Plasma electronics section
Staff: Associate Professor Naho Itagaki

Center of Plasma Nano-interface Engineering

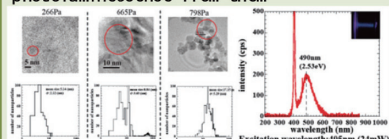### 3. Plasma environmental engineering section
Staffs: Distinguished Professor Masaharu Shiratani, Assistant Professor Giichiro Uchida
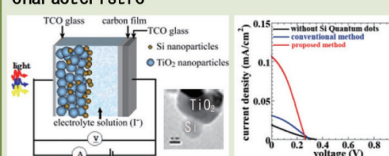
I. Third generation solar cells

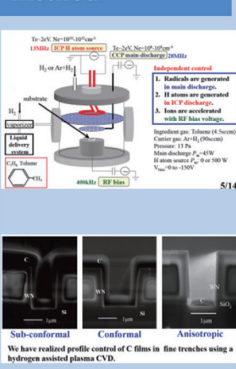Novel developed method for producing crystalline silicon nano-particles

gas viscous force drives particles downstream
particle growth
nucleation of a particle
discharge region

Size control of nano-particles and photoluminescence from them

266Pa   665Pa   798Pa

490nm (2.53eV)

Excitation wavelength:405nm (24mW)

Device structure of nano-particle sensitized solar cells and their IV characteristic

II. High quality thin film Si solar cells

Multi-hollow discharge plasma CVD method. Lower volume fraction of amorphous silicon nano-particles in films shows higher stability of the films.

parallel plate electrode

hollow electrode

conventional method
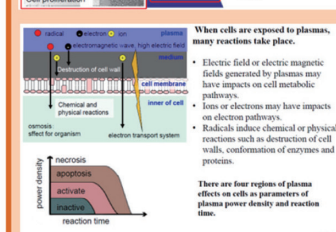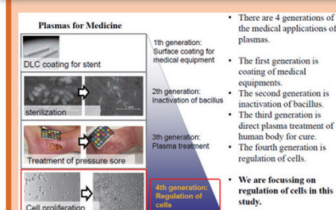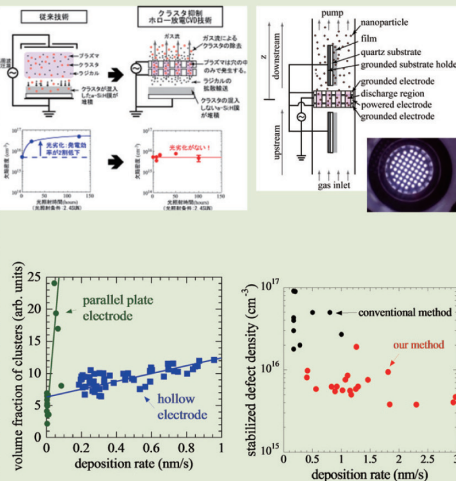
our method

4. Plasma bio-engineering section
Staffs:
Professor Junya Suehiro,
Associate Professor Kazunori Koga,
Assistant Professor Michihiko Nakano

Plasmas for Medicine

- There are 4 generations of the medical applications of plasmas.
- The first generation is coating of medical equipments.
- The second generation is inactivation of bacillus.
- The third generation is direct plasma treatment of human body for cure.
- The fourth generation is regulation of cells.
- We are focusing on regulation of cells in this study.

When cells are exposed to plasmas, many reactions take place.

- Electric field or electric magnetic fields generated by plasmas may have impacts on cell metabolic pathways.
- Ions or electrons may have impacts on electron pathways.
- Radicals induce chemical or physical reactions such as destruction of cell walls, conformation of enzymes and proteins.

There are four regions of plasma effects on cells as parameters of plasma power density and reaction time.

Ref. E. Stoffels et al., JPD 36(2003) 2908.

Plasma irradiation stimulates growth of sprouts.

The growth rate of sprouts with irradiation is 20% faster than that without irradiation.

Possible growth stimulation mechanisms are
(1) Oxidation reactions in cell metabolic cycle,
(2) Photons and/or ions effects,
(3) Etching effect.

10/15

Kyushu University is selected as one of the three chair universities (Kyushu University, Kyoto University, and Waseda University) to support the setup of Egypt-Japan University of Science and Technology (E-JUST), a national project between Japan and Egypt, in Arab Republic of Egypt. The Faculty of Information Science and Electrical Engineering in Kyushu University is in charge of establishing the intra-disciplinary collaborations with the department of Electronics and Communication Engineering (ECE) which is one of the seven departments in E-JUST. To execute these duties effectively, the Center for Japan-Egypt Cooperation in Science and Technology (EJUST Center) was set up in August 2010 in Kyushu University. Moreover, E-JUST's objective is to support a unique model of international cooperation in the higher education. It also aims to establish an ecosystem in Egypt and African region to train their students and young researchers in the department of ECE of E-JUST or even to establish a sustainable way of international exchange of future leaders in science and technology in the region.

The center provides advanced analytical as well as technological knowledge in various fields of electronics and communication engineering. The program includes a number of core as well as elective courses, which permits the students to specialize in a particular area. The center also dispatches two associate professors to E-JUST who stay at the E-JUST for a semester every year and take the responsibility to teach one course. The other full-time professors and associate professors at the center supervise the student of E-JUST through video conferencing system regularly in the capacity of a co-advisor and visit the E-JUST whenever necessary. The center is currently taking care of the students of three fields: (i) radio frequency, analog and mixed signals LSI technology for next generation wireless communication systems (ii) VLSI engineering for multi-core digital processor, and (iii) digital communication systems and networks as illustrated in Fig. 1.
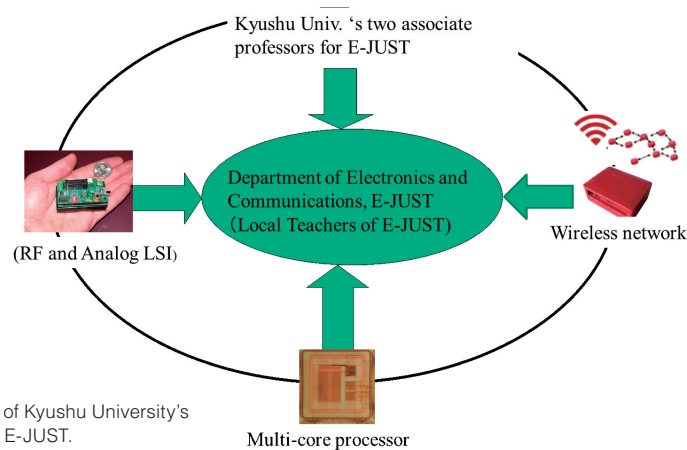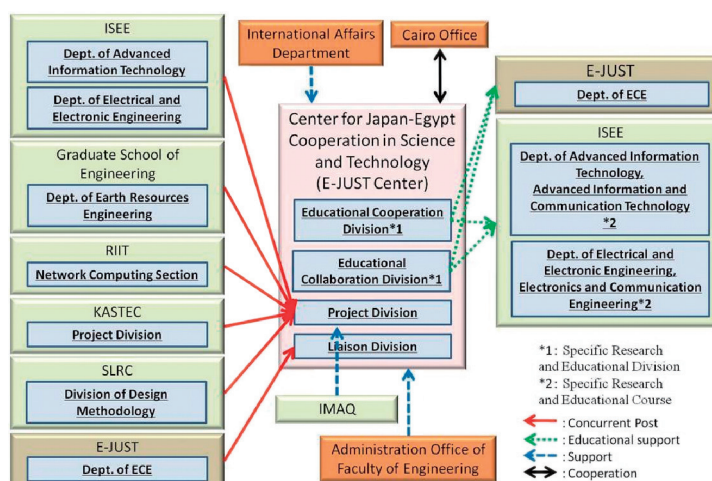

Fig.1 Illustration of Kyushu University's support to E-JUST.

Division	Role Content
Educational Cooperation Division (Specific Research and Educational Division)	Mission (1)： Contract enforcement, which was signed up with JICA, as a "Main program supporting university for E-JUST," namely, education and research guidance at E-JUST's ECE.
Educational Collaboration Division (Specific Research and Educational Division)	Mission (2)-1： Implementation of industry-university cooperative research between Japan and Egypt Mission (2)-3： Developing and implementing of acceptance programs for E-JUST's students Mission (2)-5： Developing and implementing of double degree program at E-JUST with Kyushu university
Project Division	Mission (2)-1： Implementation of industry-university cooperative research between Japan and Egypt Mission (2)-2： Development and implementation of training program on university governance and management Mission (2)-4： Development and implementation of educational programs on Japanese, Japanese culture, internal affairs of Japan, Arabic, Middle-East affairs and Middle-Eastern culture Mission (2)-5： Developing and implementing of double degree program at E-JUST with Kyushu university
Liaison Division	Mission (3)： The establishment of a liaison office at E-JUST and promoting cooperation activities between E-JUST in Egypt and E-JUST Center at Kyushu university

Divisions	Faculty Members		
Director	Keiji Yoshida	Professor	Department of Electrical and Electronic Engineering
Vice Director	Kazuaki Murakami	Professor	Department of Advanced Information Technology
Educational Cooperation	Jia Hongting	Associate Professor	E-JUST Center
	Victor Goulart	Associate Professor	E-JUST Center
Educational Collaboration	Kuniaki Yoshitomi	Professor	E-JUST Center
	Ramesh Pokharel	Professor	E-JUST Center
	Osamu Muta	Associate Professor	E-JUST Center
	Farhad Mehdipour	Associate Professor	E-JUST Center
Project	Keiji Yoshida	Professor	Department of Electrical and Electronic Engineering
	Kazuaki Murakami	Professor	Department of Advanced Information Technology
	Hiroshi Furukawa	Professor	Department of Advanced Information Technology
	Tanemasa Asano	Professor	Department of Electrical and Electronic Engineering
	Koichiro Watanabe	Professor	Department of Earth Resources Engineering, Graduate School of Engineering
	Reiji Hattori	Professor	Art, Science and Technology Center for Cooperative Research
	Koji Okamura	Professor	Research Institute for Information Technology
	Haruichi Kanaya	Associate Professor	Department of Electrical and Electronic Engineering
	Koji Inoue	Associate Professor	Department of Advanced Information Technology
Liaison	(TBD)	Professor	Egypt-Japan University of Science and Technology (E-JUST)
	(TBD)	Professor	Egypt-Japan University of Science and Technology (E-JUST)

Courses and Subjects of ISEE

The Curriculum Outline of the Graduate School of Information Science and Electrical Engineering

The curriculum of the Graduate School of Information Science and Electrical Engineering (ISEE) was drastically changed, accompanied by reorganization of the graduate school in 2009. The social and industrial communities point out shortage of information and hardware engineers, supporting information systems. To cope with the above problem is the primary object of the present curriculum revision. Social demands for the education of ISEE can be summarized as the following three subjects.

1. Needs for advanced informatics education, which copes with the rapid progress of the scientific scheme related to information technology, caused by worldwide networking.
   ○Education of researchers and engineers who support technological scheme concerned with contents structuralizing from information.
   ○Education of researchers and engineers who support a theoretical backbone of information technology.
2. Needs for ICT specialist, particularly leading researchers and engineers, triggered with infiltration of the social information foundation.
   ○Education of researchers and engineers who support the infrastructure basis of the advanced information system.
   ○Education of researchers and engineers who support an advanced information foundation with awareness of interference with the real world, including the real world information processing.
3. Needs for education, accommodating to technological revolution and extending interdisciplinary research field in the electrical engineering.
   ○Education of researchers and engineers who support the physical layer of information and energy.
   ○Education of researchers and engineers, supporting interdisciplinary area between the information system and the electrical system.

Education in the graduate school of ISEE is conducted by three departments corresponding to the above subjects. Additional courses, according to the field specialty and the educational method, are established in the department to clarify the details of educational contents. Establishment of the courses enables us to educate wide variety of engineers satisfying future industrial needs, without reorganization of the department. Fundamental ideas of the curriculum for the Doctor and Muster courses are as follows.

Characteristic Education Methods

(a) An advisory committee is organized for each student to give personalized, close guidance (Doctoral Program).
(b) Real PBL (Project-Based Learning) is introduced for practical education.
(c) Collaboration with industries is established for nurturing leading ICT engineers and introducing leading-edge technologies to Master Program.
(d) Practical English education is performed by lectures in English and international PBL.
(e) A long-term Internship program is introduced by collaboration with industries.
(f) Lectures and guidance in PBL are given by engineers who are active at the forefront of industries.
(g) Subjects on intellectual property management, entrepreneuring, and engineering ethics are available as graduate school common subjects.
(h) Practical education on safety and ethics is performed in experiments and exercise.
(i) Collaboration with Graduate School of System Life Science is established.
(j) Collaboration with Graduate School of Mathematics is established to enhance the education on mathematics.
(k) Collaboration with Graduate School of Integrated Frontier Science is established to explore new interdisciplinary fields.

Curriculum for Doctoral Course Students

ISEE will organize an advisory committee for each doctoral course student. The advisory committee is composed of several faculty members of ISEE and other specialists from companies, universities, etc. The committee first designs individual curriculum according to the research theme of the student, then checks her/his progress periodically and suggests appropriate directions. The committee also will give some advice on possible career paths. The curriculum offers chances to learn intellectual property and teaching skill and join authorized long-term internship.
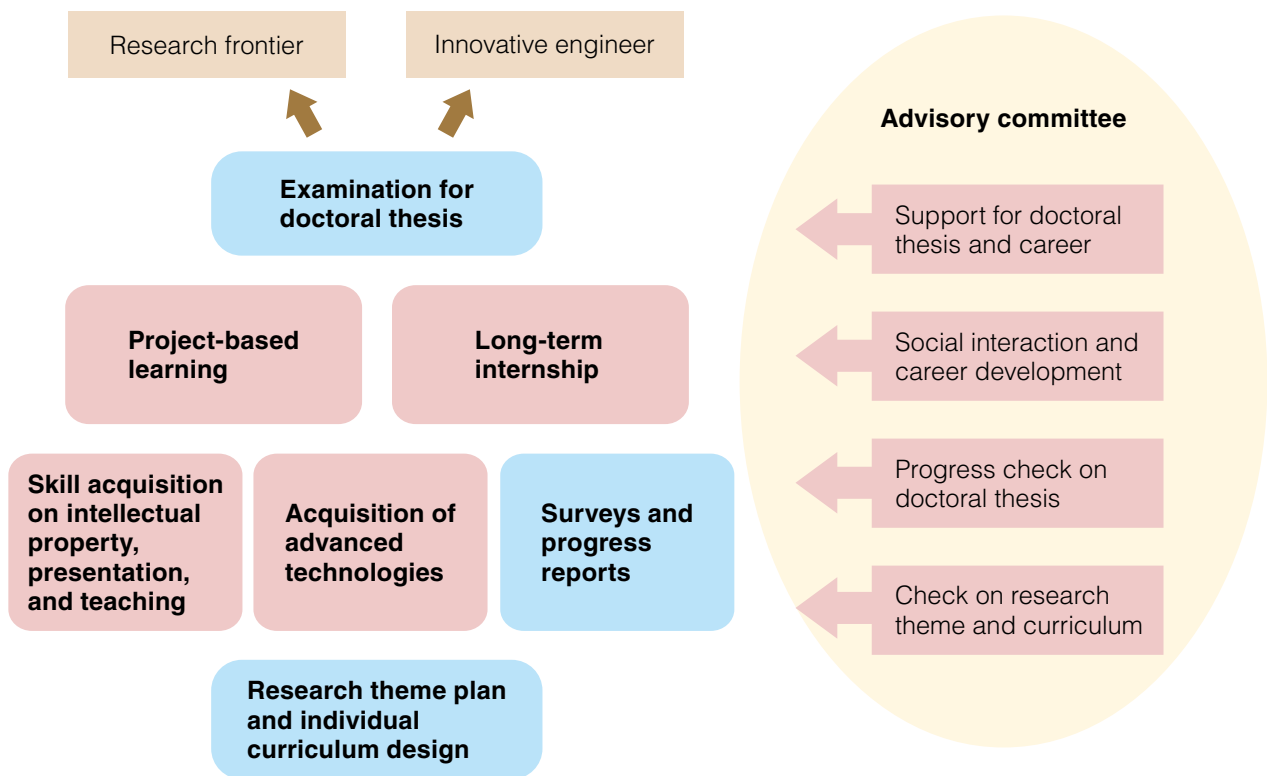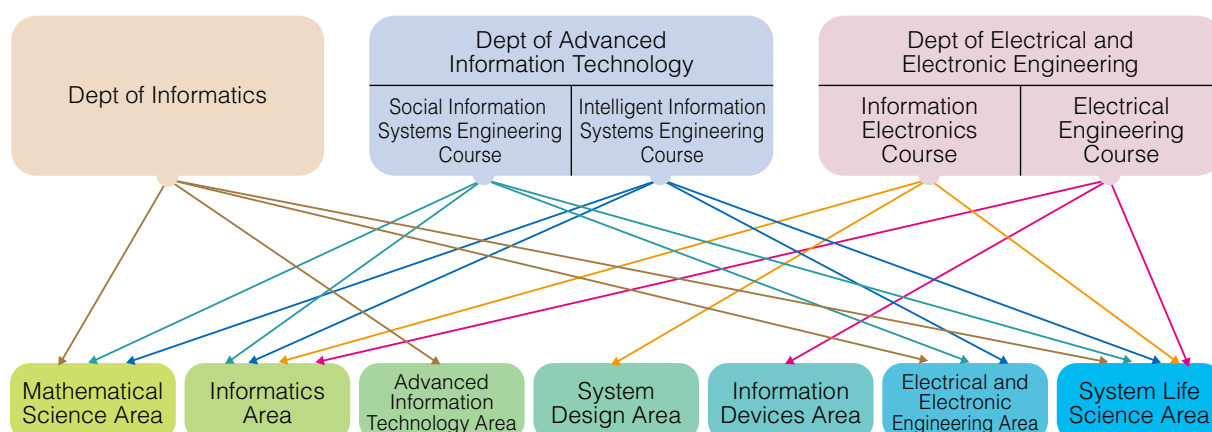

Curriculum for doctoral course students

Courses and Subjects of ISEE

Curriculum for Master Course Students

Practical education systems have been established by emphasizing experiments, exercise, discussion and course works. Especially, extended subjects have been introduced in order to cover interdisciplinary area which is closely related to each department and/or courses. Students should select one extended area and should take classes from the designated extended subjects in addition to their major field. Minimum required credits are 45, which is world standard level. Subjects are categorized as follows so as to be able to take courses in a systematic way.

(a) Common basic subject: Common subject in the ISEE (also include designated graduate school common subjects in the Kyushu University.)

(b) Core subject: Basic subjects in each department and/or courses

(c) Advanced subject: Advanced topics based on the core subjects

(d) Survey and discussion: Survey, presentation and discussion related to research works

(e) Extended subject: Basics in extended elective area closely related to major field of each department and/or course (Faculty members from other collaborated graduate school and other department will give lectures)

(f) Elective subject

Elective area for the extended subjects in each department
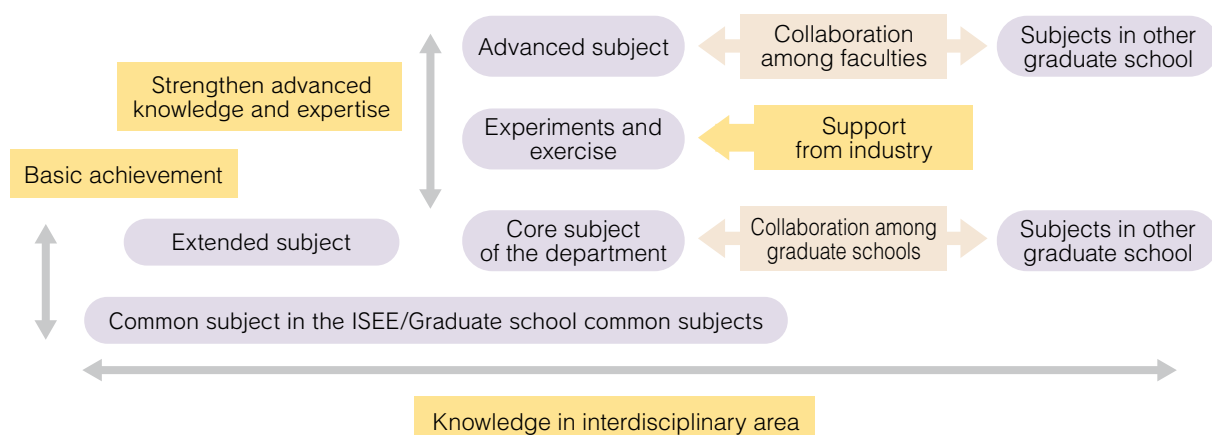
Curriculum for master course students
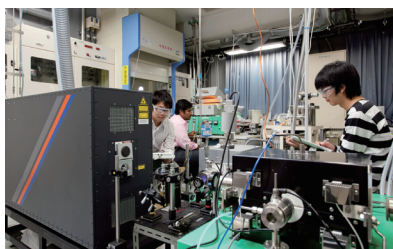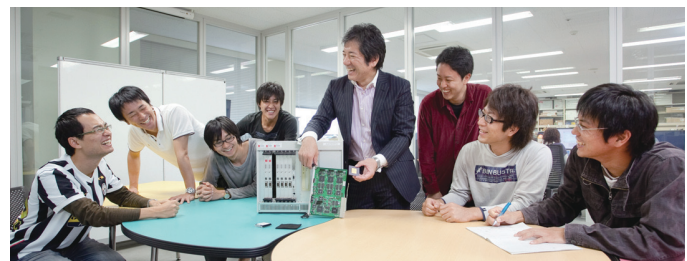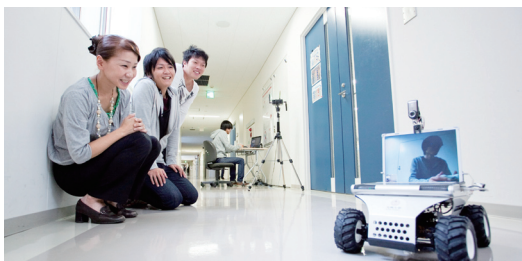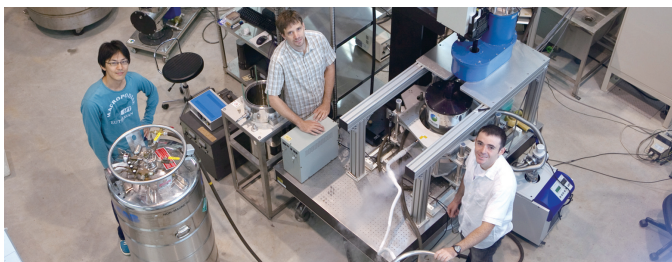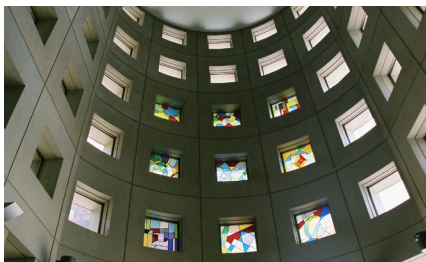
Admissions for International Students

Admission Requirements of the Applicants for the Master's Program

The time of entrance to the Master's Program for international students is in April and the selection is scheduled in August of the previous year and in early February. Applicants who have either a Japanese university degree or are expected to graduate from a Japanese university are not eligible for the selection in February.

1. Applicants must have completed sixteen years of school education abroad or must be expected to complete the curriculum.

2. Applicants must have completed fifteen years of education abroad and must be recognized by Kyushu University to have acquired enough course credits with good standing.

3. Applicants must be recognized to possess equivalent or superior qualifications of a graduate of a university based on an individual screening by our graduate school and must be 22 years old by the time of admission.

Notes

○Applicants, who are qualified to 2 or 3 of the mentioned above, must be screened for their eligibility in advance.

○Applicants who have either a Japanese university degree or are expected to graduate from a Japanese university must go through a general selection screening process.

○For more details about the application period, forms and documents which need to be submitted, the method of selection, etc., please refer to the Guidances for Applicants or the following website.

http://www.isee.kyushu-u.ac.jp/e/admissions/

Admission Requirements of the Applicants for the Doctoral Program

The time of entrance to the Doctoral Program for international students is in April and October and selection is scheduled in late February and late August.

Applicants have to meet one of the following requirements:

1. Applicants must have attained a master's degree by the time of admission or must be expected to attain a master's degree.

2. Applicants must have attained the equivalent credentials abroad to a master's degree of Japan.

3. Applicants must have been accredited by the Minister of Education, Culture, Sports, Science and Technology (Applicants who have graduated from a university and have been in charge of research in a university or institute for more than two years and besides must be recognized by our Graduate School to have the equivalent or superior qualifications to a master's degree based on their achievements).

4. Applicants must be recognized by our Graduate School to have the equivalent or superior qualifications to a master's degree based on an individual screening and must be twenty-four years old.

| Notes |

○Applicants, who are qualified to 3 or 4 of the mentioned above, are advised to contact the Educational Affairs Section of Kyushu University in advance.
○For more details about the application period, forms and documents which need to be submitted, the method of selection etc., please refer to the Guidelines for Applicants or the following website.
http://www.isee.kyushu-u.ac.jp/e/admissions/

Inquiry

Educational Affairs Section,
Faculty of Engineering, Kyushu University
744, Motooka, Nishi-ku, Fukuoka 819-0395, JAPAN
TEL+81-92-802-2722

Maps

ITO Campus

Satellite Communications Laboratory (IE20)

Research Institute of Superconductor Science and Systems(North bldg.)(CE51)

Institute of Environmental Systems

❷

Research Institute of Superconductor Science and Systems(South bldg.)(CE50)

Kyudai Kougakubu-mae Bus-stop

Energy Center

Hydrogen Station

Hydrogen Technology Research Center

← Satellite Communications Laboratory

Kyudai Big Orange-mae Bus-stop

Electric Power Laboratory(IE11)

High Voltage Laboratory (IE10)
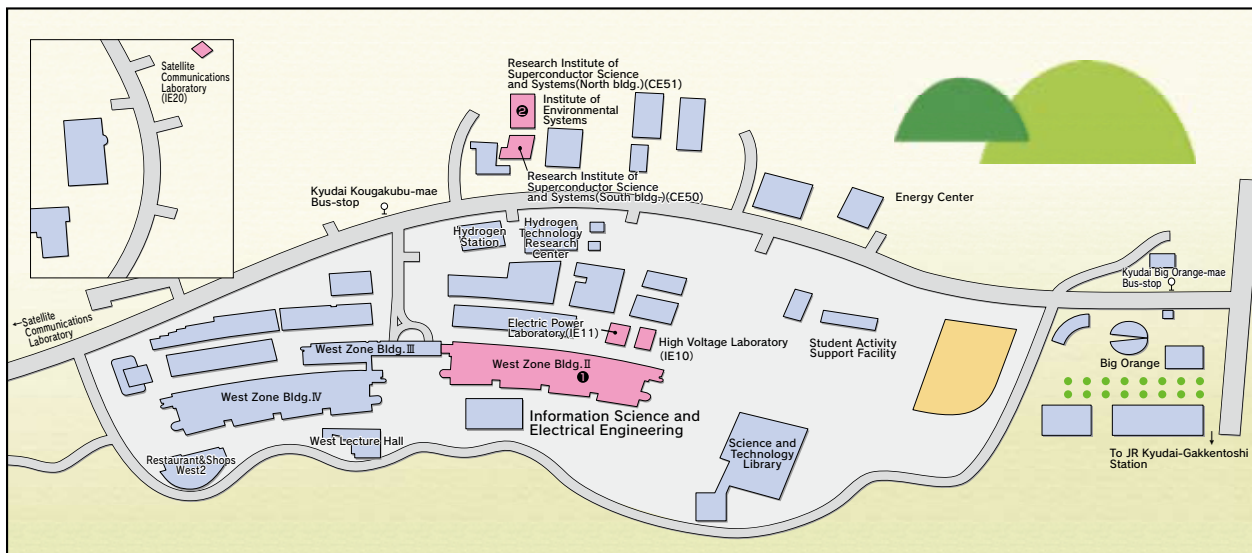
Student Activity Support Facility

West Zone Bldg.Ⅲ

West Zone Bldg.Ⅱ

❶

Big Orange

West Zone Bldg.Ⅳ

Information Science and Electrical Engineering

West Lecture Hall

Restaurant&Shops West2

Science and Technology Library

To JR Kyudai-Gakkentoshi Station

Access to Ito Campus

From Fukuoka Airport
By Subway + JR + Showa Bus:Fukuoka Kuko【Airport】Sta. ― (Subway Kuko Line: approx. 25 min.) ― Meinohama Sta. ― (JR Chikuhi Line: approx. 10 min.) ― Kyudai-Gakkentoshi Sta. ― (Showa Bus bound for Kyudai Kougakubu-mae:approx. 15 min.) ― Kyudai Kougakubu-mae

From Hakata Station
By Subway + JR + Showa Bus: Hakata Sta. ― (Subway Kuko Line: approx. 20 min.) ― Meinohama Sta. ― (JR Chikuhi Line: approx. 10 min.) ― Kyudai-Gakkentoshi Sta. ― (Showa Bus bound for Kyudai Kougakubu-mae:approx. 15 min.) ― Kyudai Kougakubu-mae
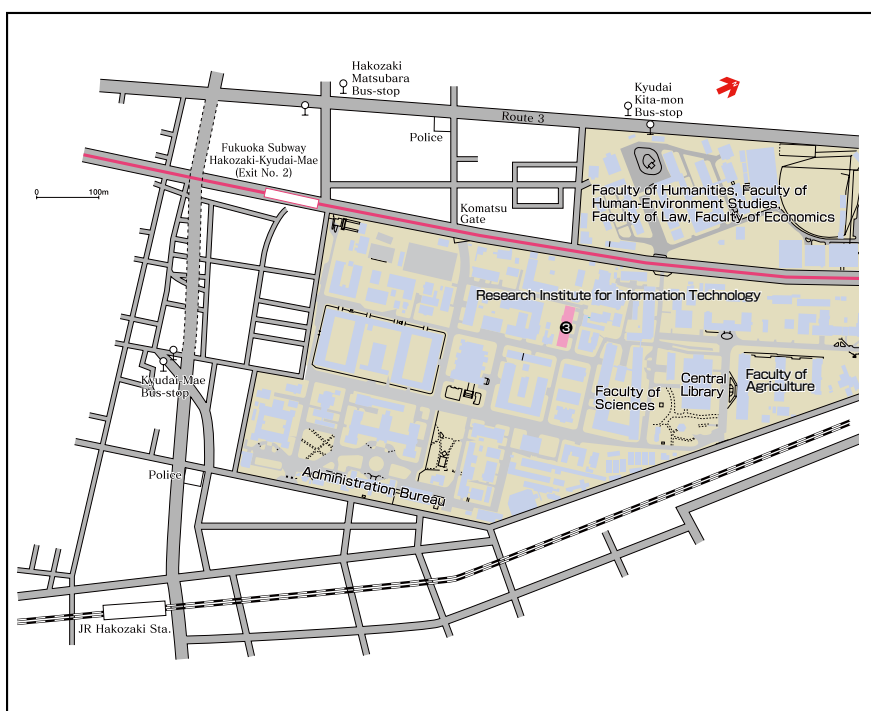**By Nishitetsu Bus**: Hakata Sta. A [Hakata Exit] ― (Nishitetsu Bus [Express] bound for Kyudai Ito Campus: approx. 55 min.) ― Kyudai Kougakubu-mae

From Tenjin
By Subway + JR + Showa Bus: Tenjin Sta. ― (Subway Kuko Line: approx. 13) ― Meinohama Sta. ― (JR Chikuhi Line: approx. 10 min.) ― Kyudai-Gakkentoshi Sta. ― (Showa Bus bound for Kyudai Kougakubu-mae:approx. 15 min.) ― Kyudai Kougakubu-mae
By Nishitetsu Bus: Tenjin2B [Solaria Stage] ― (Nishitetsu Bus [Express] bound for Kyudai Ito Campus: approx. 43 min.) ― Kyudai Kougakubu-mae

HAKOZAKI Campus

Hakozaki Matsubara Bus-stop

Kyudai Kita-mon Bus-stop

Route 3

Police

Fukuoka Subway Hakozaki-Kyudai-Mae (Exit No. 2)

Faculty of Humanities, Faculty of Human-Environment Studies, Faculty of Law, Faculty of Economics

Komatsu Gate

100m

Research Institute for Information Technology

❸

Kyudai-Mae Bus-stop

Faculty of Sciences

Central Library

Faculty of Agriculture

Police

Administration Bureau

JR Hakozaki Sta.

Access to Hakozaki Campus

From Fukuoka Airport
By Subway (approx. 30 min.): Fukuoka Kuko 【Airport】 Sta. ― (Subway Kuko Line) ― Nakasu-Kawabata Sta. ― Transfer to a train bound for Kaizuka (Subway Hakozaki Line) ― Hakozaki-Kyudaimae Sta.
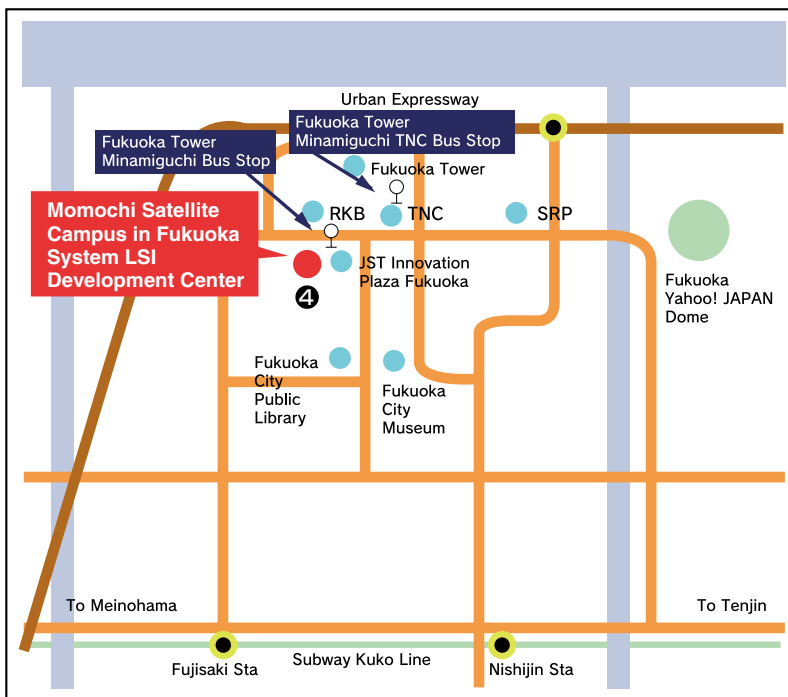**By Taxi** (approx. 20 min.)

From JR Hakata Station
By JR railway (approx. 20 min.): JR Hakata Sta. ― (JR Kagoshima Line, northbound train) ― Hakozaki Sta.
By Subway (approx. 25 min.): Hakata Sta. ― (Subway Kuko Line) ― Nakasu-Kawabata Sta. ― Transfer to a train bound for Kaizuka (Subway Hakozaki Line) ― Hakozaki-Kyudaimae Sta.
By Taxi (approx. 20 min.)

Department/Institute	Campus	Building	Number in map
Graduate School / Faculty of Information Science and Electrical Engineering	Ito	West Zone Bldg. Ⅱ	❶
Research Institute of Superconductor Science and Systems	Ito	Research Institute of Superconductor Science and Systems (CE50, 51)	❷
System LSI Research Center	Ito, Momochi, Itoshima	West Zone Bldg. Ⅱ (Ito)	❶❹❺
Research Institute for Information Technology	Hakozaki	Research Institute for Information Technology	❸
Center for Japan-Egypt Cooperation in Science and Technology	Ito, Momochi	West Zone Bldg. Ⅱ (Ito)	❶❹
Center for Plasma Nano-Interface Engineering	Ito	West Zone Bldg. Ⅱ (Ito)	❶

MOMOCHI Satellite Campus

Urban Expressway

Fukuoka Tower Minamiguchi Bus Stop

Fukuoka Tower Minamiguchi TNC Bus Stop

Fukuoka Tower

RKB   TNC   SRP

Momochi Satellite Campus in Fukuoka System LSI Development Center

JST Innovation Plaza Fukuoka

❹

Fukuoka Yahoo! JAPAN Dome

Fukuoka City Public Library

Fukuoka City Museum

To Meinohama

To Tenjin

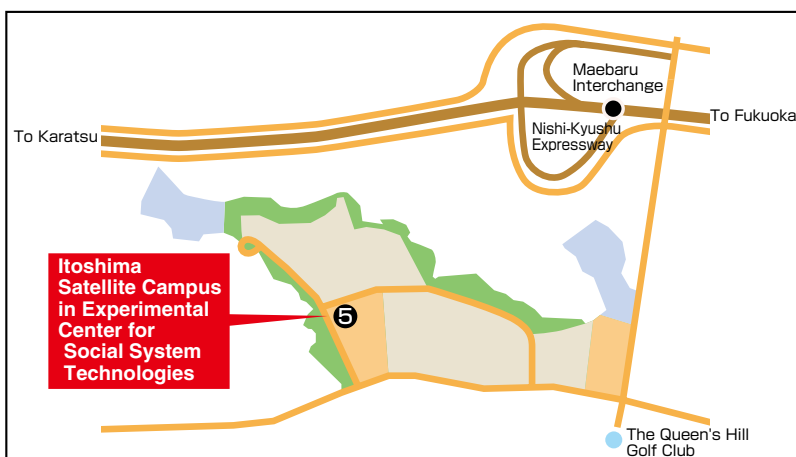Fujisaki Sta   Subway Kuko Line   Nishijin Sta

Access to Momochi Satellite Campus

From Fukuoka Airport and JR Hakata Station
By Subway (approx. 15 min.) + Taxi (approx. 10 min.)
Subway: Fukuoka Kuko【Airport】Sta. (or Hakata Sta.) ― (Subway Kuko Line) ― Nishijin Sta.

ITOSHIMA Satellite Campus

Maebaru Interchange

Nishi-Kyushu Expressway

To Karatsu

To Fukuoka

Itoshima Satellite Campus in Experimental Center for Social System Technologies

❺

The Queen's Hill Golf Club

Access to Itoshima Satellite Campus

From Fukuoka Airport, JR Hakata Station, and Tenjin
By Subway + JR + Taxi: Fukuoka Kuko【Airport】Sta. (or either Hakata Sta. or Tenjin Sta.) ― (Subway Kuko Line: approx. 25 min.) ― Meinohama Sta. ― (JR Chikuhi Line: approx. 20 min.) ― Chikuzen-maebaru Sta. ― Taxi (approx. 10 min.)

Maps

The Graduate School / Faculty of Information Science and Electrical Engineering moved to the new Ito Campus in 2006. However, some faculty members and students take part in research and educational activities at the Hakozaki Campus, since several related departments such as the Research Institute for Information Technology have not yet moved. The Graduate School / Faculty of Information Science and Electrical Engineering, the System LSI Research Center, and Center for Japan-Egypt Cooperation in Science and Technology have a satellite campus in the Momochi area, where IT industries accumulate. The System LSI Research Center also newly opened a satellite campus in Itoshima area in May 2011 in accordance with the establishment of Experimental Center for Social System Technologies, which is managed by Fukuoka Prefecture.
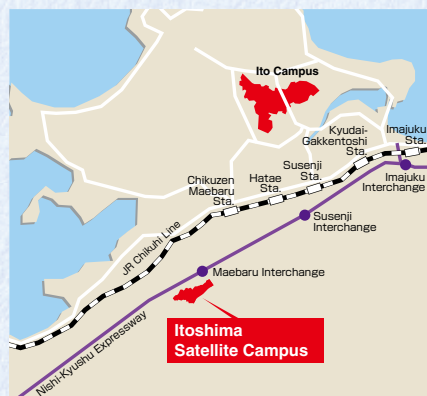
Graduate School / Faculty of Information Science and Electrical Engineering Kyushu University

http://www.isee.kyushu-u.ac.jp/e/

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- Office of the Department of Advanced Information Technology
  Tel: +81-92-802-3601
- Office of the Department of Electrical and Electronic Engineering
  Tel: +81-92-802-3701
- Graduate School / Faculty of Information Science and Electrical Engineering
  Fax: +81-92-802-3600
- Educational office of the Department of Electrical Engineering and Computer Science
  Tel: +81-92-802-3711 Fax: +81-92-802-3710

Momochi Satellite Campus: Fukuoka Institute of System LSI Design Industry 3F, 3-8-33 Momochihama, Sawara-ku, Fukuoka 814-0001
- Satellite Office
  Tel: +81-92-847-5190

Itoshima Satellite Campus: Experimental Center for Social System Technologies, 1963-4 Higashi, Itoshima, Fukuoka 819-1122
- Satellite Office of the System LSI Research Center
  Tel: +81-92-332-8006