isee

**Information Science and Electrical Engineering**
**Kyushu University**

Graduate School / Faculty of
# Information Science and
# Electrical Engineering
## ISEE Kyushu University 2013

KYUSHU
UNIVERSITY

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

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 21$^{st}$ 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 2013

Dean and Professor
Graduate School and Faculty of Information Science and Electrical Engineering

## Dr. Rin-ichiro Taniguchi
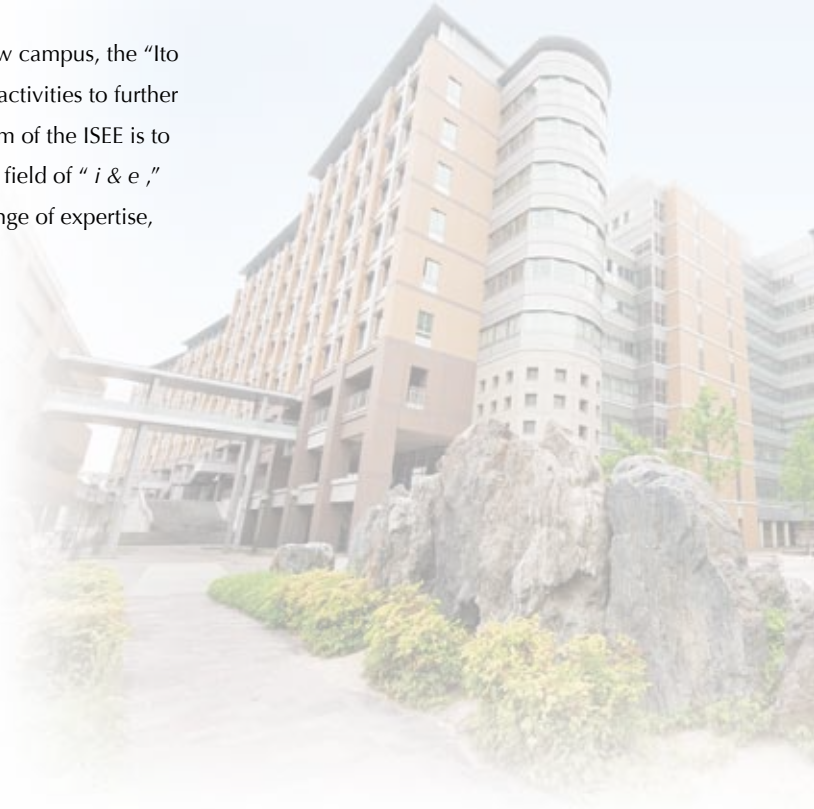
# Summary

## 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. Following the Kyushu University's strategic scheme for University Reform and Activation, the ISEE founded the following two independent departments; Department of Giga Photon Next GLP in 2011 and Department of I & E Visionaries in 2012.

# Educational Features of the ISEE

## 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-four 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 2014, 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 ISEE

## 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 April, 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.

## 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.
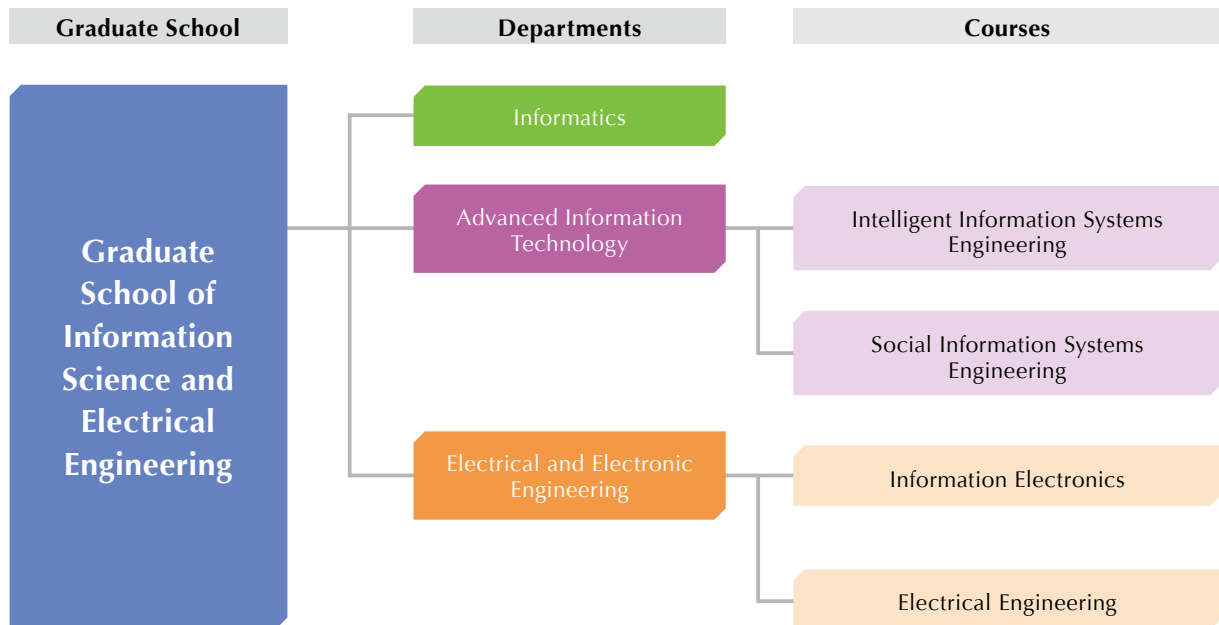
At present, departments in the Graduate School correspond to departments in the Graduate Faculty except for the Department of Electrical and Electronic Engineering. The advantage of separating research from education is to make the Graduate School system more flexible. For example, this flexibility has 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. the Graduate School of Systems Life Sciences and the 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

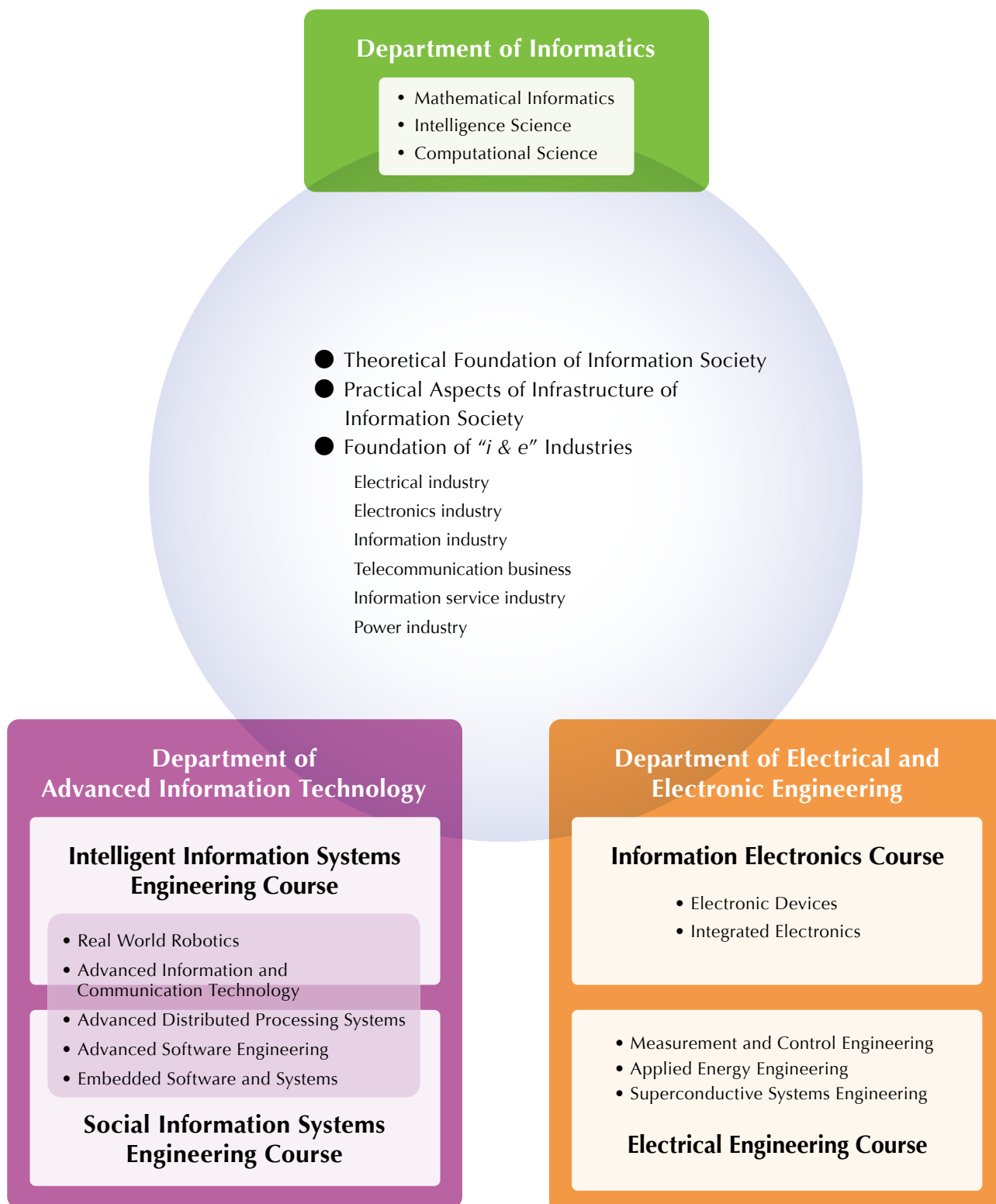**Departments and Their Quota of Students**

| 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<br>　(Intelligent Information Systems Engineering Course)<br>　(Social Information Systems Engineering Course) | 15 | 45<br>(25)<br>(20) |
| Department of Electrical and Electronic Engineering<br>　(Information Electronics Course)<br>　(Electrical Engineering Course) | 16 | 55<br>(27)<br>(28) |
| Total | 45 | 140 |

## 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

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

### Electrical Engineering Course

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

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

## 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*

## 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*
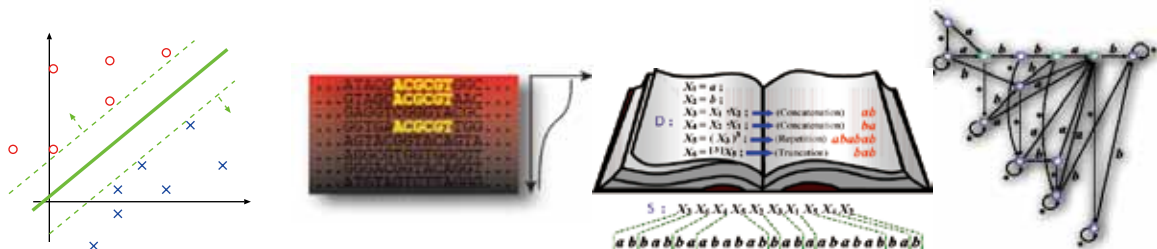


## Learning Theory and Nonlinear Systems Laboratory

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, Assist. Prof. Masanori Kawakita*
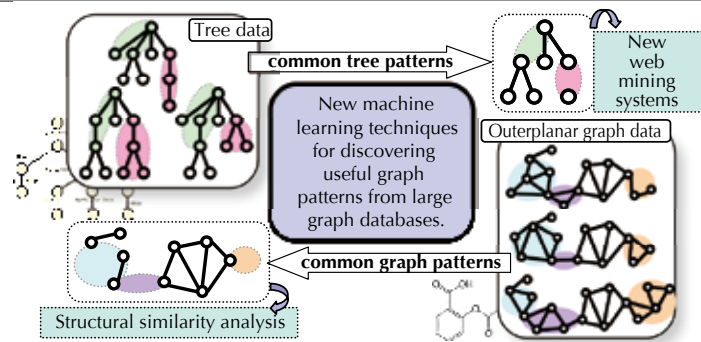
## Algorithm Science Laboratory

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*



1. Extract User's Profile

*User's Profile*

2. Web Retrieval by Using User's Profile

4. Personalize the Results

*User*

*Web*

Personalized Results     Results

5. Return the Personalized Results

3. Return the Results

*Personalization*
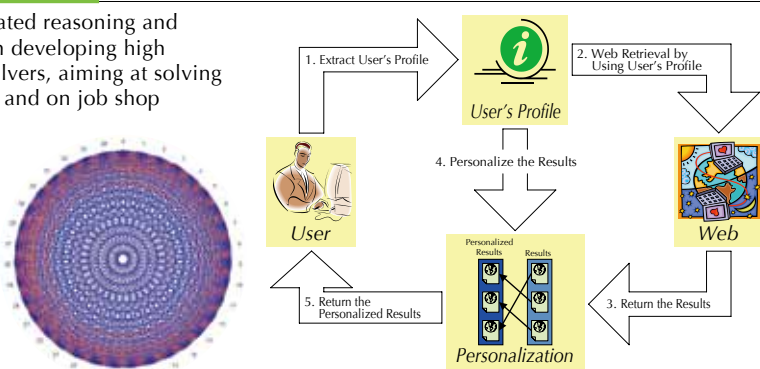
**A solution to Ramsey problem**          **An intelligent Web retrieval system**

## 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

## 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*



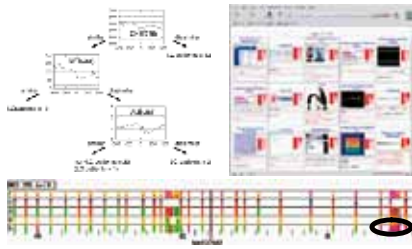Biological motion of tennis forehand stroke          Driving simulator          Favorite color of fruits          Virtual reality

## 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*
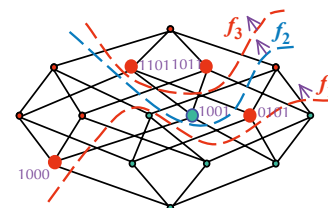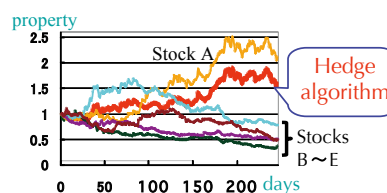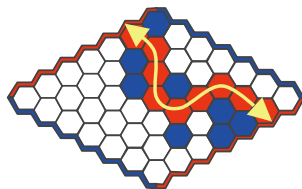


## Multi-agent Systems Laboratory

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, Assit Prof. Atsushi Iwasaki*



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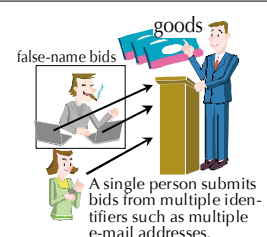
## Natural Language Processing  Laboratory

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*

**Corpus**

- Knowledge acquisition for NLP
- Support System for Writing English
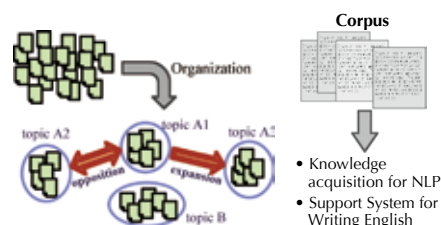
## Scholarly Communication and Contents Mining Laboratory

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.*
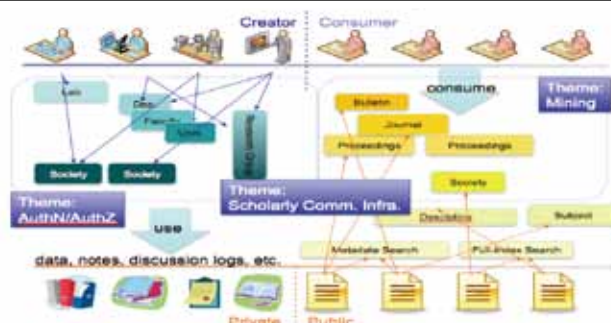
## 3D Multimedia Software Laboratory

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

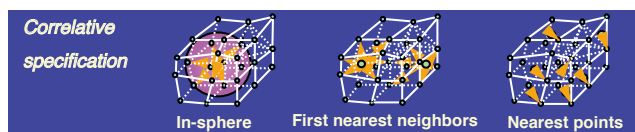*Prof. Yoshihiro Okada, Assist. Prof. Shigeru Takano*

**Computer Animation**

**Information Visualization**

**Network Collaboration**     **Entertainment**

**Wavelet transform**

**Multimodal Interfaces**     **Image retrieval**
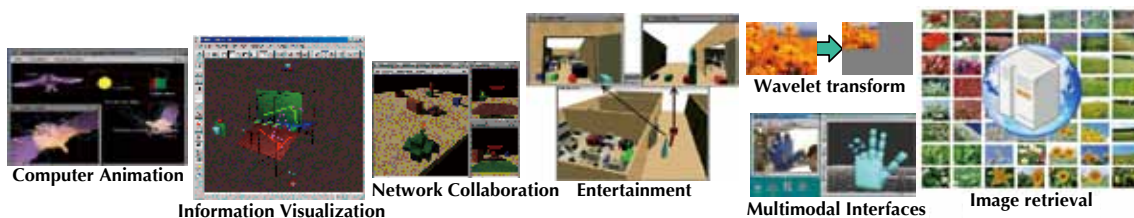
## Computational Science Laboratory

**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*
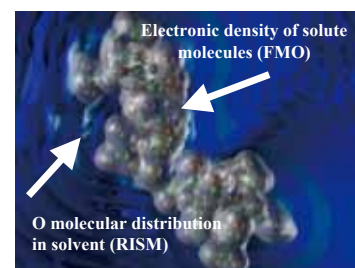
**Correlative specification**

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

**Electronic density of solute molecules (FMO)**

**O molecular distribution in solvent (RISM)**

# Department of Advanced Information Technology

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. The Language Informatics Group conducts studies of natural language processing, information retrieval, and computational linguistics. The members describe the universal nature of language through mathematical models and create language-related software.

## 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 with 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**<br>Kazuaki Murakami, Hiroto Yasuura, Hiroshi Furukawa<br><br>**Associate Professor**<br>Kouji Inoue, Yuuske Matsunaga, Kiyotaka Fujisaki, Makoto Sugihara, Ahmed Ashir Uddin<br><br>**Assistant Professor**<br>Masayosi Yoshimura |
| Advanced Software Engineering | **Professor**<br>Keijiro Araki, Akira Fukuda, Naoyasu Ubayashi, Kumiko Tanaka-Ishii<br><br>**Associate Professor**<br>Shigeru Kusakabe, Tsunenori Mine, Tsuneo Nakanishi, Kenji Hisazumi<br><br>**Assistant Professor**<br>Yoichi Omori, Yasutaka Kamei |
| Real World Robotics | **Professor**<br>Rinichiro Taniguchi, Ryo Kurazume, Seiichi Uchida<br><br>**Associate Professor**<br>Kunihiko Kaneko, Hajime Nagahara, Ken'ichi Morooka<br><br>**Assistant Professor**<br>Tokuo Tsuji, Yumi Iwashita, Atsushi Shimada, Yaokai Feng |
| Advanced Distributed Processing Systems | **Professor**<br>Sachio Hirokawa, Koji Okamura<br><br>**Associate Professor**<br>Hirofumi Amano, Eisuke Ito |
| Information Communication Engineering (E-JUST) | **Associate Professor**<br>Osamu Muta, Mehdipour Farhad, Victor Mauro Goulart Ferreira |
| Practical Embedded Software Development Engineering | **Professor**<br>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/)
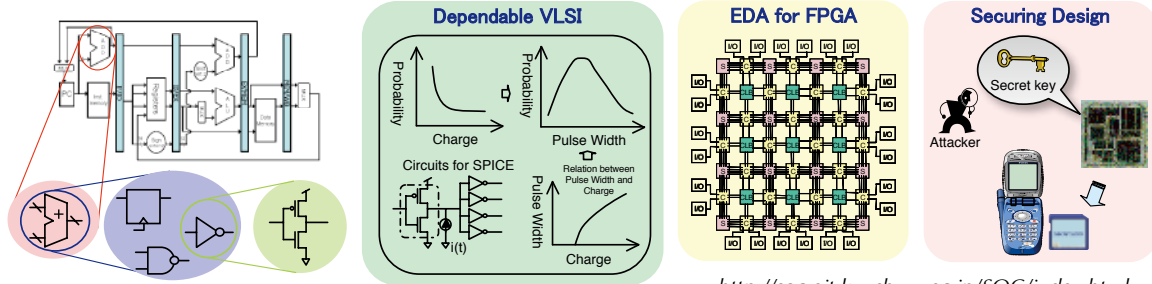
**Main Topics** : Multi-Core Processors, 3D-IC Architectures, Reconfigurable Processors and Compiler Optimizations, Energy Efficient Accelerators, Performance Predictions, Architecture Explorations, Biometrics Authentication, Homology Search Algorithms

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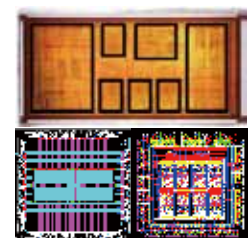
## SoC Design Laboratory

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

**Dependable VLSI**

**EDA for FPGA**

**Securing Design**

Secret key

Attacker

*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*

**High Reliable Satellite Communicatoin Systems**
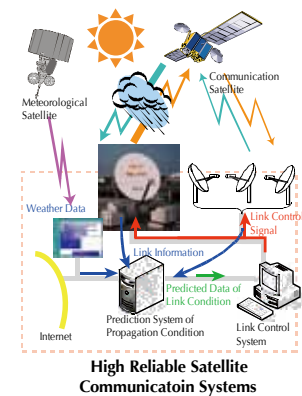
## Mobile Communication Systems Laboratory

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

**Internet**

**Broadband Fiber Lines**

**Wireless Backhaul network**
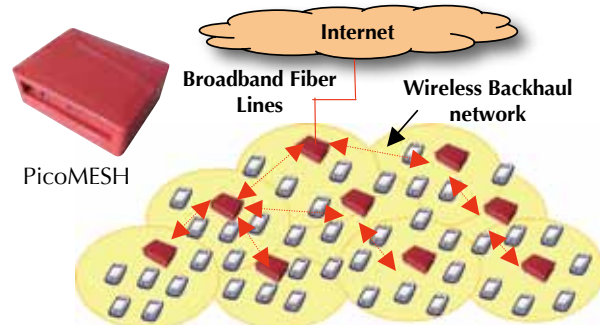
## Software Engineering Laboratory

**(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*
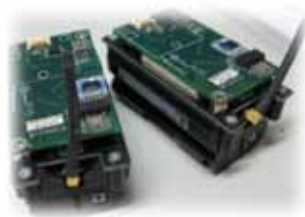


## Software Language Laboratory

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.
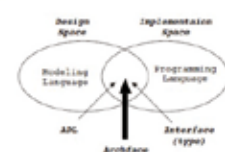
*Prof. Naoyasu Ubayashi, Assist Prof. Yasutaka Kamei*

**Archface**

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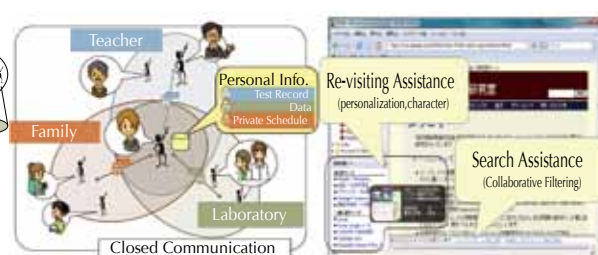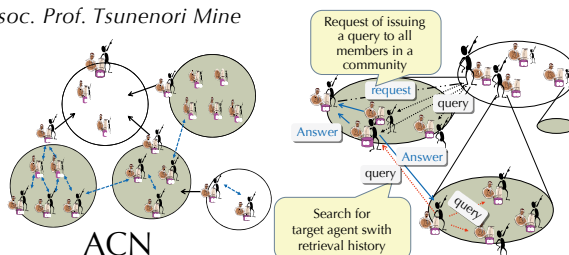
Architectural information is encapsulated in interfaces



## 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*

## Language Informatics Laboratory

The universal nature of natural language is described through mathematical models, and language-related software is generated by applying the models.

1. Natural Language Processing and Information Retrieval: Elements of information technologies are studied by using machine learning techniques to process immense amounts of natural language texts and meaningful data.
2. Language Software Applications: Useful software applications are created to aid human language processing and communication, both among humans and between humans and various devices.
3. Mathematical Modeling of Language: Universal properties of language are studied and described via mathematical models by using a variety of large-scale language corpora.

*Prof. Kumiko Tanaka-Ishii       http://www.cl.ait.kyushu-u.ac.jp*



## 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. 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*
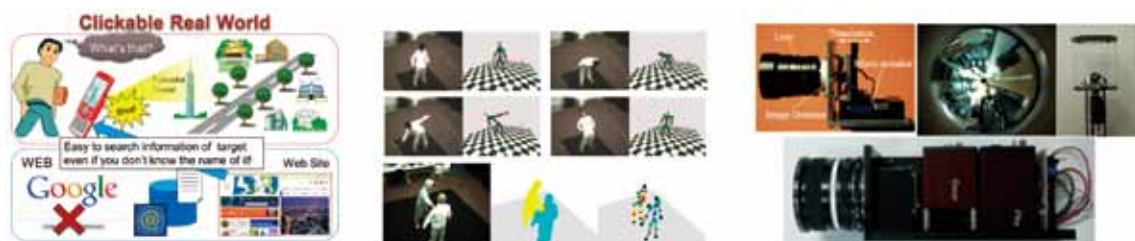


## Real World Information Robotics Laboratory

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*
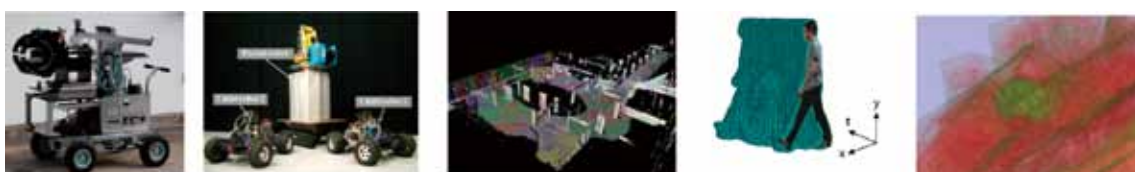
## Human Interface Laboratory

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.
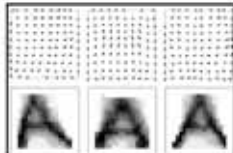
*Prof. Seiichi Uchida, Assist Prof. Feng Yaokai*



| 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.
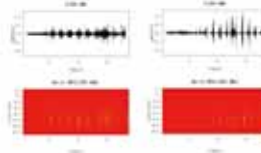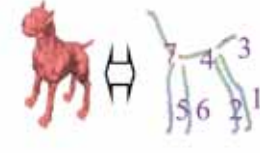
*Assoc. Prof. Kunihiko Kaneko*



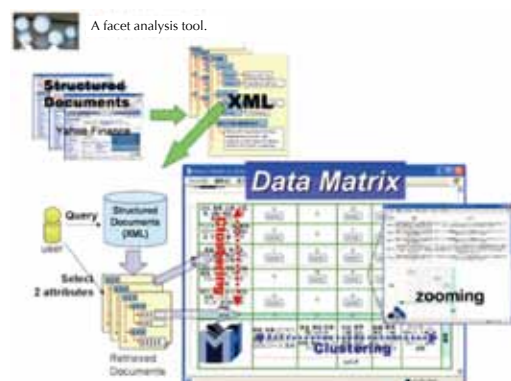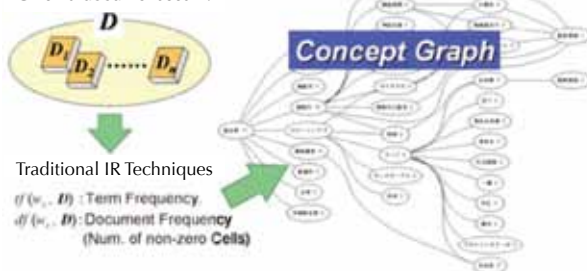| Medical Image Management | Spatial Models for Digital Human | Time Series Data Management | Skelton and Bone Models for Motion Analysis and Control |

## 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*
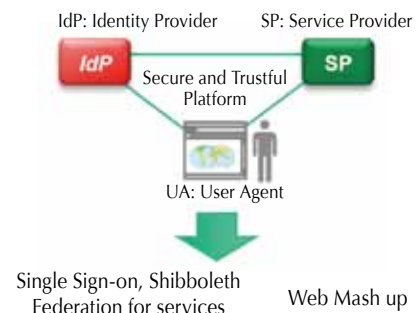
## Grid Computing Laboratory

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

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
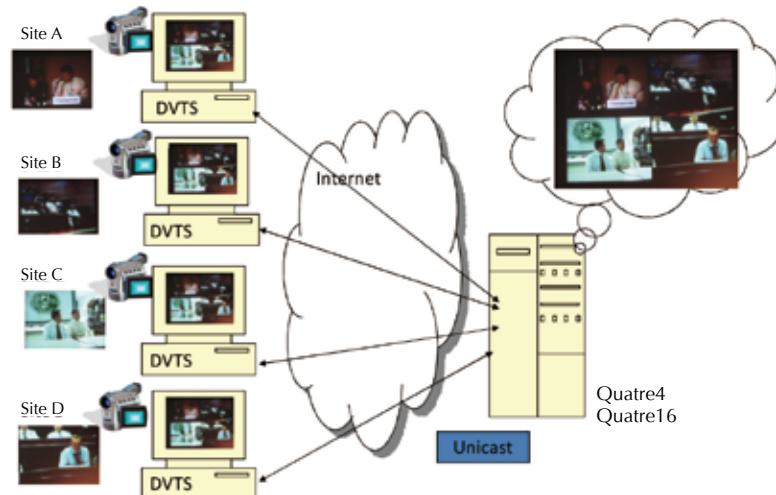


Site A

Site B

Site C

Site D

DVTS

Internet

Quatre4
Quatre16

Unicast

# Social Information Systems Engineering Course

"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 fifteen hub universities of "Education Network for Practical Information Technologies". 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 Miyazaki.
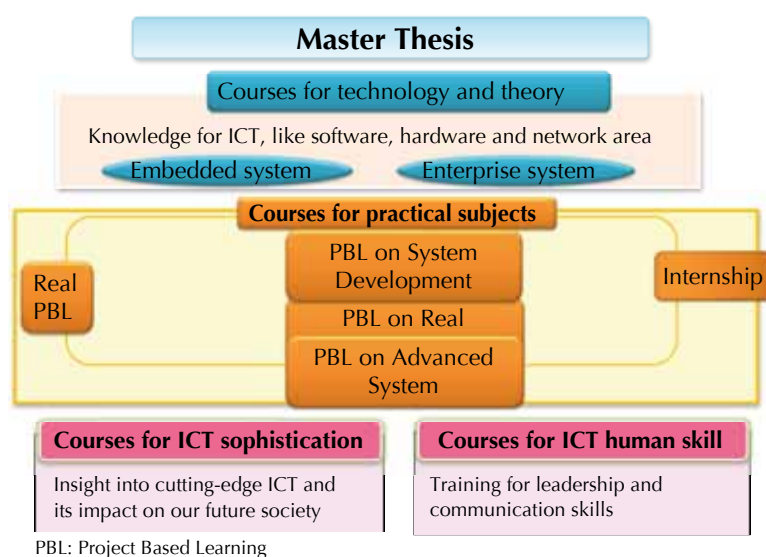
Master Thesis

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

Internship

Courses for ICT sophistication

Insight into cutting-edge ICT and its impact on our future society

Courses for ICT human skill

Training for leadership and communication skills

PBL: Project Based Learning

Figure 1 : Framework of curriculum

## Course Overview

The purpose of this course is to have the students acquire the following state-of-the-art IT knowledge and skills;

1) Skills and knowledge to plan, design, develop and manage the technology in the society
2) Entrepreneur mind
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, 2013)

Center for Future ICT Leaders, Software Research Associates, Nomura Research Institute, Hitachi, Ltd., 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., IBM Japan, CATS, Japan Aerospace Exploration Agency, Kyushu Hitachi Maxell, Runesas Solutions, Accela Technology Corporation, ITS Japan, FUJITSU DESIGN LIMITED, Queen's University

# 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 and I&E Visionaries, 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.

## Electrical Energy Environment Engineering

Electrical Energy Environment Engineering offers education and research on new power system which can deal with expanding electricity liberalization and increasing renewable power sources. One of our approaches is to utilize superconducting technology which has potential for high-efficiency power transmission, energy storage, power conversion, etc. Effective installation and control of such advanced devices are also investigated to maintain power system stability and quality. This division is endowed by Kyushu Electric Power Co., Inc.

## Gigaphoton Next GLP

Gigaphoton Next GLP is the first Joint Research Department(*) of Kyushu University, which was founded in 2011 by support of Gigaphoton Inc. for investigating next generation gas laser processing (Next GLP). Gigaphoton Inc. is the world's leading company supplying the laser light source for lithography processes. Laser processing technologies have been widely utilized to various industrial applications such as electronic devices, automobile, medical care and new material synthesis. Our mission is to contribute to society through development of innovative laser processing technologies.

(*) Joint Research Departments have been established as research hub to conduct joint research in a specific field between Kyushu University and the private organization, etc. The Joint Research Departments are to be provided with joint research staff such as associate professor, and such staff forms core of the joint research. Thus, this system constitutes a new mechanism for collaboration differing from those of both the Donation Research Department System and the Joint Research System.

## Information Electronics Course

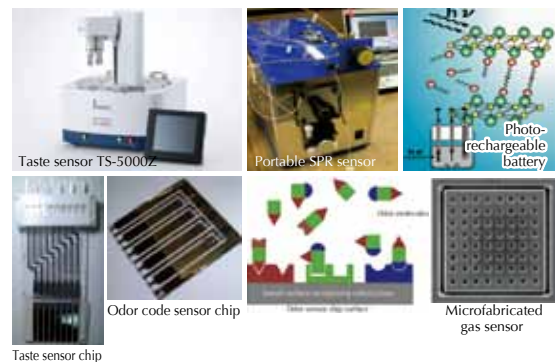| Divisions | Faculty Members |
|---|---|
| Electronic Devices | **Professor**<br>Kiyoshi Toko, Kimihide Matsuyama, Masaharu Shiratani, Kenshi Hayashi<br>**Associate Professor**<br>Taizoh Sadoh, Hisao Kuriyaki, Kazunori Koga, Naho Itagaki<br>**Assistant Professor**<br>Takeshi Onodera, Giichiro Uchida, Terumitsu Tanaka, Yusuke Tahara, Chuanjun Liu |
| Integrated Electronics | **Professor**<br>Tanemasa Asano, Kazutoshi Kato, Ramesh K. Pokharel, Yuji Oki<br>**Associate Professor**<br>Haruichi Kanaya, Kohei Hamaya<br>**Assistant Professor**<br>Akihiro Ikeda, Ryo Takigawa, Hiroaki Yoshioka |
| Electronics and Communication Engineering | **Professor**<br>Kuniaki Yoshitomi<br>**Associate Professor**<br>Hongting Jia |

## Electrical Engineering Course

| Divisions | Faculty Members |
|---|---|
| Measurement and Control Engineering | **Professor**<br>Taketoshi Kawabe, Takanobu Kiss, Junichi Murata<br>**Associate Professor**<br>Katsumi Kesamaru, Masayoshi Inoue<br>**Assistant Professor**<br>Masakazu Mukai, Hirotaka Takano |
| Applied Energy Engineering | **Professor**<br>Tatsuo Okada, Junya Suehiro, Masahito Shoyama, Masataka Iwakuma<br>**Associate Professor**<br>Daisuke Nakamura, Takashi Yoshida<br>**Assistant Professor**<br>Michihiko Nakano |
| Superconductive Systems Engineering | **Professor**<br>Keiji Enpuku<br>**Associate Professor**<br>Kazuhiro Kajikawa |
| Electrical Energy Environment Engineering | **Associate Professor**<br>Kohei Higashikawa<br>**Assistant Professor**<br>Sihun Yang |
| Gigaphoton Next GLP | **Research Professor**<br>Keishiro Kurihara<br>**Associate Professor**<br>Hiroshi Ikenoue |

## 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, Assoc. Prof. Hisao Kuriyaki,*
*Assist. Prof. Takeshi Onodera and Assist. Prof. Yusuke Tahara*
*URL: http://ultrabio.ed.kyushu-u.ac.jp/*



Taste sensor TS-5000Z

Portable SPR sensor

Photo-rechargeable battery

Taste sensor chip

Odor code sensor chip

Microfabricated gas sensor

## 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*
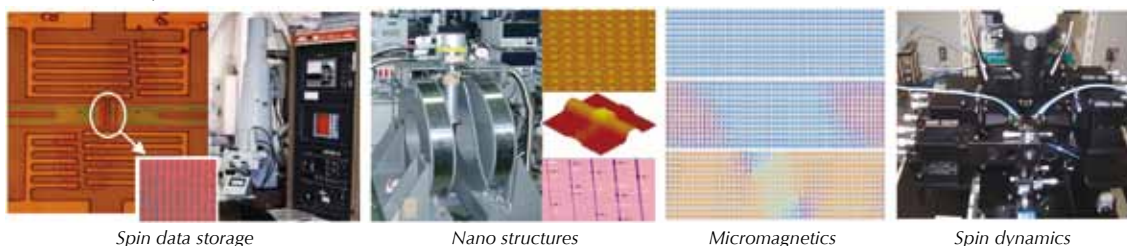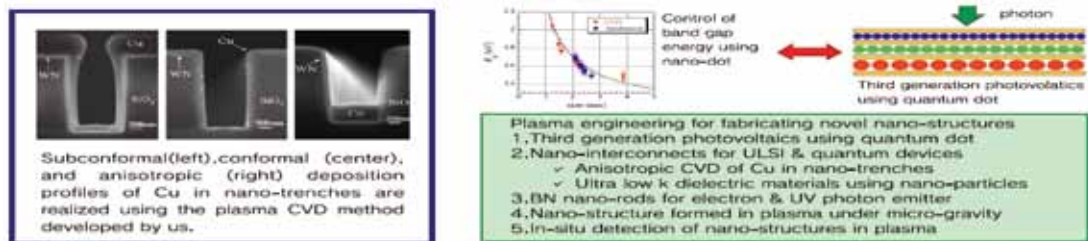
## Si-Nanotechnology Laboratory

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

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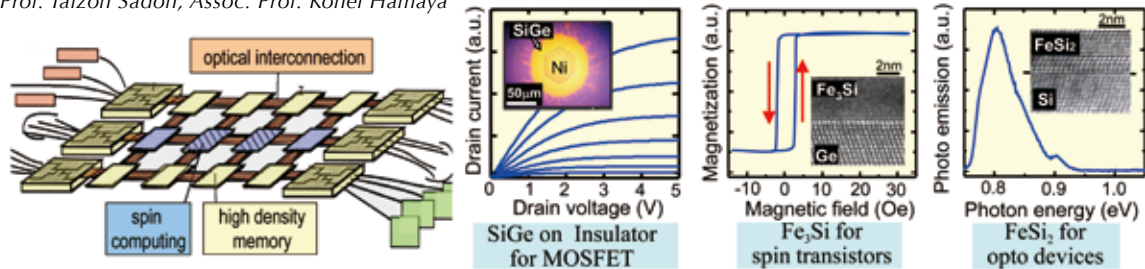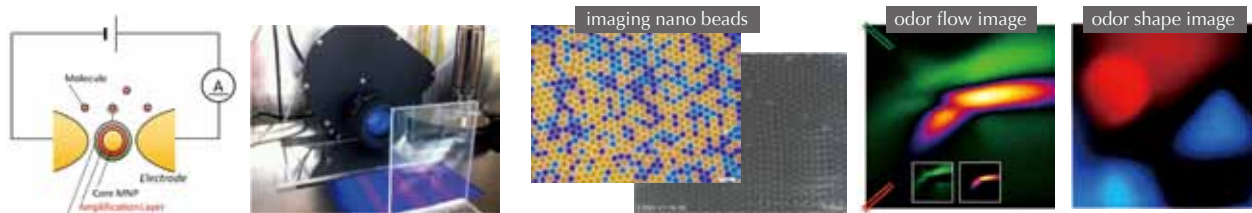


## Plasma Nanosystem Laboratory

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



## Organic Electronic Device Laboratory

Research topics: sensor device, nano material, plasmonic device, organic electronic material, spatial chemical information, odor sensor and odor visualization.

*Prof. Kenshi Hayashi, Assist. Prof. Chuanjun Liu*



## 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.
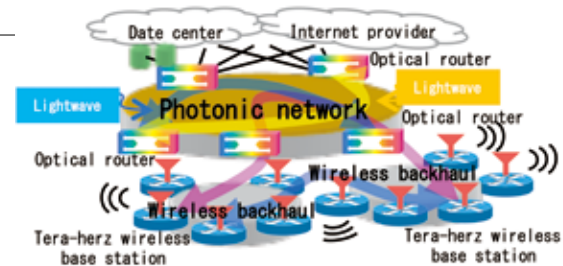
## Opto-electronics device Laboratory

Our laboratory studies the following topics:
-wavelength-tunable semiconductor lasers,
        -optical switches,
        -photo-mixers,
        -optical routers
for photonic networks and tera-herz wireless systems

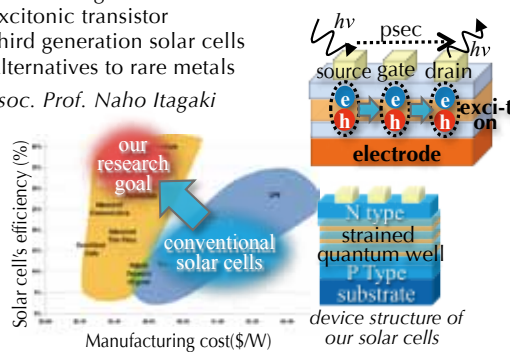*Prof. Kazutoshi Kato*



## Electronic Materials Laboratory

Research Targets:
· Excitonic transistor
· Third generation solar cells
· Alternatives to rare metals

*Assoc. Prof. Naho Itagaki*



*device structure of our solar cells*

## RFIC Laboratory

■ *Research Fields*: RF-CMOS front-end, advanced matching circuit, band pass filter and small antenna
■ *Applications*: Wireless LAN, Ultra Wideband(UWB), broadband and millimeter wave transmission
■ *URL*: http://yossvr0.ed.kyushu-u.ac.jp/

*Assoc. Prof. Haruichi Kanaya*



Circularly polarized small antenna @5.8GHz

RF receiver LSI

## 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*
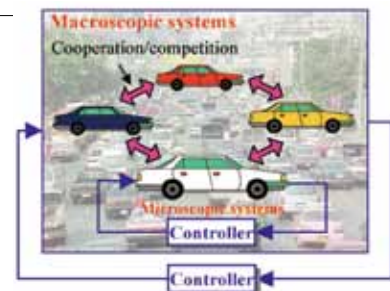


## Instrumentation Engineering Laboratory

Our studies focus on the understanding and resolving key performance issues of superconducting forefront materials and power devices based on the state-of-the-art measurement technologies. Perspective of these studies are to lead breakthrough to the energy-efficiency solutions to electric power grid, alternative energy, transportation and advanced medical systems. (See also the Research Institute of Superconductor Science and Systems.)

*Prof. Takanobu Kiss*
*Assoc. Prof. Masayoshi Inoue*
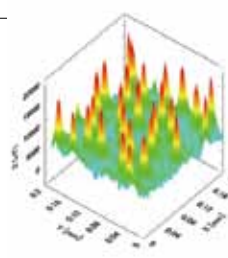


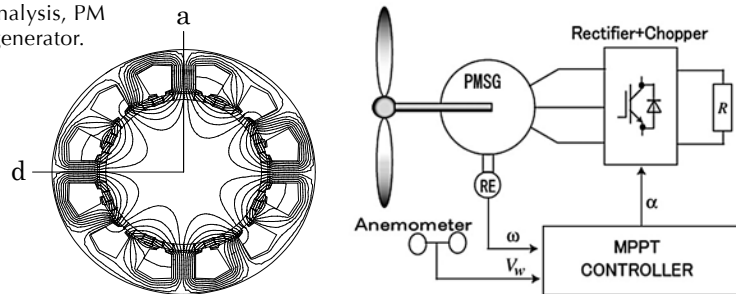SQUID microscopy of Vortex dynamics
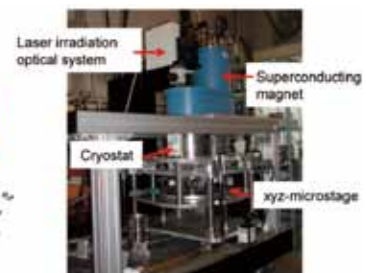
Development of novel laser microscope

## 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.

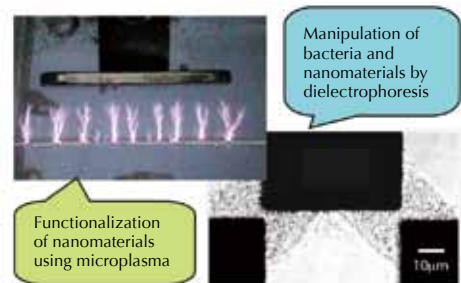*Prof. Tatsuo Okada, Assoc. Prof. Daisuke Nakamura*

Laser-induced plasma

## 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.
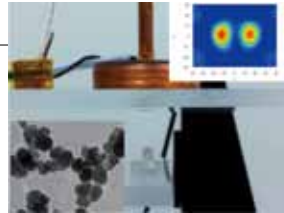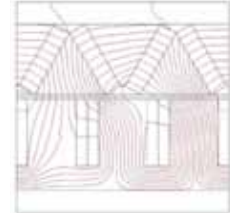
*Prof. Masahito Shoyama*
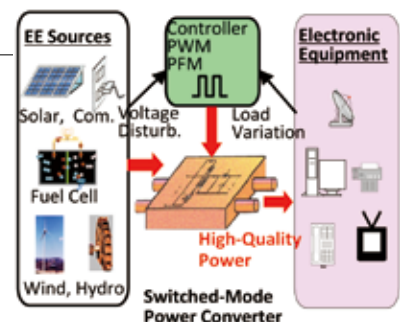
## Applied Electromagnetics Laboratory

Our laboratory studies the following topics : NanobioMagnetic, Design and Control of Motors

*Assoc. Prof. Takashi Yoshida*

Magnetic nano-bio imaging     FE analysis of a PMLSM

## 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. Masataka Iwakuma*

Characteristic test of a 15kW superconducting motor in water
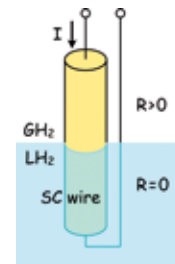
## Superconducting Sensing System Laboratory

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*

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

## Electrical Energy Environment Laboratory

Our studies mainly focus on
- technology development for advanced electric power devices such as superconducting applications
- their effective installation and control in the power system with increasing renewable power sources

*Assoc. Prof. Kohei Higashikawa,*
*Assist. Prof. Sihun Yang*

Advanced Power Device     Real-time Simulation for Power System
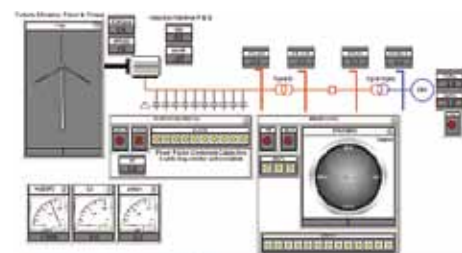
## Next Generation Laser Processing Laboratory

We have been investigating next generation laser processing utilizing high power gas laser such as KrF-, ArF-excimer laser, $F_2$ laser and ns pulsed $CO_2$ laser.

Main research topics
· Direct micromachining of glass plates for electric device fabrication.
· Laser annealing of semiconductor thin films.
· Impurity doping by liquid immersion laser irradiation.

*Research Prof. Keishiro Kurihara, Assoc. Prof. Hiroshi Ikenoue*

Our laboratory is supported by
GIGAPHOTON

# Department of I&E Visionaries

The Graduate School of Information Science and Electrical Engineering (ISEE) has a principle of collaboration of Information Science and Electrical 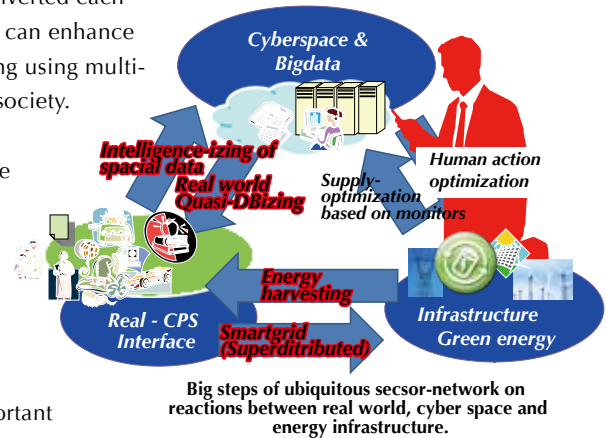Engineering and aims to cultivate researchers and engineers of the next generation in the field of information and electricity-electronics (I & E). The ISEE applied to the Kyushu University's strategic scheme for University Reform and Activation and proposed to establish a new department to promote the above collaboration between Information Science and Electrical-Electronics Engineering. Fortunately, our proposal was approved and the Department of I & E Visionaries was newly established in 2012.

This department is a special organization independent of the existing departments in the ISEE, and has the members listed below including Inner-ISEE sabbatical professors and cooperating professors. This department has a mission to activate the collaborations between I & E, create new research areas, and renew the ISEE continuously. In the first stage, this department would mainly focus on the Cyber-Physical Systems (CPS) as the common research interests.
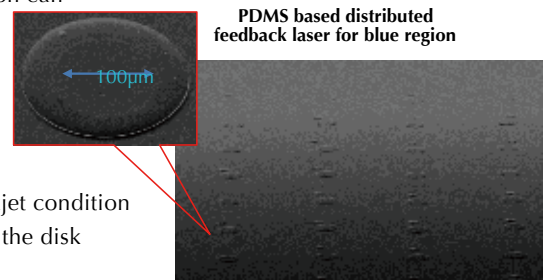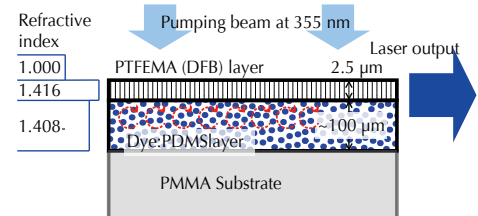
## Research area

### I&E Ubiquitous sensing group

Our goal is realize of ultra-distributed and ubiquitous sensors network for IT-social system based cyber physical system (CPS). The unlimited objects in real-world must require large amount of electrical energy based on traditional electrical CPS. Therefore, we proposed multiple-quantronic sensing in which multiple quantum (electron, photon, polariton, spintron, and molecules) can be converted each other without electoronic-conversion. The fully-photonic sensors can enhance optical information. For example, battery-free or optical harvesting using multi-quantronics can be key-technology for green energy and secure society. Extremely low cost fabrication of optical sensing structure is also another theme for ubiquitous sensor network. With above scheme the ubiquitous sensing network can be construct over our real-world. The networks are activated by optical scanning and optically enhanced information can be observed with spectrally extended cameras. We can name them such as "Quasi-database-izing" of real-physical-world.



Big steps of ubiquitous secsor-network on reactions between real world, cyber space and energy infrastructure.

The optical microcavity structure on organic materials are important candidate for extremely low cost, human-suitable and printable sensing device. The intermediate material between solid-state and liquid-state was studied for optical system. Polydimethylsiloxane (PDMS) based waveguide can solve and deliver doped molecules inside. Right figure shows a schematic of multiple layered waveguide laser using the PDMS lasing layer. The refractive index design as shown realize single peak of distributed structure and inter-circulated dye layer. Fluorene based blue-chromophore is newly developed as PDMS soluble. The inter-circulation can extend dye durability by 20 times.



PDMS based distributed feedback laser for blue region

Another micro fabrication research is based on ink-jet technique. Right figure shows SEM image of organic micro disk fabrication using low-viscus polymer. Refractive index controlled and stacked disks were wet-etched and organic micro-disks with diameter of 150μm. Inkjet condition control, solubility control and drying-up profile must be optimized for the disk quality control.



Organic micro disks fabricated with inkjet technology

## I&E LSI and System Group

With advance technology, the data size is growing exponentially and handling such "big data" for capturing, transmission and process is challenging. Innovations in both software and hardware platforms are desired. Our group is devoted to develop innovative and intelligent solutions in wireless technologies. Our research is aimed to ease the challenges of "big data" with respect to its capture, storage, process, transfer and visualization by novel solutions in wireless technologies. Big data renders several considerable challe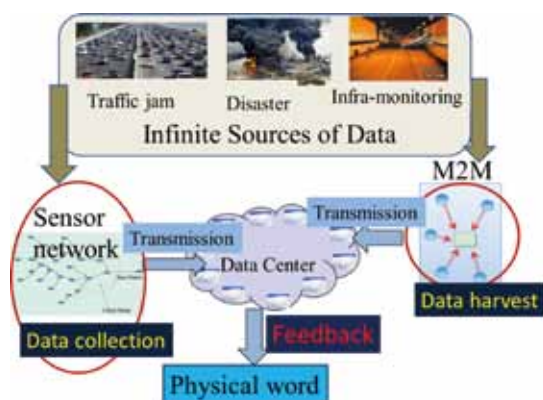nges on cyber physical systems (CPS) and advance semiconductor technology solutions ,i.e. LSI solutions, are always dedicated to deliver improved solutions to cut short the challenges. Fig.1 depicts how a semiconductor technology brings forth the solution to big data and cyber physical systems. More specifically, our research and development is focused on a battery-less wireless sensor node (see Fig. 2) and a maintenance-free ultrafast wireless transmitting system. The system is capable of continuous collection of huge and complex data from several sources and transmission to a data center at data rate which exceeds 10 Gbps.



Fig. 1 : Big data.CPS related technologies that semiconductor technology bring forth
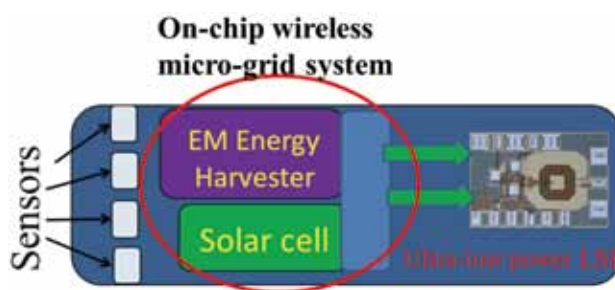


Fig. 2 : Battery-less sencor node

## Members of Department of I&E Visionaries

| Faculty | Yuji Oki | Professor | |
| | Pokharel Ramesh Kumar | Professor | |
| | Hiroaki Yoshioka | Assistant Professor | |
| Inner-ISEE sabbatical professors | Naho Itagaki | Associate Professor | (Electronics) |
| | Haruichi Kanaya | Associate Professor | (Electronics) |
| Cooperating professors | Kazuaki Murakami | Professor | (Advanced Information Technology) |
| | Keijiro Araki | Professor | (Advanced Information Technology) |
| | Masaharu Shiratani | Professor | (Electronics) |
| | Kazutoshi Kato | Professor | (Electronics) |
| | Shigeru Kusakabe | Associate Professor | (Advanced Information Technology) |

# 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.
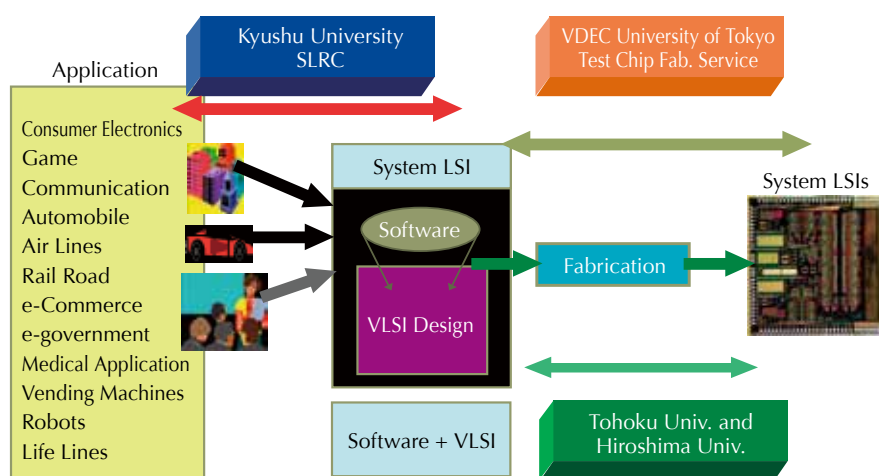
## Silicon Sea Belt

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] |
| Application Systems | Motoji Yamamoto | Professor | [Department of Mechanical Engineering, Faculty of Engineering] |
| | Kunio Urakawa | 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 five divisions: Material Science, Applied Physics, Electronics, Electric Engineering and Advanced Electric System. 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.

Image of a future society with superconductor technologies

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

Superconducting transformer for a Shink-ansen rolling stock developed in collabo-ration with Railway Technical Research Institute.
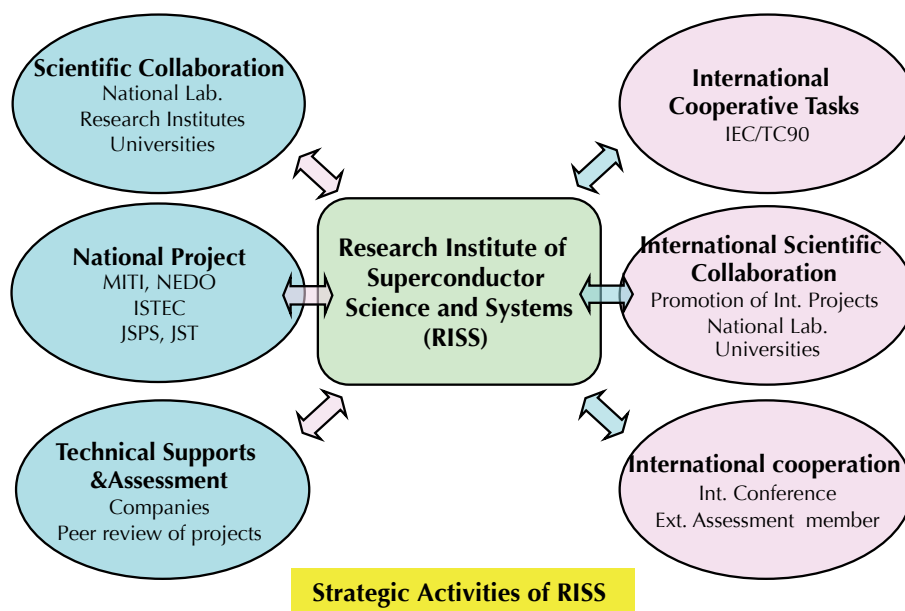
Superconductor science and Vortex engineering are basic concepts in **RISS** for developing wide application of superconductivity to near-future systems of Information and Energy.

**Strategic Activities of RISS**

| Divisions | Members | Education and Research Area |
|---|---|---|
| Director | Prof. Keiji Enpuku | |
| Material Science | Professor<br>  Kenji Kaneko<br><br>Associate Professor<br>  Ryo Teranishi | · Nano-structure and superconductivity<br><br>· New superconducting materials |
| Applied Physics | Professor<br>  Takanobu Kiss<br><br>Associate Professor<br>  Masayoshi Inoue | · Electromagnetic properties of superconductor<br><br>· Vortex science for superconductor application |
| Electronics | Professor<br>  Keiji Enpuku<br><br>Associate Professor<br>  Keisuke Maehata | · Superconducting sensor systems<br><br>· Advanced biomedical and analysis systems |
| Electric  Engineering | Professor<br>  Masataka Iwakuma<br><br>Associate Professor<br>  Kazuhiro Kajikawa | · High Jc and low loss SC conductors<br><br>· Superconducting machine and energy devices |
| Advanced Electric System | Professor<br>  Ichiro Sasada<br><br>Associate Professor<br>  Takashi Yoshida | · Superconducting energy systems<br><br>· System engineering for social and life innovation |

# 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 | Koji Okamura | Professor | Department of Advanced Information Technology |
| Academic Information Section | Sachio Hirokawa<br>Takahiko Suzuki<br>Eisuke Itoh<br>Tetsuya Nakatoh | Professor<br>Associate Professor<br>Associate Professor<br>Assistant Professor | Department of Advanced Information Technology<br>Department of Informatics<br>Department of Advanced Information Technology |
| Language Education Environment Section | Yoshiyuki Tabata<br>Chengjiu YIN | Professor<br>Assistant Professor | |
| Learning Spaces Design Section | Naomi Fujimura<br>Hitoshi Inoue<br>Takahiro Tagawa<br>Keiichiro Fukazawa | Professor<br>Associate Professor<br>Assistant Professor<br>Assistant Professor | |
| Next Generation and Future Network Section | Koji Okamura<br>Yoshiaki Kasahara | Professor<br>Assistant Professor | Department of Advanced Information Technology |
| Interdisciplinary Computational Science Section | Mutsumi Aoyagi<br>Hirohumi Amano<br>Toshiya Takami<br>Taizo Kobayashi<br>Hiroaki Honda | Professor<br>Associate Professor<br>Associate Professor<br>Project Associate Professor<br>Project Associate Professor | Department of Informatics<br>Department of Advanced Information Technology<br>Department of Informatics |
| Advanced Computing Infrastructure Section | Seiji Fujino<br>Yoshitaka Watanabe<br>Takeshi Nanri | Professor<br>Associate Professor<br>Associate Professor | Department of Informatics<br>Department of Informatics<br>Department of Advanced Information Technology |
| Research Staff for Computational Science | Ryutaro Susukita | Project Associate Professor | |

## 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

**IC staff ID card**

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

**Educational Computer Room**

**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.
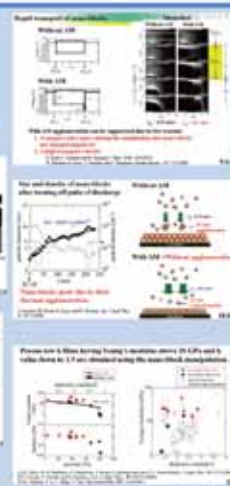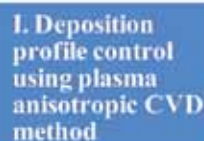
## The Purpose of CPNE

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<br>Seo Hyunwoong | Assistant Professor<br>Assistant Professor | [Faculty of Arts and Science] |
| Plasma electronics | Naho Itagaki | Associate Professor | [Department of Electronics] |
| Plasma environmental engineering | Masaharu Shiratani<br>Giichiro Uchida | Professor<br>Assistant professor | [Department of Electronics]<br>[Department of Electronics] |
| Plasma bio-engineering | Junya Suehiro<br>Kazunori Koga<br>Michihiko Nakano | Professor<br>Associate professor<br>Assistant professor | [Department of Electrical Engineering]<br>[Department of Electronics]<br>[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.
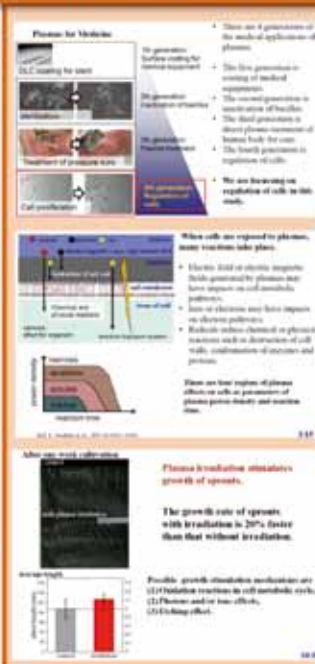
# Center for Japan-Egypt Cooperation in Science and Technology (EJUST Center)

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 intra-disciplinary collaborations with the department of Electronics and Communication Engineering (ECE) which is one of the eight 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 courses besides advising graduate student's research as co-supervisors. The other full-time professors and associate professors at the center supervise the students 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 in 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.
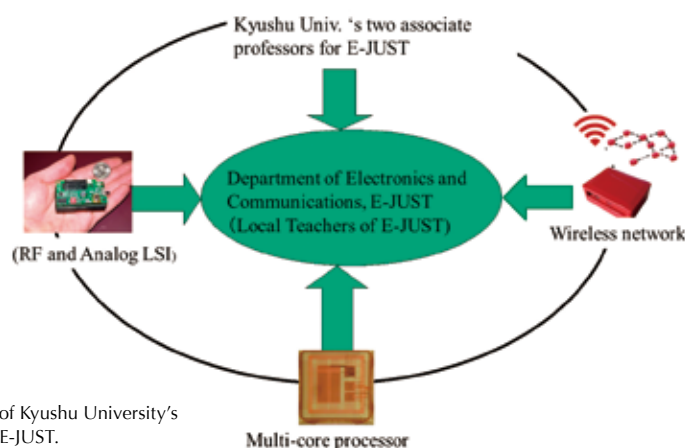


Fig.1 Illustration of Kyushu University's support to E-JUST.

| Divisions | 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<br>Mission (2)-3 : Developing and implementing of acceptance programs for E-JUST's students<br>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<br>Mission (2)-2 : Development and implementation of training program on university governance and management<br>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<br>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 |

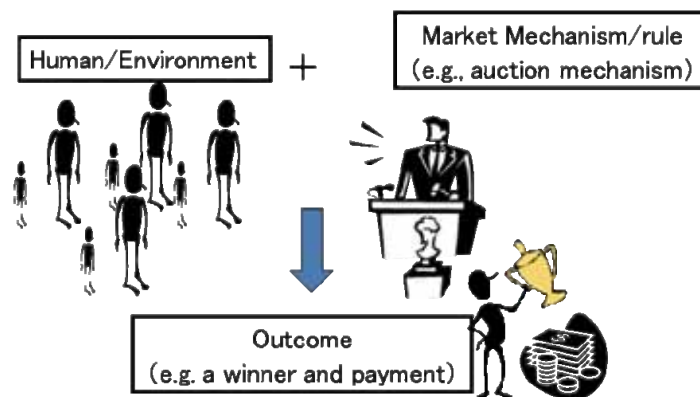| Divisions | Faculty Members | | |
| --- | --- | --- | --- |
| Director | Hiroshi Furukawa | Professor | Department of Advanced Information Technology |
| Vice Director | Ramesh Pokharel | Professor | Department of I&E Visionaries |
| Educational Cooperation | Jia Hongting<br>Victor Goulart | Associate Professor<br>Associate Professor | E-JUST Center<br>E-JUST Center |
| Educational Collaboration | Kuniaki Yoshitomi<br>Osamu Muta<br>Farhad Mehdipour | Professor<br>Associate Professor<br>Associate Professor | E-JUST Center<br>E-JUST Center<br>E-JUST Center |
| Project | Kazuaki Murakami<br>Hiroshi Furukawa<br>Tanemasa Asano<br>Ramesh Pokharel<br>Koichiro Watanabe<br><br>Reiji Hattori<br><br>Koji Okamura<br>Haruichi Kanaya<br>Koji Inoue | Professor<br>Professor<br>Professor<br>Professor<br>Professor<br><br>Professor<br><br>Professor<br>Associate Professor<br>Associate Professor | Department of Advanced Information Technology<br>Department of Advanced Information Technology<br>Department of Electronics<br>Department of I&E Visionaries<br>Department of Earth Resources Engineering, Faculty of Engineering<br>Art, Science and Technology Center for Cooperative Research<br>Research Institute for Information Technology<br>Department of Electronics<br>Department of Advanced Information Technology |
| Liaison | (TBD)<br><br>(TBD) | Professor<br><br>Professor | Egypt-Japan University of Science and Technology (E-JUST)<br>Egypt-Japan University of Science and Technology (E-JUST) |
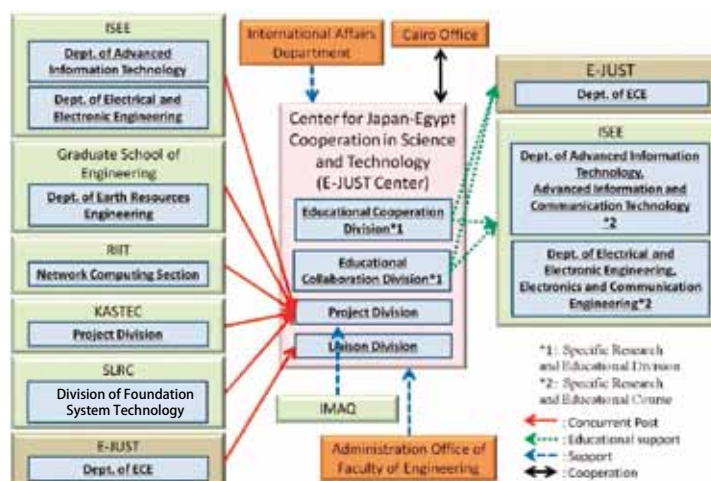
# Innovative Market Design Research Center

This center was established in 2012 to promote innovative research on market design. Market design is a research field that aims to design/modify real economic markets that allocate precious resources in a socially desirable way based on the knowledge obtained in micro economics and game theory. Such markets include real complicated markets (e.g., spectrum auctions), as well as markets that do not involve monetary transfers (e.g., school choice programs). To analyze/design real economic markets in a feasible way, contributions from computer science are indispensable. This center systematically conducts basic and applied research on market design from computational/algorithmic perspective, and will be established as a center of excellence on market design research. This center conducts interdisciplinary joint research with international/domestic universities/research institutes, and fosters young talented individuals who are well acquainted with both computer science and micro economics.

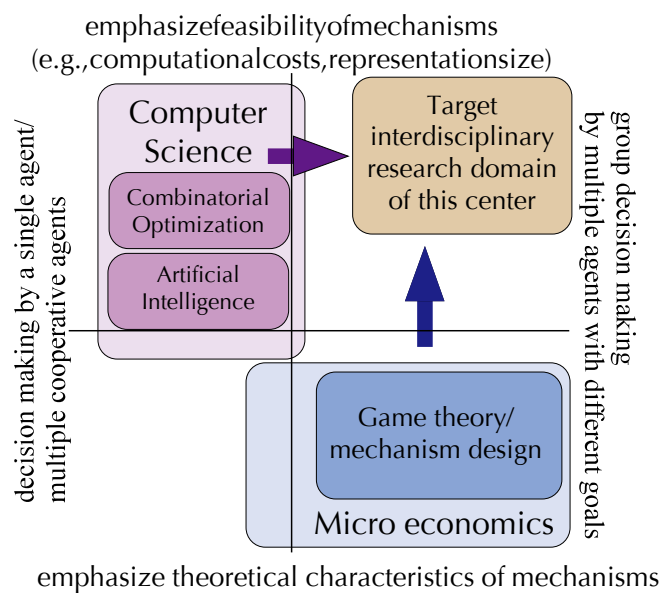This center will develop the following three types of key technologies.
(1) design technologies, which enable us to design market mechanisms that incorporate various constraints and agent preferences, and can be executed in a reasonable amount of time.
(2) analytic technologies, which accomplish systematic analysis of the robustness of market mechanisms, considering the interaction among multiple markets.
(3) representation technologies, which enable us to concisely  represent the input parameters of market mechanisms so that market mechanisms can be efficiently executed and analyzed by utilizing/extending the knowledge representation technologies developed in Artificial Intelligence.

Specific research topics of this center include automated mechanism design, equilibrium analysis of repeated games, concise representation schemes for cooperative games, mechanism design for two-sided matching, combinatorial auctions, discrete convex analysis, etc.

| Divisions | Faculty Members | Education and Research Areas |
| --- | --- | --- |
| Director | Professor Makoto Yokoo | |
| Market Design Theory Research Division | Professor<br>　Makoto Yokoo<br><br>Associate Professor<br>　Yuko Sakurai<br><br>Assistant Professor<br>　Atsushi Iwasaki | · Conduct fundamental research on market design based on game theory and agent theory |

Human/Environment + Market Mechanism/rule (e.g., auction mechanism)

Outcome (e.g. a winner and payment)

Goal of Market Design :
Design Market Mechanism/rule
that achieves a socially desirable outcome



emphasize feasibility of mechanisms
(e.g., computational costs, representation size)

decision making by a single agent/ multiple cooperative agents

group decision making by multiple agents with different goals

Computer Science
- Combinatorial Optimization
- Artificial Intelligence

Target interdisciplinary research domain of this center

Game theory/ mechanism design

Micro economics

emphasize theoretical characteristics of mechanisms

**Traditional Economics**
- Assume a market mechanism is given
- Deal with an idealized market (perfectly competitive market)
- Assume "invisible hand" optimize the market

**Market Design**
- Intend to design a new market mechanism or to revise an existing market mechanism
- Deal with a wider range of markets, such as a market without monetary transfer (e.g., school choice, kidney exchange)
- Require appropriate market design to avoid "market failure"

Comparison between Traditional Economics and Market Design

# Research Center for Architecture-Oriented Formal Methods

The Research Center for Architecture-Oriented Formal Methods was established on the 1st May 2013 to propose and utilize formal approaches to develop high-quality software systems efficiently.

Under the collaboration between industry and academia, we propose practically effective formal approaches to model, analyze, verify, operate, and maintain complicated IT systems.  We accumulate case studies of applying formal methods into conventional software development processes, and present as process models effective to real development projects.  We also develop tools which embody our approaches and support system developers and users to realize high quality and dependable IT systems.

Our research topics include the following:
(1) Proposal of effective formal techniques applicable to model and analyze complicated IT systems and case studies of their applications,
(2) Reference models of software development processes based on formal methods,
(3) Architecture oriented formal approaches to treat complicated systems of systems including environment and operation phases, and
(4) Development of support tools.

We show practice and experience of architecture oriented formal methods applicable through the whole software lifecycle.  E.g.,
(1) Engineering cases of software development projects to share and reuse,
(2) Education and training materials and courses for high-quality and dependable IT systems,
(3) Systematic software lifecycle model based on architecture orientation to realize high quality and dependable IT systems, and
(4) Software process improvement through support tools which embody our research results.

| Divisions | Faculty Members | | |
|---|---|---|---|
| Director | Keijiro Araki | Professor | Department of Advanced Information Technology |
| Formal Methods Application Division | Keijiro Araki | Professor | Department of Advanced Information Technology |
| | Shigeru Kusakabe | Associate Professor | Department of Advanced Information Technology |
| | Yoichi Omori | Assistant Professor | Department of Advanced Information Technology |
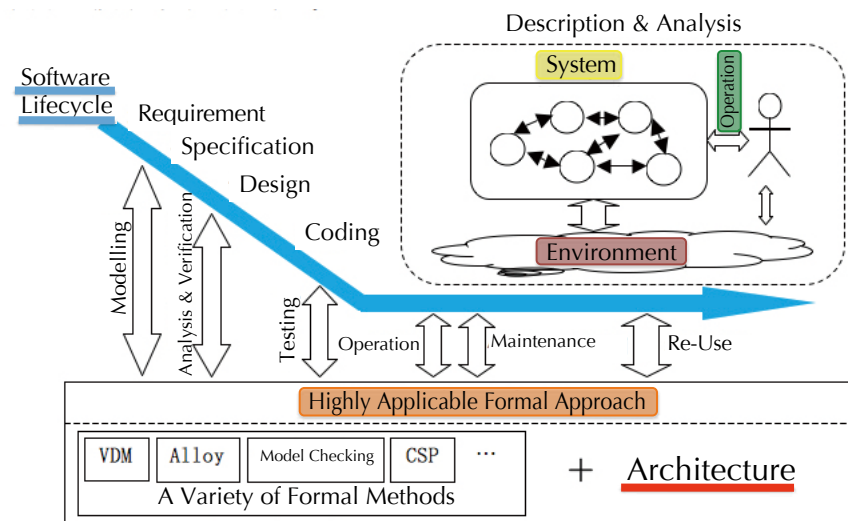
Formal Approach Effective at Each Stage in Software Lifecycle
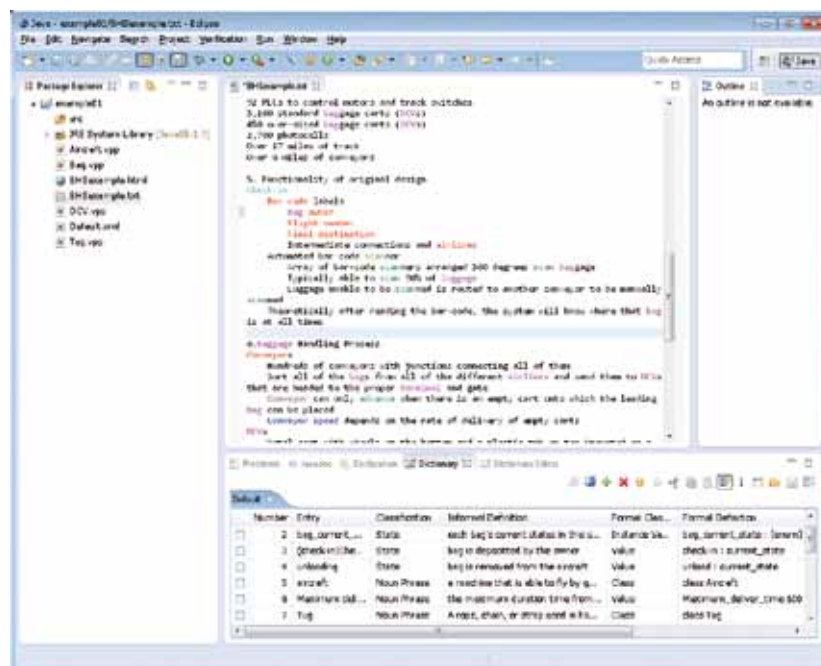


Support Tool for Formal System Modeling (under construction)

# Research Center for Advanced Information and Communication Technology Education

QUTE (Kyushu University Research Center for Advanced Information and Communication Technology Education) was established with the purpose of developing the most advanced educational methods in the ICT field. Collaborating with the industries such as Keidanren (Japan Business Federation), Kyukeiren (Kyushu Economic Federation), and so on, QUTE engages in the research and development of practical educational methods. For example, QUTE has been systematizing the educational experience and know-how obtained from the Social Information Systems Engineering Course in the Graduate School of Information Science and Electrical Engineering, and been summarizing them as educational materials. In particular, methods for effectively carrying out PBL (Project-Based Learning) have been under development. PBL is an educational method for fostering the capabilities of solving practical problems in teamwork. As projects continue, students get to equip themselves with the strength of technologies and communication etc. The educational materials developed by QUTE are accessible by all universities in Japan.

QUTE is composed of the following six divisions, which conduct extensive research related to educational methods ranging from infrastructure to application. Business Strategy Education and Research Division is a featured division. It becomes necessary for technologists, who will lead the next-generation of information-oriented society, to master not only information technologies but also knowledge about the society and business. This division targets the research of educational methods for such a scenario.

### Educational Infrastructure Research Division

R&D of methods for educational collaboration with both the inside and the outside of the university

### Architecture Education and Research Division

R&D of educational methods for system architecture that enables cultivating novel social information infrastructure

### Software Education and Research Division

R&D of educational methods for the architecture, design, and development methodologies of social information infrastructure software

### Application Education and Research Division

R&D of practical educational methods targeting social information infrastructure

### Business Strategy Education and Research Division

R&D of business strategy educational methods for realizing novel ICT value

### Liaison Division

Serving as a bridge between universities / industries for an industry-academia collaboration education

| Divisions | Faculty Members | | |
|---|---|---|---|
| Director | Naoyasu Ubayashi | Professor | Department of Advanced Information Technology |
| Educational Infrastructure Research Division | Akira Fukuda<br>Tsunenori Mine | Professor<br>Associate Professor | Department of Advanced Information Technology<br>Department of Advanced Information Technology |
| Architecture Education and Research Division | Hiroshi Furukawa<br>Kenji Hisazumi | Professor<br>Associate Professor | Department of Advanced Information Technology<br>Department of Advanced Information Technology |
| Software Education and Research Divisio | Keijiro Araki<br>Naoyasu Ubayashi<br>Shigeru Kusakabe<br>Yoichi Omori<br>Yasutaka Kamei | Professor<br>Professor<br>Associate Professor<br>Assistant Professor<br>Assistant Professor | Department of Advanced Information Technology<br>Department of Advanced Information Technology<br>Department of Advanced Information Technology<br>Department of Advanced Information Technology<br>Department of Advanced Information Technology |
| Application Education and Research Division | Junichi Murata<br>Daisuke Ikeda<br>Haruichi Kanaya | Professor<br>Associate Professor<br>Associate Professor | Department of Electrical Engineering<br>Department of Informatics<br>Department of Electronics |
| Business Strategy Education and Research Division | Toru Tanigawa<br><br>Megumi Takata | Professor<br><br>Associate Professor | Art, Science and Technology Center for Cooperative Research<br>Faculty of Economics |
| Liaison Division | Kunihiko Kaneko | Associate Professor | Department of Advanced Information Technology |



PBL Scenes



PBL Presentation

# Courses and Subjects of ISEE

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

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.
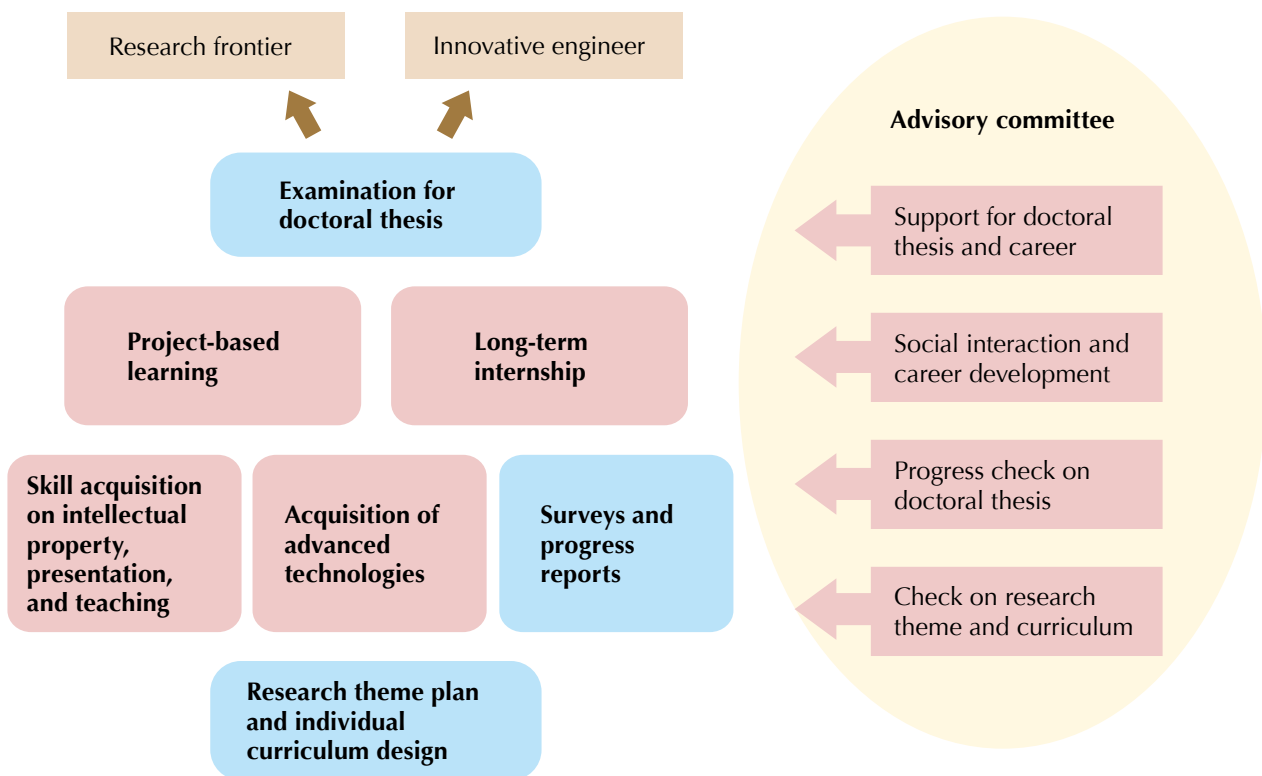
## Characteristic Education Methods

(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.

Research frontier

Innovative engineer

**Examination for doctoral thesis**

**Project-based learning**

**Long-term internship**

**Skill acquisition on intellectual property, presentation, and teaching**

**Acquisition of advanced technologies**

**Surveys and progress reports**

**Research theme plan and individual curriculum design**

**Advisory committee**

Support for doctoral thesis and career

Social interaction and career development

Progress check on doctoral thesis

Check on research theme and curriculum

Curriculum for doctoral course students

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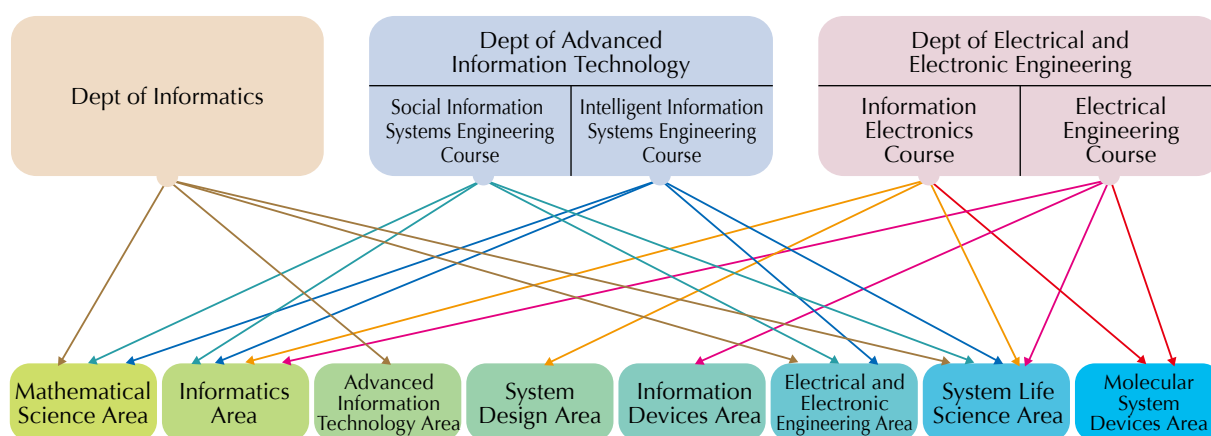
(b) Core subject: Basic subjects in each department and/or courses

(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)
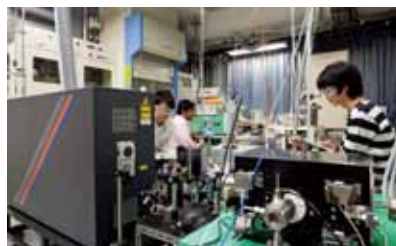
(f) Elective subject



Elective area for the extended subjects in each department
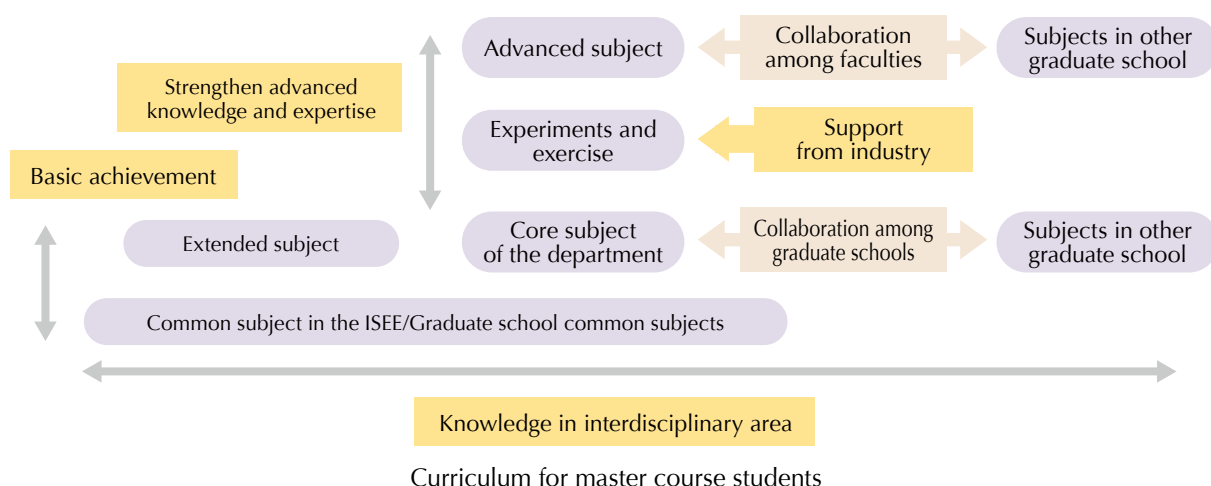


Curriculum for master course students

# 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.

## Applicants have to meet one of the following requirements:

(1) Persons who have graduated, or are scheduled to graduate by the time of admission, from a college or university defined in Article 83 of the School Education Act

(2) Persons who have received, or are scheduled to receive by the time of admission, a bachelor's degree as stipulated in Article 104, Clause 4 of the School Education Act (namely those who have been recognized as qualified to receive a bachelor's degree by the National Institution for Academic Degrees and University Evaluation)

(3) Persons who have received, or will have received by the time of admission, 16 years of school education in foreign countries

(4) Persons who have undergone, or are scheduled to have undergone by the time of admission, 16 years of school education implemented by a foreign country, including the completion of a correspondence course program provided by a school of the country while living in Japan

(5) Persons who have completed, or are scheduled to complete by the time of admission, an education course provided by a Japanese educational institution that has been recognized by the school education system of a foreign country as the country's academic course and designated by the Minister of Education, Culture, Sports, Science, and Technology, provided that the persons have received 16 years of the country's school education

(6) Persons who have completed, or are scheduled to complete by the time of admission, a specialist course provided by a vocational school designated by the Minister of Education, Culture, Sports, Science, and Technology (a four-year or longer course that fulfills the criteria established by the Minister) on the day specified by the Minister or later

(7) Persons who have been designated as qualified applicants by the Minister of Education, Culture, Sports, Science, and Technology

(8) Persons who entered a graduate school according to Article 102, Clause 2 of the School Education Act and have been recognized by the Graduate School of Information Science and Electrical Engineering as having an adequate academic ability to receive education in the school

(9) Persons who are aged, or scheduled to become by the time of admission, 22 years or older and have been recognized by the Graduate School of Information Science and Electrical Engineering, based on an individual screening of applicants' qualifications for admission, as having the academic ability at least equivalent to that of a university graduate

(10) Persons who have undergone 15 years of school education in foreign countries, and have been recognized by the Graduate School of Information Science and Electrical Engineering as having received the required number of credits with excellent results

(11) Persons who have undergone 15 years of school education implemented by a foreign country, including the completion of a correspondence course program provided by a school of the country while living in Japan, and are recognized by the Graduate School of Engineering as having received the required credits with excellent results

(12) Persons who have completed an education course provided by a Japanese educational institution that has been recognized by the school education system of a foreign country as the country's academic course and designated by the Minister of Education, Culture, Sports, Science, and Technology, by receiving the required number of credits with excellent results, provided that the persons have received 15 years of the country's school education

### Notes

○ Applicants wishing to be qualified by any of (8) to (12) of the Qualifications for Application must undergo screening 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 July.

### Applicants have to meet one of the following requirements:

(1) Persons who hold a Master's degree or Professional degree, or who are expected to earn one by the time of admission.

(2) Persons who hold a degree equivalent to a Master's degree or a Professional degree from an accredited institution outside of Japan, or who are expected to obtain one by the time of admission.

(3) Persons who have completed their formal education by taking a correspondence course through a non-Japanese university while residing in Japan, and hold a degree equivalent to a Master's degree or a Professional degree, or who are expected to obtain one by the time of admission.

(4) Persons who have earned a degree from a graduate program at an educational institution in a country outside of Japan, which has been assessed by the Minister of Education, Culture, Sports, Science, and Technology of Japan to be equivalent to a graduate program in the education system of Japan, or who are expected to earn one by the time of admission.

(5) Persons who completed the course of the United Nations University, who hold a degree equivalent to a Master's degree, or who are expected to obtain it by the time of admission.

(6) Persons who have completed their formal education by taking a correspondence course through a non-Japanese university, an educational institution which received the designation of Article 156.3 in Enforcement Regulations for the School Education Law, or the United Nations University, who have passed an examination or a screening equivalent to the regulations by Article 16.2 in Standards for the Establishment of Graduate Schools, and who are recognized to have an academic ability equivalent to Master's degree holders by the Graduate School of Engineering.

(7) Persons who have qualifications approved by the Minister of Education, Culture, Sports, Science and Technology of Japan
   1) Those who, after graduating from a university or finishing 16 years of academic education outside of Japan, have engaged for two or more years in research at a university or a research institute, and have been recognized to have an academic ability equivalent to Master's degree holders. This recognition is given by the Graduate School of Information Science and Electrical Engineering, Kyushu University, on the basis of his/her previous research.
   2) Those who, after finishing 16 years of academic education through correspondence courses run by foreign educational establishments, have engaged for two or more years in research at a university or a research institute and have been recognized to have an academic ability equivalent to Master's degree holders. This recognition is given by the Graduate School of Information Science and Electrical Engineering, Kyushu University, on the basis of his/her previous research.

(8) Persons who are evaluated by an individual screening of requirements for admission to have an academic ability equal to or surpassing that of students who have graduated from the Master's or Professional Program of the Graduate School of Information Science and Electrical Engineering, Kyushu University, and are at least 24 years of age.

### Notes

○ Applicants, who are qualified to 7 or 8 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.
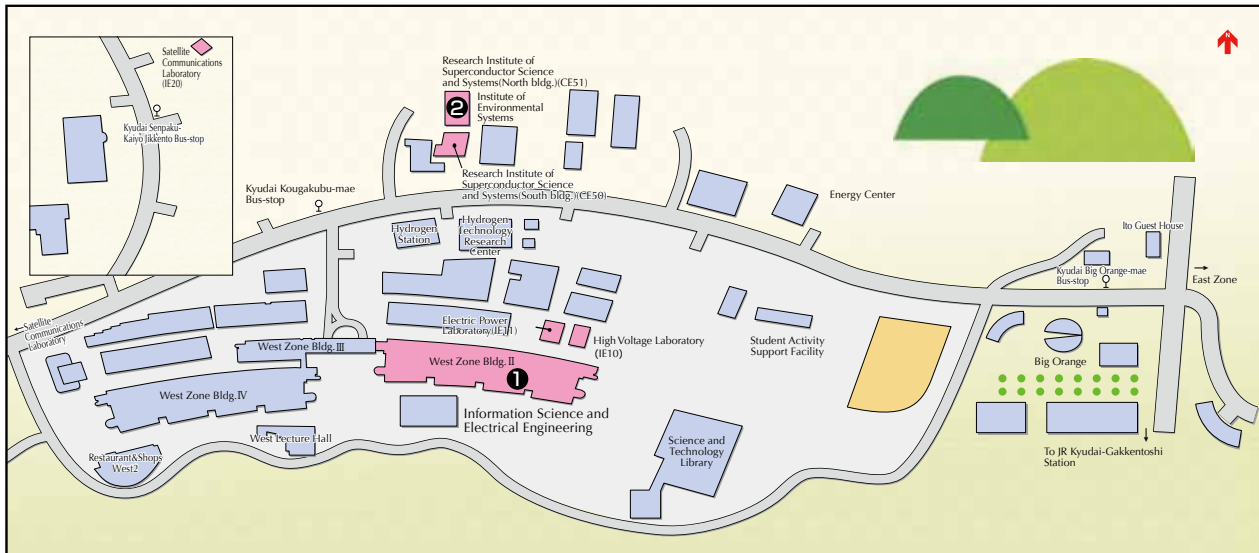**http://www.isee.kyushu-u.ac.jp/e/admissions/**

**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



### 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
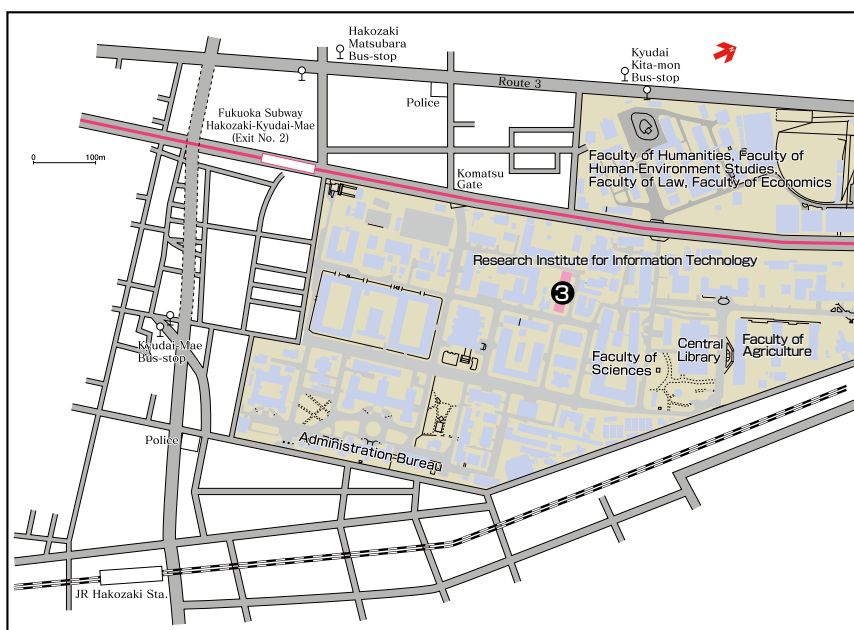


### Access to Hakozaki Campus

**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.
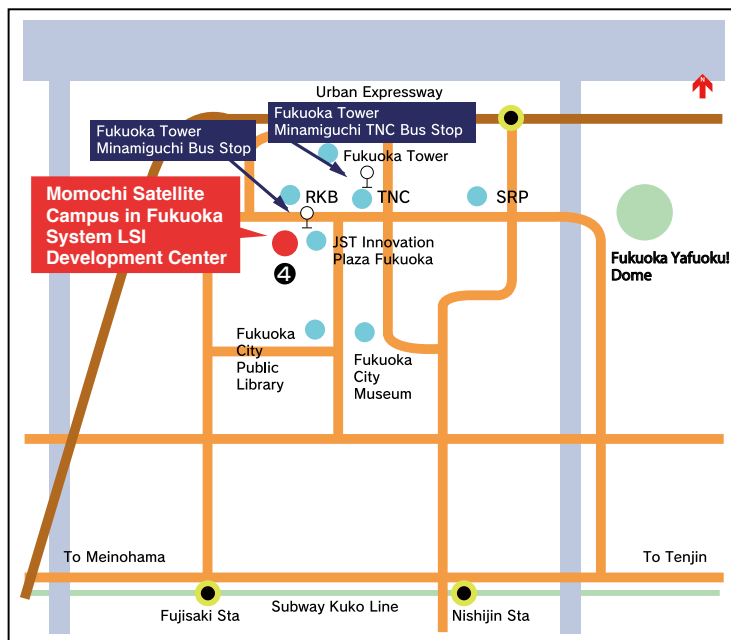**By Taxi** (approx. 20 min.)

## MOMOCHI Satellite Campus

Urban Expressway

Fukuoka Tower
Minamiguchi Bus Stop

Fukuoka Tower
Minamiguchi TNC Bus Stop

Fukuoka Tower

**Momochi Satellite Campus in Fukuoka System LSI Development Center**

RKB  TNC  SRP

JST Innovation Plaza Fukuoka

❹

Fukuoka Yafuoku! Dome

Fukuoka City Public Library

Fukuoka City Museum

To Meinohama

To Tenjin
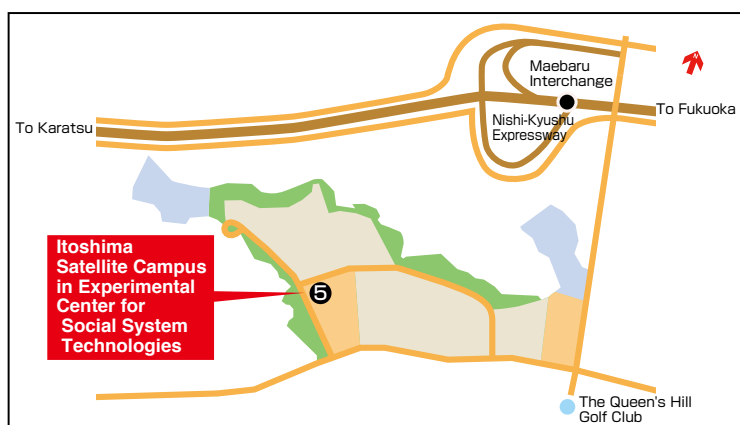
Fujisaki Sta  Subway Kuko Line  Nishijin Sta

### 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 Fukuoka

To Karatsu

**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.)

| Department/Institute | Campus | Building | Number in map |
|---|---|---|---|
| · Graduate School / Faculty of Information Science and Electrical Engineering<br>· Research Center for Advanced Information and Communication Technology Education<br>· Innovative Market Design Research Center<br>· Research Center for Architecture-Oriented Formal Methods | 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 |

# Maps
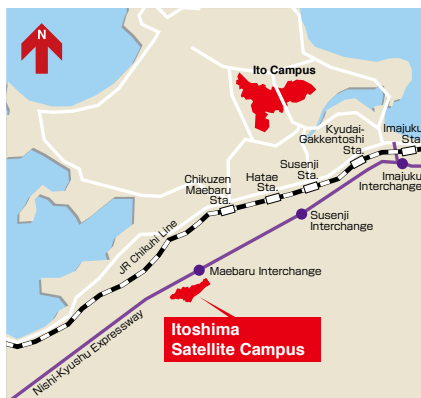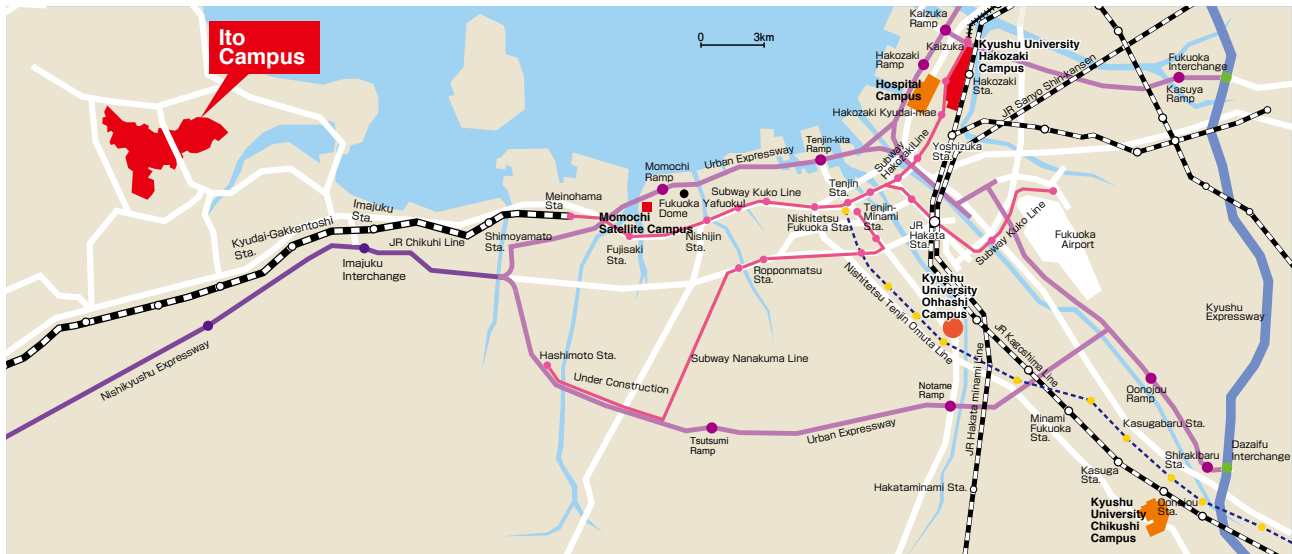




The Graduate School / Faculty of Information Science and Electrical Engineering moved to the new Ito Campus in 2006. However, some faculty members and students take part in research and educational activities at the Hakozaki Campus, since several related departments such as the Research Institute for 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/

**Ito Campus: 744 Motooka, Nishi-ku, Fukuoka 819-0395**
- Office of the Department of Informatics
  Tel: +81-92-802-3801
- 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