WASEDA University

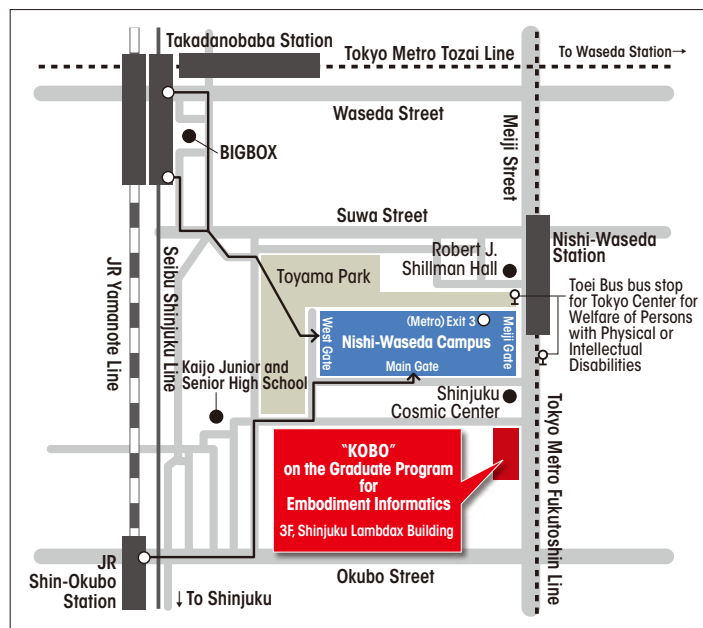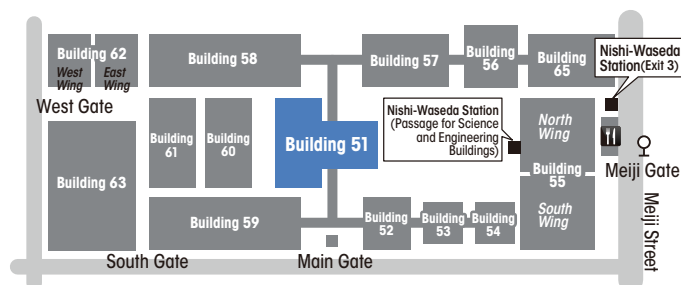## Access to Waseda University Nishi-Waseda Campus / "KOBO"

- (Metro) Exit 3 (Passage for Science and Engineering Buildings)of Nishi-Waseda Station on the Tokyo Metro Fukutoshin Line (directly connected to the campus)
- 12-minute walk from Shin-Okubo Station on the JR Yamanote Line
- 15-minute walk from Takadanobaba Station on the JR Yamanote Line, the Tokyo Metro Tozai Line and the Seibu Shinjuku Line

Map of Nishi-Waseda Campus

INNOVATION

COMPUTING NETWORKS

EMBODIMENT

Graduate Program for Embodiment Informatics

Graduate Program for Embodiment Informatics
Faculty of Science and Engineering, Waseda University

http://www.leading-sn.waseda.ac.jp/
E-mail: leading-sn-info@list.waseda.jp

Administration office
Room 08A, 1F, Building 51, Nishi-Waseda Campus,
3-4-1 Okubo, Shinjuku-ku, Tokyo 169-8555, Japan
Tel: 03-5286-2836 Fax: 03-5286-2847

KOBO
3F, Shinjuku Lambdax Building, 2-4-12, Okubo,
Shinjuku-ku, Tokyo, 169-0072, Japan
Tel: 03-6233-7801 Fax: 03-5285-0028

WASEDA

Graduate
Program for
Embodiment
Informatics

Work Hard in a Stimulating Academic Environment and
Become a Next-Generation Systems Innovation Leader

As work continues apace on a global scale to create new technology, significant innovation is required to ensure this technology excels. In the field of information and communications technology, new industries are being created at a rapid pace. In the field of mechanical engineering, which embodies technology in tangible products, significant contributions are being made to Japan's industrial competitiveness. The integration of these important fields is expected to create new industries and a strong demand for innovative and talented individuals.

Our "Graduate Program for Embodiment Informatics" has been selected as part of the Ministry of Education, Culture, Sports, Science and Technology's"Program for Leading Graduate Schools," which aims to "advance the establishment of university graduate schools of the highest caliber by supporting the dramatic reform of their education programs in such a way that they will institute degree programs recognized as top quality around the world."

Reference: http://www.jsps.go.jp/english/e-hakasekatei/index.html

Next-generation Systems Leader

Integration

Integration of embodiment with information

The Workshop study space

Graduate Program for Embodiment Informatics

Five-year education system

KOBO

System

Develop global leaders who can lead innovation with foresight, imagination, and strong leadership skills and accomplishment abilities to work in domestic and overseas industries

Welcome to Embodiment Informatics

Professor **Shigeki Sugano**,

Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
Coordinator for the Graduate Program for Embodiment Informatics

Japan's *monozukuri* (manufacturing) technology is highly regarded around the world. It creates *mono*, all kinds of tangible products from cars and trains to production equipment. Nevertheless, many world-leading innovators, such as Google, Apple, and KUKA, were first established in Europe and the U.S. Some believe that in the *monozukuri* field Japan lacks human resources with three abilities: foresight, the ability to identify possible areas for innovation; imagination, the ability to integrate advanced technology in a broad range of fields; and leadership and accomplishment abilities. In particular, foresight and imagination are essential in the fields of information and communications technology and mechanical systems to develop new medical, welfare, manufacturing and social infrastructures. Development of human resources in these fields is a priority that researchers, educators, and entrepreneurs need to address.

Of importance here is how information and communications technology should be integrated with mechanical engineering. Both are core technologies in *monozukuri*, so many universities and research institutions have been working to combine them. Merely combining them, however, does not achieve technological innovation or integration. Those who are familiar with programming and networks in the field of information and communications technology need to learn mechanical design, while those who are familiar with mechanical design need to learn methodologies in the field of information and communications technology. In other words, there is a need for talented individuals who have completed a course of comprehensive study in a new academic and research field integrating these two technological fields.

For example, developing a surgery support system requires high-precision robotic and human interface technologies. If methodologies from the information and communications field, such as networking and high-speed data processing, can be applied to such a system, this new surgery support system will be able to manage large amounts of medical data and instantly provide appropriate therapeutic procedures. This is a typical example of embodiment informatics.

If a student learns the core technologies in one of the fields of information, communication, or machinery, graduates from that department, and then goes on to a graduate school in that field, he or she will gain expertise in that field only. However, if a student goes on to graduate school to study embodiment informatics—a program that integrates these fields—rather than going on to graduate school to study each field individually, he or she can successfully develop foresight, imagination, and the leadership and the accomplishment abilities to achieve breakthroughs. Of course, the study environment is important. If students conduct their studies independently of each other, they cannot generate new ideas in embodiment informatics. For this reason, Waseda University has created an educational space called *KOBO* (Workshop), where all students come together to study and motivate each other. We strongly encourage motivated students to join the Graduate Program for Embodiment Informatics to exhibit how innovative and world-leading Japan's *monozukuri* technology can be.

Targeting human resources and the key to their development

Learn from the past and live in the present

Foresight
Ability to read the trends of the times from an international perspective and identify challenges for innovation
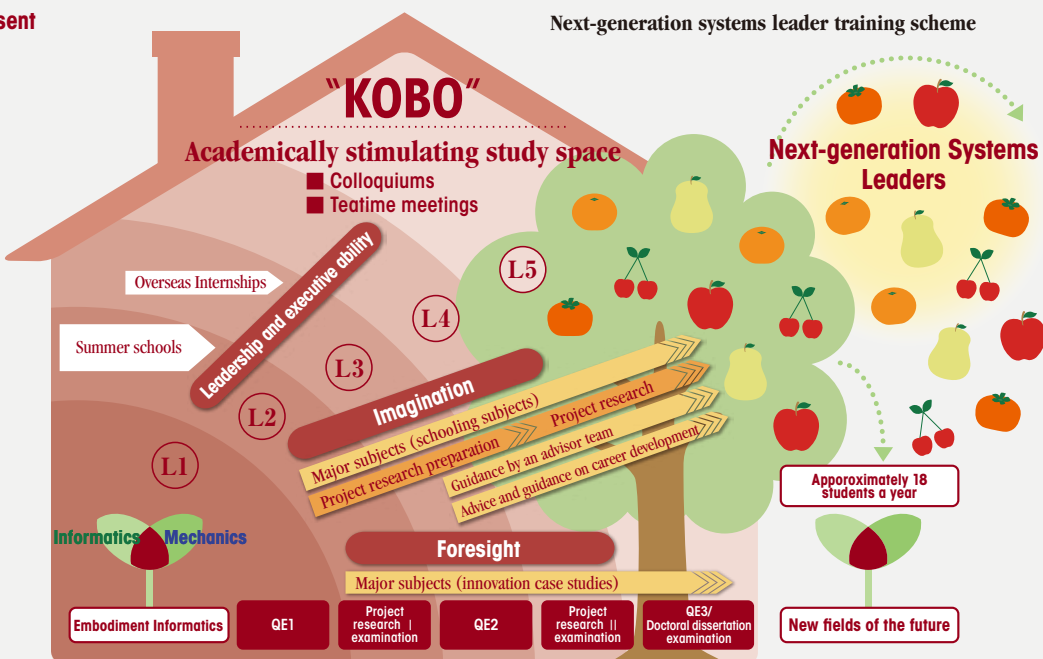
Know the molds and break them

Imagination
Ability to find systematic solutions to challenges by integrating advanced information, communications, and machinery technologies

Act as a leader with an understanding of what a leader should be like

Leadership and accomplishment abilities
Ability to implement plans to overcome challenges by making effective use of human and material resources

Next-generation systems leader training scheme

"KOBO"
Academically stimulating study space
■ Colloquiums
■ Teatime meetings

Next-generation Systems Leaders

L5
L4
L3
L2
L1

Overseas Internships

Summer schools

Leadership and executive ability

Imagination

Major subjects (schooling subjects)
Project research
Project research preparation
Guidance by an advisor team
Advice and guidance on career development

Informatics Mechanics

Foresight

Major subjects (innovation case studies)

Embodiment Informatics | QE1 | Project research I examination | QE2 | Project research II examination | QE3/Doctoral dissertation examination

Apporoximately 18 students a year

New fields of the future

The Workshop Study Space

Students study in a shared workshop, which is independent of the laboratories of their academic supervisors, together with other students from different backgrounds.
This academically stimulating study environment enables students' ideas and studies to become transparent and interactive, motivating students to devote themselves to their studies and facilitating interdisciplinary activities.

Lab.space
HIROBA
Lounge
Lab.space
Lab.space
Entrance
IDOBATA
Personal

HIROBA

HIROBA means a common space in Japanese. Lectures, colloquia, workshops and other activities that gather students, faculty members as well as guests are held here. A high-fidelity communication system to connect satellite sites (Kita-kyushu campus or others), cutting-edge presentation tools and movable tables are available to help facilitate active discussions.

Lounge

This may be the most relaxing area in KOBO, equipped with a large monitor for information display, also surrounded by a range of books, magazines, and other study materials. Way-out concepts and/or lively ideas are expected to be generated here, which would lead to novel collaborations.

IDOBATA

IDOBATA, in Japanese, originally denotes a place for small talk. The open and cheerful atmosphere here makes it a place best suited for casual discussions.

Lab.space

In this area, students embody and corroborate their innovative ideas through a trial and error process. Machine tools of various kinds, 3-D printers, and computers help their efforts. "Lab. space" embodies KOBO.

Personal

Faculty members and admin staff are doing their own work in this relatively quiet area, while sometimes hearing the active discussions of the students in the background.

Future Leaders Studying at KOBO

"Let's give it a go!" Challenges exist to be overcome. "Kobo" is the exactly right base for intellectual experiences and creation.

(Left) **Taro KANAI** Department of Modern Mechanical Engineering
Graduate School of Creative Science and Engineering

The activities in kobo continue to be challenging every day. Here, with the students from mechanical engineering and computer science gathered, we often hear unknown technical terms and learn their meanings. New collaborative projects are started frequently, which we discuss using whiteboards, and then proceed to make prototypes immediately. Through these intellectual activities, my kobo life is a truly stimulating experience for me.
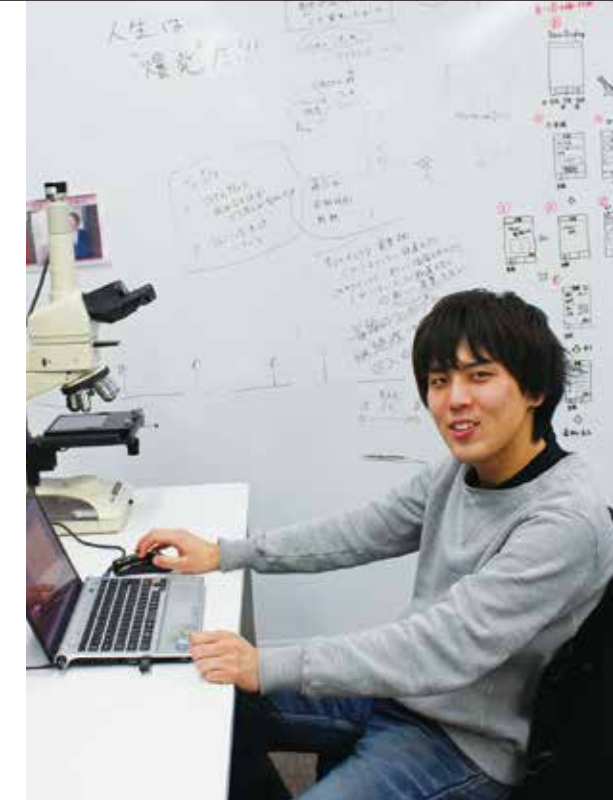
The path to become a researcher working in industry This program provides many opportunities

Tomoya KOSHI Department of Applied Mechanics
Graduate School of Fundamental Science and Engineering

I decided to join in this program because I am eager to develop new innovative devices or systems in the future as a leading researcher for the industry. I am realizing my own growth every day through a lot of experiences, which are never offered in conventional graduate schools, such as subjects related to innovation or management, English language training in U. C. Davis, a field work in Vietnam, a variety of colloquiums and collaborations with students in different fields, and so on.

The place where imagination becomes reality Innovative ideas that go beyond all borders

(Right) **Takuya KATO** Department of Pure and Applied Physics
Graduate School of Advanced Science and Engineering

Kobo is wall-less. Just by looking around Kobo, there is nothing to stop me from interacting with other students using the 3D printers, creating animations with 3DCG, or doing experiments with robots. This atmosphere encourages us every day to originate innovative ideas beyond any borders of age, department affiliation, origin etc.

Faculty

Hiroshi G. OKUNO
Title and Organization:Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
Current Specialty and Degree:Artificial Intelligence, Computational Auditory Scene Analysis, Robot Audition / Ph.D.

Kinji MORI
Title and Organization:Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
Current Specialty and Degree:Information Engineering / Doctor of Engineering

Yoshihiko HAYASHI
Title and Organization:Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
Current Specialty and Degree:Natural Language Processing, Semantic Computing, Information Access Systems / Doctor of Engineering

Yuko SHIRAI
Title and Organization:Associate Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
Current Specialty and Degree:Environmentology / Doctor of Engineering

Alexander SCHMITZ
Title and Organization:Assistant Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
Current Specialty and Degree:Robotics / Ph.D.

Wei WANG
Title and Organization:Assistant Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
Current Specialty and Degree:Intelligent Machines, Robot Motion Planning, Compliance Control, Indoor Positioning / Ph.D.

Cheng ZHANG
Title and Organization:Assistant Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
Current Specialty and Degree:Machine Control Algorithm, Embedded Software, Game Theory, Network Economics, Machine Learning / Doctor of Science

Kazuhiko IWATA
Title and Organization:Researcher, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
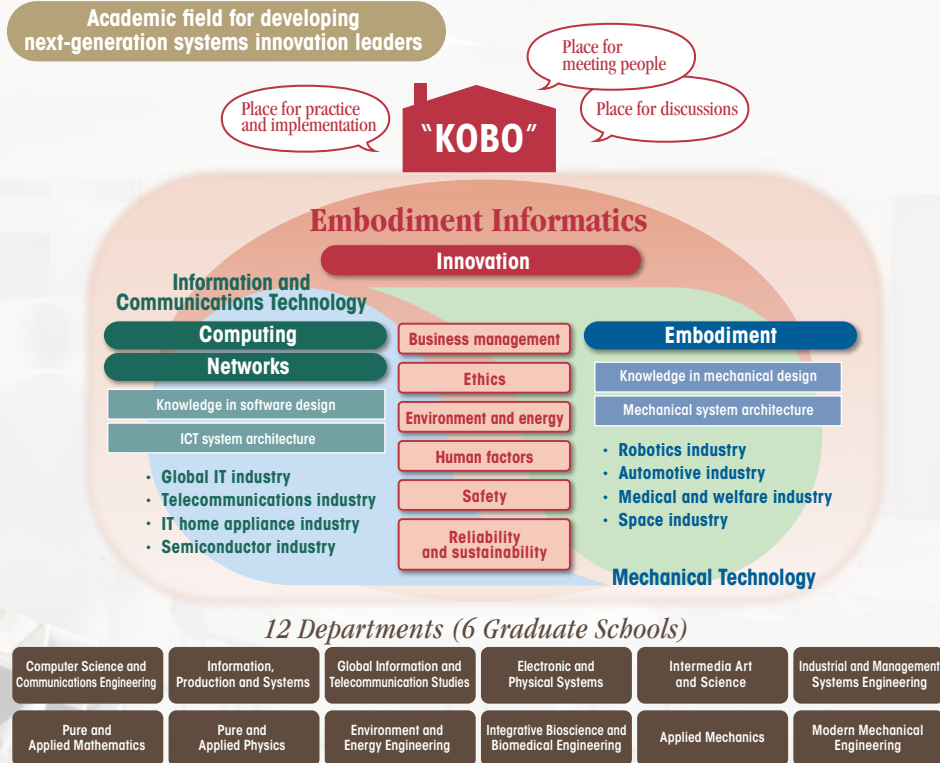Current Specialty and Degree:Speech information processing / Master of Engineering

Staff

(in the back row, from the left)
Utako YAMADA
Masumi TOYOFUKU

(in the front row, from the left)
Madoka KUNIYASU
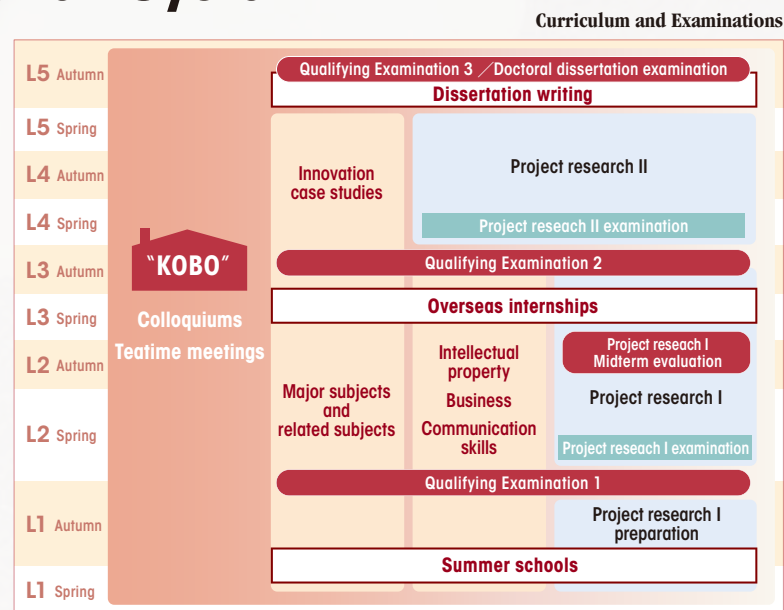Atsuko TSURIYA

Integration of Embodiment with Information

Embodiment informatics is a new academic field that integrates embodiment with informatics to produce benefits for applications (with a focus on problem-solving) in important fields, such as production, medicine, and environment. It also aims to create added values by integrating the benefits of information technology (strength in computing and reasoning), communications technology (strength in networks and sharing resources), and mechanical engineering (strength in embodiment and hardware implementation). The curriculum of this program is designed to enable students to acquire a broad range of engineering knowledge. Mechanical engineering graduates are required to take basic informatics courses, while computer science graduates are required to take basic mechanical engineering courses.

Academic field for developing next-generation systems innovation leaders

Place for meeting people
Place for practice and implementation
"KOBO"
Place for discussions

Embodiment Informatics

Innovation

Information and Communications Technology

Computing
Networks
Knowledge in software design
ICT system architecture

Business management
Ethics
Environment and energy
Human factors
Safety
Reliability and sustainability

Embodiment
Knowledge in mechanical design
Mechanical system architecture

- Global IT industry
- Telecommunications industry
- IT home appliance industry
- Semiconductor industry

- Robotics industry
- Automotive industry
- Medical and welfare industry
- Space industry

Mechanical Technology

12 Departments (6 Graduate Schools)

Computer Science and Communications Engineering	Information, Production and Systems	Global Information and Telecommunication Studies	Electronic and Physical Systems	Intermedia Art and Science	Industrial and Management Systems Engineering
Pure and Applied Mathematics	Pure and Applied Physics	Environment and Energy Engineering	Integrative Bioscience and Biomedical Engineering	Applied Mechanics	Modern Mechanical Engineering

Five-Year Education System

This program encourages project-based learning (PBL) and offers students an attractive curriculum consisting of various coursework and laboratory work. Students are expected to acquire knowledge and experience required of a global leader through frequent interaction with professors and engineers in overseas institutions and industries as well as through collaboration with domestic and overseas companies and research institutions.

During the five-year course, the program gives students three qualifying examinations (QE) with clear evaluation criteria to check their study progress. In addition, an examination committee (advisory team), which consists of a chief academic supervisor, one or two assistant academic supervisors, and two external supervisors for the program (one from government or industry and one from overseas), guarantees the quality of each student.

Curriculum and Examinations

L5 Autumn — Qualifying Examination 3 / Doctoral dissertation examination
Dissertation writing
L5 Spring
L4 Autumn — Innovation case studies — Project research II
L4 Spring — Project reseach II examination
L3 Autumn — "KOBO" — Qualifying Examination 2
Colloquiums — Overseas internships
L3 Spring — Teatime meetings — Intellectual property
L2 Autumn — Major subjects and related subjects — Business — Project research I
L2 Spring — Communication skills — Project reseach I examination
— Qualifying Examination 1
L1 Autumn — Project research I preparation
— Summer schools
L1 Spring

Various Career Paths

As various companies and research institutions are involved in QE, project examination, research guidance, internships, overseas study, and other programs, students can get valuable opportunities to interact with domestic and overseas companies and research institutions from early on in their study in this program. This interaction provides students with more job opportunities than conventional job search efforts based on university recommendations or their own applications, enabling students to choose various career paths. Students enrolled in this program are entitled to a study grant and other financial assistance.

◆Our program has various assistive measures including study grants. Please see our website for details.

Professors and Lecturers

[① Title and Organization ② Current Specialty and Degree ③ Research Themes]

◎Head program supervisor

Shuji HASHIMOTO
①Senior Executive Vice President for Academic Affairs & Provost and Professor, Department of Pure and Applied Physics, Graduate School of Advanced Science and Engineering
②Measurement and information engineering / Doctor of Engineering
③Research on robots, AI, and image and sound processing

◎Program coordinator

Shigeki SUGANO
①Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
②Intelligent mechanics / Doctor of Engineering
③Human-symbiotic robot design and its control

◎Program sub-coordinator

Tetsunori KOBAYASHI
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Perceptual computing systems / Doctor of Engineering
③Research on conversation-based human-computer interaction

◎In charge of curricula

Toshiyasu MATSUSHIMA
①Professor, Department of Pure and Applied Mathematics, Graduate School of Fundamental Science and Engineering
②Information theory / Doctor of Engineering
③Information theory and its applications

Hiroyuki KAWAMOTO
①Professor, Department of Applied Mechanics and Aerospace Engineering, Graduate School of Fundamental Science and Engineering
②Precision Engineering / Doctor of Engineering
③Dynamics of electromagnetic particles and applications in image formation and space exploration

Tetsuya SATO
①Professor, Department of Applied Mechanics and Aerospace Engineering, Graduate School of Fundamental Science and Engineering
②Aerospace propulsion engineering / Doctor of Engineering
③Research on air-breathing engines for hypersonic aircraft

Eiji IWASE
①Associate Professor, Department of Applied Mechanics and Aerospace Engineering, Graduate School of Fundamental Science and Engineering
②Micro-electro-mechanical Systems / Doctor of Information Science and Technology
③Flexible micro-devices and optical micro-devices

Masao YANAGISAWA
①Professor, Department of Electronic and Physical Systems, Graduate School of Fundamental Science and Engineering
②Information engineering / Doctor of Engineering
③Integrated system design, information and communications system design, and bioinformatics

Nozomu TOGAWA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Information engineering / Doctor of Engineering
③Integrated system design, circuit design, and information and communications system design

Shigeru SHIMAMOTO
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Information and telecommunications / Doctor of Engineering
③Wireless access, air and space communications, and human body communications

Ikuro CHOH
①Professor, Department of Intermedia Art and Science, Graduate School of Fundamental Science and Engineering
②Media design / Doctor of Art
③Media design, User interface design

◎In charge of curricula

Hiroyasu IWATA
①Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
②Neurorobotics / Doctor of Engineering
③Neuro-rehabilitation assistive RT and Next generation cancer treatment robots

Shingo TAKAHASHI
①Professor, Department of Industrial and Management Systems Engineering, Graduate School of Creative Science and Engineering
②Systems theory / Doctor of Science
③Systems theory and social simulation
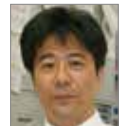
Takeshi IKENAGA
①Professor, Department of Information, Production and Systems, Graduate School of Information, Production and Systems
②Image signal processing systems / Doctor of Information and Computer Science
③Image information processing algorithms and systems

Shinji KIMURA
①Professor, Department of Information, Production and Systems, Graduate School of Information, Production and Systems
②Information Science / Doctor of Engineering
③VLSI Design Verification & Optimization

Yushi KAMIYA
①Professor, Department of Environment and Energy Engineering, Graduate School of Environment and Energy Engineering
②Engineering, electrical and electronic engineering, electric power engineering, power conversion, and electrical machinery / Doctor of Engineering
③Research and development of electric vehicles friendly to both people and the environment

◎In charge of evaluation of students

Tetsuya OGATA
①Professor, Department of Intermedia Art and Science, Graduate School of Fundamental Science and Engineering
②Cognitive robotics / Doctor of Engineering
③Informatics for emergent interaction systems

◎In charge of QE and project examination

Shinichi OISHI
①Professor, Department of Pure and Applied Mathematics, Graduate School of Fundamental Science and Engineering
②Guaranteed accuracy in numerical computation / Doctor of Engineering
③Guaranteed accuracy in numerical computation and its applications in science and engineering

Kazunori UEDA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Information engineering / Doctor of Engineering
③Very high-level programming languages and software verification

Hiroshi ISHIKAWA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Computer vision / Ph.D.
③Computer vision and medical image processing

Masakatsu FUJIE
①Professor, Department of Integrative Bioscience and Biomedical Engineering, Graduate School of Advanced Science and Engineering
②Medical, Rehabilitation and Healthcare Engineering / Doctor of Engineering
③Research on Healthcare Robot based on Organ Dynamics

Mitsuo UMEZU
①Professor, Department of Integrative Bioscience and Biomedical Engineering, Graduate School of Advanced Science and Engineering
②Medical equipment engineering / Doctor of Engineering and Doctor of Medicine
③Medical equipment engineering and regulatory science

◎In charge of career paths and internships

Hayato YAMANA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Big Data Analysis / Doctor of Engineering
③Big data analysis and analysis techniques

Jin KUSAKA
①Professor, Department of Modern Mechanical Engineering, School of Creative Science and Engineering
②Fluid-Thermo dynamics with chemical reaction, transport phenomena, internal combustion engines, catalyst for automobile, fuel cell, li-ion battery simulation / Doctor of Engineering
③Research on thermal energy reaction engineering

Makoto YOSHIDA
①Professor, Department of Modern Mechanical Engineering, Graduate School of Creative Science and Engineering
②Engineering materials and manufacturing engineering / Doctor of Engineering
③Transport equipment and energy materials engineering

◎In charge of cooperation with businesses

Shigeki GOTO
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Information engineering / Doctor of Engineering
③Network security and management

Hironori KASAHARA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Advanced computing systems / Doctor of Engineering
③Multi-core parallelizing compilers for low power high performance computing

Shigeo MORISHIMA
①Professor, Department of Pure and Applied Physics, Graduate School of Advanced Science and Engineering
②Information engineering / Doctor of Engineering
③Authoring system to support content creation, direction and appreciation using computer vision and graphics technologies

◎In charge of cooperation with overseas organizations

Yasuo MATSUYAMA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Information engineering / Doctor of Engineering,Ph.D.
③Creation of machine learning algorithms and their application to ICT

Tatsuo NAKAJIMA
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Distributed interactive systems / Doctor of Engineering
③Research on digital-physical hybrid platforms

Takuro SATO
①Professor, Department of Computer Science and Communications Engineering, Graduate School of Fundamental Science and Engineering
②Telecommunications / Doctor of Engineering
③Ubiquitous communication networks

Atsuo TAKANISHI
①Professor, Department of Integrative Bioscience and Biomedical Engineering, Graduate School of Advanced Science and Engineering
②Robotics / Doctor of Engineering
③Development of humanoid robots and robots for medical use, disaster response, and outdoor use

Takeshi YOSHIMURA
①Professor, Department of Information, Production and Systems, Graduate School of Information, Production and Systems
②Optimization technologies / Doctor of Engineering
③Research on optimization technologies for VLSI design automation

◎In charge of cooperation with businesses (partner company),Advisor in charge of projects

Kenjiro FUJII
①Administrative Officer, Manager of Marking Systems and Hoist Systems Division and Head of Toga Administrative Division, Hitachi Industrial Equipment Systems Co., Ltd.
②Automation and networks / Master of Engineering

◎In charge of cooperation with domestic public research institutions

Kazuhito YOKOI
①Deputy Director of Intelligent Systems Research Institute, National Institute of Advanced Industrial Science and Technology
②Robotics / Doctor of Engineering

◎In charge of curricula and career paths

Noriaki ITO
①Representative Director, President Consulting Co., Ltd.
Visiting Professor, Tokyo University of Agriculture and Technology
②Business management / Bachelor's degree

◎In charge of cooperation with businesses (partner company), and advisory and career paths QE and degree examination

Makoto IWAMURA
①Head Researcher/Research Fellow, Secure Platform Laboratories, Nippon Telegraph and Telephone Corporation
②Information engineering / Doctor of Engineering

Toshiaki YASUE
①Advisory Researcher, IBM Research-Tokyo, IBM Japan, Ltd.
②Information engineering / Doctor of Engineering

Takuya OIKAWA
①Senior Engineering Manager, Google Japan Inc.
②Web platform technology / Bachelor of Engineering

◎In charge of cooperation with overseas organizations (partner organization) International cooperation, Examination committee

Jing Xiao
①Professor, Department of Computer Science College of Computing and Informatics, University of North Carolina at Charlotte
②Robotics, haptics, and intelligent systems / Ph.D.

Martin Buss
①Professor, (Chair), Department of Electrical Engineering and Information Technology, Technische Universität München
②Robotics and Control / Dr.-Ing

◎In charge of cooperation with overseas organizations (partner organization), QE and degree examination

Giovanni De Micheli
①Professor, Electrical Engineering & Computer Science, École Polytechnique Fédérale de Lausanne (EPFL)
②Electronic circuit design / Ph.D.

Jan M. Rabaey
①Professor, Electrical Engineering and Computer Science, University of California, Berkeley
②Electronic circuit design / Ph.D.

Frank Soong
①Principal Researcher, Microsoft Research Asia
②Speech modeling and recognition / Ph.D.

◎In charge of cooperation with overseas organizations, QE and degree examination

Peilin Liu
①Professor, IC & System Research Center, Shanghai Jiao Tong University
②Multimedia processing / Ph.D.