Creating new industries and advancing civilization

Engineering contributes to civilization – the framework that guarantees the happiness of human being – and creates technologies that make human lives richer and more comfortable.

The School of Engineering was founded in April 2016 as a result of organizational reform by Tokyo Institute of Technology. The School consists of five undergraduate departments teaching the core fields of engineering: Mechanical Engineering, Systems and Control Engineering, Electrical and Electronic Engineering, Information and Communications Engineering, and Industrial Engineering and Economics, and also offers various graduate programs following those undergraduate programs. Through innovative curricula, students learn a diverse range of topics, including monotsukuri – advanced manufacturing as applications of the fundamental engineering and science. They engage in cutting-edge research in their laboratories, and interact with excellent students and researchers around the world through exchanges and international conferences, which cultivates in them the abilities they need to be creative engineers, researchers, and educators capable of working globally.

On the research front, we are promoting the reorganization of the research fields and groups across all schools in Tokyo Institute of Technology to better respond to the changing needs of the time. We have also established several interdisciplinary research groups that can be researching the global issues to realize our goal of building a sustainable society, including the Integrated IoT Technology Group, the Human Centric Group, and the Smart Power Grid Group. These research structures contribute to the original, fundamental research conducted by faculties in our school, and promote collaboration research between industry and academia, with a particular emphasis on international research collaborations with some of the world’s top universities and corporations.

The education and research at the School of Engineering is building a new future for human being.

Nobuyuki IWATSUKI
Dean, School of Engineering Professor

Steering Committee
Mitsuji SAMPEI, Associate Dean for Education and International Affairs
Hirotsgu INOUE, Associate Dean for Finance and Safety
Koichi YASUOKA, Associate Dean for Planning and Public Relations
Shigetaka TAKAGI, Associate Dean for Research and Evaluation
### Departments and Research Groups in School of Engineering

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<td>Advanced Management and Paradigm Creation</td>
<td>Industrial System, Human Centered System, Operations management</td>
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<td>Analysis Method Creation</td>
<td>Operations Research, Mathematical Sciences and Informatics, Econometrics, Cyber Physical System</td>
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<td>Economic Science</td>
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* interdisciplinary graduate majors that span multiple schools or departments

### Interdisciplinary Research Groups

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Interdisciplinary Research Groups

Smart Power Grid Group

To accelerate the advanced usage of renewable energy based on the research and development on distributed and cooperative control with a core of power electronics and secondary batteries, the School of Engineering organizes Smart Power Grid Group beyond the framework of Departments, and various research activities are conducted.

Faculty

Smart Power Grid Group

Renewable Power Generation Field

Toshiya Nanahara, Professor
Power system engineering/Power engineering/Generation control/Wind power/Photovoltaic power/Energy storage/Time series analysis/Stochastic analysis

Kenichi Kawabe, Assistant Professor
Power system engineering/Power engineering/Wind power/Photovoltaic power/Energy storage/Power electronics-based devices/Mathematical Programming

Smart Power Grid Group

Electric Power Control Field

Jun-ichi Imura, Professor
Control theory of harmonized power systems accepting massive renewable energy of photovoltaic/wind power, Design theory of global power systems with power markets

Takayuki Ishizaki, Associate Professor
Distributed power systems stabilization based on retrofit control and electricity market design under high penetration of storage and renewable energy resources

Smart Power Grid Group

Electric Energy Storage Field

Shuichiro Hirai, Professor
X-ray, MR In-situ measurements and numerical simulations of fuel cell, lithium battery, lithium air battery, etc.

Takashi Sasabe, Associate Professor
Investigation into transport phenomena within electrochemical devices, like fuel cell and Li-ion battery by using nano/micro X-ray imaging and CFD modeling

Smart Power Grid Group

Advanced usage of renewable energy

Electric Power Control F
Systems and Control Eng. Dept.
• Systems and control
• Smart city
• Distributed and cooperative control
• Power network control

Electric Power Conversion F
E & E Eng. Dept.
• Power electronics
• DC transmission
• Solar power generation
• Motor Drive

Renewable Power Generation F
E & E Eng. Dept.
• Wind power generation
• Solar power generation
• Power system control
• Grid integration of distributed energy resources
Interdisciplinary Research Groups

Integrated IoT Group

In order to realize a smart society using IoT technology, we are conducting research activities with a department-transverse research group in the school of engineering.

Cyber Physical System Field

Integrated IoT Group

Masayuki Fujita, Professor
Our Research lies in Cooperative Control and Distributed Learning in Human Robotic-Network Teaming with Visual Feedback.

Takeshi Hatanaka, Associate Professor
Distributed control/optimization/learning for Cyber-Physical Systems including buildings, data centers and microgrids

Junichi Iijima, Professor
Enterprise Engineering consisting of Enterprise Ontology, Enterprise Governance and Enterprise Architecture, Especially, DEMO for Enterprise Ontology and IT-EQM for Enterprise Governance of IT.

Yoichiro Higuchi, Professor
Econometrics, Spatial Econometrics, Development and Application of Spatial Interaction Data on Human Migration, Goods Distribution, Capital Circulation and Information Traffic

Jaehyun Park, Assistant Professor
My research highlights three genres – (1) ICT-enabled Innovations, (2) design thinking, and (3) smart cities & tourism in innovation, information systems, and design.

Integrated IoT Group

Integrated Robotics Field

Koichi Suzumori, Professor
Development of new actuators and their application to biomimetic robots, soft robots, body support wears, tough robots and micro robots.

Hiroyuki Naba, Assistant Professor
Study on component technologies with a focus on new actuators, and their application to micro robots and mechatronics devices.

Integrated Circuit Field

Akira Matsuzawa, Professor
Mixed signal ICs, Data converters, Radio frequency ICs, Millimeter wave transceivers, Sensor circuits, and Automated analog IC design

Kenichi Okada, Associate Professor
Millimeter-wave Wireless Transceiver/5G/Battery-less IoT Wireless Sensor Node/CMOS Integrated Circuits/PLL/Atomic Clock/Terahertz Communication & Sensing & Imaging

Integrated IoT Group

Wireless Communication Field

Kazuhiko Fukawa, Professor
Transmission and network techniques for wireless communications by developing digital signal processing, adaptive filters, and statistical based algorithms.

Jiro Hirokawa, Professor
Millimeter-wave high-efficiency planar antenna, 2D beam-switching circuit, fast analysis for antenna design, 2D orthogonal multiplexing

Kei Sakaguchi, Professor
Wireless communication engineering 5G/IoT/Millimeter-wave/Wireless energy transmission Connected car/Automated driving

Takashi Tomura, Specially Appointed Associate Professor
Research based on electromagnetic engineering: large-scale EM analysis, near-field communication system, satellite onboard & phased array antennas.

Tran Gia Khanh, Assistant Professor
Next generation wireless communication networks/Next generation sensor networks
Interdisciplinary Research Groups

Human Centric Group

We are working to create and develop the field of human centered engineering from the various points of view, such as design, humanomics, human information processing, cybernetics.

Faculty

Human Centric Group

Human Centric Design Field

Masafumi Okada, Professor
Robot design and control from mathematical or physical point of view, and its application to human motion instruction.

Wataru Hiji kata, Associate Professor
Study on medical device and mechanical system based on mechatronics and biomedical engineering. Development of implantable power generator, artificial heart, wireless power transfer, control of muscle contraction.

Celine Moun genot, Associate Professor
Our goal is to understand “design” through a scientific approach and to create tools to support designers’ creativity and users’ involvement in co-design.

Takako Yoshida, Associate Professor
Brain science, human perception and psychophysics, visuo-haptic multimodal man-machine interface, attention/inattention.

Human Centric Group

Sensory Information Processing Field

Hirohiko Kaneko, Professor
Visual information processing, Psychophysics, Space perception, Stereopsis, Binocular disparity processing, Multisensory integration, Eye movements, Perceptual adaptation

Rumi Hisakata, Assistant Professor
Psychophysics/Human visual processing/Binocular vision and 3D perception/Motion perception/Visual illusions/small eye movements/visual stability

Yasu haru Koike, Professor (Biointerfaces Unit)
Computational Neuroscience, Human Motor Control Theory, Human interface: Brain Machine Interface, Analysis of subjective feeling based on computational model

Human Centric Group

Humanomics Field

Natsue Yoshimura, Associate Professor (Biointerfaces Unit)
Brain activity information decoding (motor control, emotion, language, etc) / Brain-machine interfaces / Machine learning / EEG / fMRI

Hiroyuki Kanbara, Assistant Professor (Biointerfaces Unit)
Computational Neuroscience: We proposed computational model for neural motor learning of reaching movements.

Human Centric Group

Cybernetics Field

Dai Senoo, Professor

Emiko Fukada, Associate Professor
Industrial economics/experimental economics/numerical analysis of game theory model/congestion management/Security and disaster-relief service

Jacqueline Urakami, Assistant Professor
Human Factors/culture and technology/cognitive ergonomics for interface design/technology for an aging society

Human Centric Group

Cybernetics Field

Motomu Nakashima, Professor
Modeling of human motion in sports, optimization of human motion as well as design and development of optimal tools and equipment using simulation and humanoid robot

Kazuhiro Nakadai, Specially Appointed Professor
Key research topics are robot audition and computational scene analysis, and wide areas are covered such as robotics, signal and speech processing, AI, and machine learning.
Department of Mechanical Engineering

Education and research at the Department of Mechanical Engineering is designed to discover new phenomena, principles, and methods and to create new machinery capable of achieving a balance between humanity and the environment.

Students at the Department of Mechanical Engineering acquire advanced, specialized knowledge in the field of mechanical engineering and much more. By teaching students how to identify and solve problems, and by instilling in them the abilities they need to communicate with people around the world, our aim is to cultivate individuals who will be active in industry and academia, and contribute to maintaining and improving Japan’s competitiveness on the global stage into the future. In the excellent education and research environment, discover your own potential alongside faculty who work on the frontier of mechanical engineering.

The Department of Mechanical Engineering offers courses such as Engineering Mechanics, Mechanics of Materials, Thermodynamics, Fundamentals of Fluid Mechanics, Mechanical vibrations, and Machine Design and Machine Drawing. Through courses like these, student learn how to analyze the behavior of mechanical systems, and gain the knowledge they need to integrate that understanding into the creation of new mechanisms. In addition to these disciplines, which serve as the core of mechanical engineering, students set their sights on a broad array of research fields, including control, robotics and mechatronics; precision engineering; mechanical design; processing, production and materials; biomedical and welfare engineering; design engineering; space engineering and more. Students learn not only how to analyze various phenomena theoretically; they also learn how to apply that knowledge to solve issues that arise in engineering. Our aim is to cultivate individuals capable of devising innovative mechanical systems that will help humanity achieve balance with its environment.

Students of the 4th academic group go on to the Department of Mechanical Engineering. In addition to the undergraduate program, the department offers graduate programs in Mechanical Engineering, Energy Science and Engineering, Engineering Sciences and Design, Human Centered Science and Biomedical Engineering, and Nuclear Engineering.

Research and Fields of Research

**Research**

The Department of Mechanical Engineering is actively working toward expanding the fundamental areas of study and research in the field of mechanical engineering. The department is building an educational/research framework that thoroughly displays the strengths of mechanical engineering as an integrated technological field, thereby contributing to the advancement of research into advanced energy applications, advanced functional materials, digital manufacturing, and other such areas. In addition, we are producing outstanding results in the fields of robotics and advanced manufacturing technologies, both of which share strong ties with industry, and are putting forth great effort in frontier fields such as aerospace and medical engineering. Moreover, we promote safe, secure technological development from a mechanical engineering viewpoint, as we conduct research and development aimed at achieving human-centric design. From the perspective of societal collaboration, our department (as a member of the Industry-University Cooperation Office in the School of Engineering) serves as an intermediary and provides a forum to bring together faculty working on a wide variety of research projects, allowing us to contribute more to society through discoveries made in the field of mechanical engineering.

**Education**

The Department of Mechanical Engineering offers courses such as Engineering Mechanics, Mechanics of Materials, Thermodynamics, Fundamentals of Fluid Mechanics, Mechanical vibrations, and Machine Design and Machine Drawing. Through courses like these, student learn how to analyze the behavior of mechanical systems, and gain the knowledge they need to integrate that understanding into the creation of new mechanisms. In addition to these disciplines, which serve as the core of mechanical engineering, students set their sights on a broad array of research fields, including control, robotics and mechatronics; precision engineering; mechanical design; processing, production and materials; biomedical and welfare engineering; design engineering; space engineering and more. Students learn not only how to analyze various phenomena theoretically; they also learn how to apply that knowledge to solve issues that arise in engineering. Our aim is to cultivate individuals capable of devising innovative mechanical systems that will help humanity achieve balance with its environment.

Students of the 4th academic group go on to the Department of Mechanical Engineering. In addition to the undergraduate program, the department offers graduate programs in Mechanical Engineering, Energy Science and Engineering, Engineering Sciences and Design, Human Centered Science and Biomedical Engineering, and Nuclear Engineering.

**Research Groups and Fields of Research**

**Thermo-fluid Group**

Utilizing thermodynamics and fluid dynamics to blaze a trail in the fields of energy and environmental technology.

- Energy Engineering Field
- Power and Propulsion Engineering Field
- Environmental Thermo-fluid Engineering Field

**Materials and Processing Group**

R & D into safe and secure technologies for mechanical structures, and advanced materials and processing technologies.

- Advanced Production Engineering Field
- Advanced Functional Materials Field
- Structural Safety and Security Technology Field

**Mechanical System Group**

Researching dynamic system theory and its application in everything from large-scale mechanical systems to robots and MEMS.

- Dynamics Field
- Robotics Field
- Advanced Machine Elements Field

**Frontier Technology Group**

Gathering new knowledge on the frontiers of mechanical engineering.

- Aerospace Systems Field
- Biomedical Engineering Field
- Human Centric Design Field
Thermo-fluid Group

Energy Engineering Field

Tetsuji Okamura, Professor
The field is refrigeration and cooling engineering, e.g., a cryogenic thermosyphon for superconducting magnet and a room-temperature magnetic refrigerator.

Yoshihiro Okuno, Professor
Applications of magnetohydrodynamic technology, especially a high efficient MHD electrical power generation with non-equilibrium plasma flow.

Keiji Kyogoku, Professor
Research fields include basic research on tribology (lubrication, friction, wear) and development of mechanical elements applying tribology.

Tomohiro Nozaki, Professor
Our research group focus on clean energy technology via plasma-mediated catalysis for greenhouse gas (CH4, CO2) conversion and novel nanostructured materials for energy conversion devices.

Seiji Okawa, Associate Professor
Aiming for energy saving technology development, active control of freezing of supercooled liquid, cold insulator for transportation systems of refrigerated food, materials for equipment startup in cold area.

Hiroshige Kikura, Associate Professor (LANE)
For safety improvement and advancement of nuclear reactors, we are researching thermal hydraulics, fluid measurement, nuclear safety, robot remote measurement.

Takao Nagasaki, Associate Professor
Applications and fundamentals of thermo-fluid dynamics mainly focused on liquid-vapor phase change such as heat pipe, heat pump, cavitation and heat exchanger.

Yoichiro Murakami, Associate Professor
Molecular energy engineering, thermal engineering, physical chemistry, molecular photophysics, engineering of triplet spins, development of energy conversion materials.

Tetsuo Sawada, Assistant Professor (LANE)
Study on safety of fast reactors, development of advanced nuclear energy systems, study on safety of fusion energy systems.

Tsutomu Hozumi, Assistant Professor
Study on active control methods of supercooling and measurements of thermal properties for cold reserving materials, heat storage materials and foods.

Satoshi Momozono, Assistant Professor
Fundamental researches of tribology and tribological applications for reduction of mechanical loss, wear and unexpected behavior caused by frictional characteristics.

Hirotatsu Watanabe, Assistant Professor
Chemical reaction and transport phenomena in energy conversion of carbon resources for low-carbon society.

Hideharu Takahashi, Specially Appointed Assistant Professor (LANE)
Research themes are thermal hydraulics for safety and advancement of nuclear reactors, decommissioning, waste treatment and disposal, decontamination.

Thermo-fluid Group

Power and Propulsion Engineering Field

Takayoshi Inoue, Professor
Heat transfer and its control under the extreme conditions, such as ultra low temp. to high temp., micro to macro, zero-gravitational to strong centrifugal field.

Hidenori Kosaka, Professor
High efficiency mobility systems, high efficiency, clean internal combustion engines, investigation of combustion via laser diagnostics, combustion control.

Mamoru Tanahashi, Professor
Physics and modeling of turbulence, turbulent heat/mass transfer and turbulent combustion in gas turbine combustors and internal combustion engines.

Shuichiro Hirai, Professor
X-ray MR In-situ measurements and numerical simulations of fuel cell, lithium battery, lithium air battery, etc.

Toshihiko Yoshida, Specially Appointed Professor
Element research to vehicle application on polymer electrolyte fuel cell, element research of SOFC.

Takashi Sasabe, Associate Professor
Investigation into transport phenomena within electrochemical devices, like fuel cell and Li-ion battery by using nano/micro X-ray imaging and CFD modeling.

Susumu Sato, Associate Professor
Improvement of environment load in transportation system, high efficiency after-treatment system, alternative fuel engines.

Masayasu Shimura, Associate Professor
Investigation of turbulent combustion using laser diagnostics such as LIF and PIV, and numerical simulations. Development of combustion control methods.

Jun Hasegawa, Associate Professor (LANE)
Fundamental researches on generation of high-brightness quantum beams composed of ions, clusters, neutrons, or ELV light, and their applications in the field of fusion energy.

Kazuyoshi Fushinobu, Associate Professor
Wide range of thermal/energy phenomena, from fundamental to applications. Laser, H2/PC, Electronic packaging. Strong ties with industries.

Suguru Uemura, Specially Appointed Associate Professor
X-ray In-situ measurements of transport phenomena in porous media of fuel cell and lithium battery.

Yuki Kameya, Specially Appointed Associate Professor
Transport phenomena of energy/environmental technologies; photocatalysis, fuel cell, etc.

Yu Ito, Assistant Professor
Rocket and jet engines with a focus on compressible flows, cavitating flows, cryogenic flows, supercritical fluid flows, and heat transfer between these and solids.

Yuki Minamoto, Assistant Professor
Investigation into fundamental physics of turbulent combustion using theoretical and computational approaches, and mathematical modeling for industry use.
Thermo-fluid Group
Environmental Thermo-fluid Engineering Field

Takayuki Aoki, Professor (GSIC)

Isao Satoh, Professor
Improvement of energy utilization in application fields such as production processes and air conditioning, and development of thermal storage and transport required for these applications.

Feng Xiao, Professor
Computational fluid dynamics, high-fidelity numerical methods for various complex flows, development of practical numerical models for real-case applications.

Tetsuya Suekane, Professor
Study on multiphase flows in porous media in geological storage of carbon dioxide and enhanced oil recovery based on X-ray microtomography and digital rock physics.

Katsunori Hanamura, Professor
Near-field radiation transfer and its application to power generation, analysis of anode for high power density SOFC, and development of DPF for next generation.

Shuzo Oshima, Associate Professor
Development of new material processing using MHD and MFD, particularly establishment of magnetic levitation production technology and a magnetic maintenance technology.

Takushi Saito, Associate Professor
Research and development of the materials processing and physical properties control based on the heat transfer control and laser aided processing as well as the evaluation of thermal physical properties of composite materials.

Kiyoshi Horiuti, Associate Professor
Fluid physics, theoretical and numerical analysis of turbulence. Vortex-dynamics and drag reduction in polymer-diluted flows.

Tatsuya Kawaguchi, Assistant Professor
Experimental and numerical investigation of multiphase and transport phenomena and their interaction by means of the optical techniques.

Yuji Suzuki, Assistant Professor
Research and development of heat transfer devices based on the heat pipe technology for the thermal control of space equipment and so on.

Masamichi Nakagawa, Assistant Professor
(1) Boundary layer controls (+ separated flows and wakes), (2) Dynamic lift of wings, (3) Flow stability/instability, (4) Unsteady flows, (5) Multi-phase flows.

Materials and Processing Group
Advanced Production Engineering Field

Hidenori Shinno, Professor (FIRST)
Our research topics include ultra-precision machining, design methodology for machine tool, development of innovative mother machines, and machine tool engineering.

Masahiko Yoshino, Professor
Nano/micro Manufacturing, Metalforming, Machining Development of functional materials/surfaces.

Tomohisa Tanaka, Associate Professor
Development of new production technologies by using high-frequency vibration and laser energy. Development of practical devices with additive manufacturing technology.

Takahisa Yamazaki, Associate Professor
Joining by various heating source, dissimilar materials like carbon based materials and heat resistant metals are joined using advanced material filler based on the change of interfacial energy in joining process.

Hayato Yoshioka, Associate Professor (FIRST)
Research on Nano-machining and Nano-measurement technologies based on originally developed precision mechanical elements and controllers.

Jiang Zhu, Assistant Professor
Development of new technology for freeform surface machining and measurement, digital manufacturing and intelligent manufacturing.

Materials and Processing Group
Advanced Functional Materials Field

Naoto Ohtake, Professor
Main field of interest is materials processing and technology, including plastic forming, fabrication of hard carbon films and their application to industrial uses.

Atushi Hirata, Professor
Ultra-precision polishing, coating, laser processing, tribology and material characterization with micro/nano materials for surface function design.

Masao Kikuchi, Specially Appointed Professor
Tribological technologies for hydraulic equipment of construction machinery, such as evaluation and characterization of sliding materials and lubricants.

Yuko Aono, Associate Professor
Laser modification of mechanical and chemical property, Digital manufacturing with shape and function design, Fabrication and application of functional film.

Hiroki Akasaka, Associate Professor
Main research field is carbon and related materials. Related keywords are thin film engineering, material science and engineering, materials analysis, inorganic carbon materials.

Chiaki Sato, Associate Professor (MSL)
Research on the mechanical aspects of carbon fiber reinforced composite material (CFRP) and adhesively bonded joints between CFRP and dissimilar materials frequently used for transportation such as automobiles and aircraft.

Takatoki Yamamoto, Associate Professor
Micro/nano technologies and its applications in medicine and healthcare.

Shinji Tanaka, Specially Appointed Associate Professor
Tribological technologies for hydraulic equipment of construction machinery, such as visualization of lubrication condition of real machine, lubrication analysis, evaluation of sliding characteristics of sliding materials and lubricants.

Yu Sekiguchi, Assistant Professor (MSL)
Design, strength evaluation and strength improvement of adhesively bonded joints, especially reversible adhesives mimicking gecko.

Materials and Processing Group
Structural Safety and Security Technology Field

Hirotsugu Inoue, Professor
Research topics in the field of mechanics of materials: non-destructive testing (infra-red thermography, ultrasonic), impact problem, and inverse analysis.

Kikuo Kishimoto, Professor
Research fields of interest are mechanics of materials, computational mechanics, fracture mechanics, mechanics of interface and related fields.
Interdisciplinary Research Groups

Mechanical Engineering

Systems and Control Engineering

Electrical and Electronic Engineering

Information and Communications Engineering

Industrial Engineering and Economics

Interdisciplinary Research Groups

Mechanical Engineering

Systems and Control Engineering

Electrical and Electronic Engineering

Information and Communications Engineering

Industrial Engineering and Economics

Dynamics Field

Mechanical Systems Group

Masaaki Okuma, Professor
Research of theoretical, experimental and hybrid CAE for analysis, design and utilization of machinery and structural dynamics.

Hiroki Takahara, Professor
Focusing on the mechanism of vibration, we conduct research on the nonlinear vibration of fluid-related vibration, dynamics of uncertain systems, etc. We aim at improving the function, reliability and safety of mechanical structures.

Hiroshi Yamaura, Professor
Research on dynamics, control and tribology of machinery for construction machinery, earthmoving machinery, vehicles, robots, mechatronics equipment, etc.

Yutaka Nakano, Associate Professor
We are studying the generation mechanisms of self-excite vibrations and their suppression (e.g. friction vibration, chatter, and so on).

Ikuma Ikeda, Assistant Professor
Active noise control with low sampling frequency, analysis and suppression of human tremor.

Kensuke Hara, Assistant Professor
Development of theory and numerical methods for multibody systems in multi-physics problems (e.g. Fluid-Structure Interaction, contact & friction).

Mechanical Systems Group

Robotics Field

Nobuyuki Iwatsuki, Professor
Kinematics and dynamics of robotic mechanisms, functional material actuator, estimation of machinery noise and structural optimization to reduce noise.

Koichi Suzumori, Professor
Development of new actuators and their application to biomimetic robots, soft robots, body support wears, tough robots and micro robots.

Yukio Takeda, Professor
Mechanical systems design, kinematics, mechanisms, machine elements, robotics, industrial robot, assistive device.

Gen Endo, Associate Professor
Design and development of practical robot and mechanical system. Study on mobile robot, decommissioning robot, super redundant manipulator, tendon-driven robot, welfare robot.

Yusuke Sugahara, Associate Professor
Design and control of mechanical and robotic systems. Study on biopowered vehicle, stair-climbing wheelchair, working partner robot, aero-train, human-powered robotics.

Hiroyuki Nabae, Assistant Professor
Study on component technologies with a focus on new actuators, and their application to micro robots and mechatronics devices.

Daisuke Matsuura, Assistant Professor
Development of devices for welfare and disaster response, precise noncontact 3D manipulation equipment utilizing magnetic levitation technology.

Advanced Machine Elements Field

Mechanical Systems Group

Shigeki Saito, Professor
Robotics based on Micro-mechanics, adhesive device by bio-inspired structure, creativity in engineering design.

Mikio Horie, Professor (FIRST)
Research fields are kinematics/robotics/CAD/mechanical design and production theory etc. It is aimed at R&D of new machine elements and mechanical systems, such as polymer robots, etc.

Kazuhiko Yoshida, Professor (FIRST)
Development of innovative mechatronics/devices/systems such as new actuator systems for advanced soft micro robots that perform power-needed tasks in micro space.

Joon-wan Kim, Associate Professor (FIRST)
Micro hydraulic pressure sources integrating MEMS technology with Electro-conjugate fluid (ECF) and its application systems.

Seiichiro Hara, Associate Professor
Sensing method of surface texture and machining information, processing and evaluation of measurement information, design applying quality and sensitivity engineering, modeling of surface texture.

Shigeki Matsumura, Associate Professor (FIRST)
Research on dynamics and energy saving of power transmitting system.
Takeshi Iino, Assistant Professor (FIRST)
Visualization of sound, noise/vibration analysis, acoustic intensity measurement and acoustic measurement in fluid.

Sang In Eom, Assistant Professor (FIRST)
A study on microactuators using dielectric elastomer actuators.

Takao Yasui, Assistant Professor
A study on improvement of lesson content and the self-taught type e-learning system based on survey on comprehension degree of machine drawing standard.

Frontier Technology Group
Aerospace Systems Field

Saburo Matunaga, Professor
Concept creation, fundamental research, design, development, launch and operation of World first revolutionary space systems and robotic aerospacecraft.

Hiraku Sakamoto, Associate Professor
Thorough investigating dynamic structural analysis methods for lightweight and flexible structures, we aim at generating innovative space structure systems.

Hiromi Nakanishi, Associate Professor
Research on mechanism, dynamics, and control for advanced space systems including space robotics, orbital service, astronaut support, and micro/nano satellites.

Hiroki Furuya, Associate Professor
Structural analysis and design of space structures, spacecraft systems, and deployable structures for space development.

Atsushi Noda, Visiting Associate Professor
Planning & research for next space system, small satellite and space robot, and its technology roadmap development.

Frontier Technology Group
Biomedical Engineering Field

Norio Inou, Professor
Biomechanics, Development of intelligent bedding system, Patient-specific simulation.

Toru Omata, Professor
Grasping/manipulation with robot hands, surgical robots for manipulation in human body, and cell culture devices for cancer study, etc. using MEMS technology.

Tadahiko Shinshi, Professor (FIRST)
Medical mechatronics and micro/nano mechatronics based on magnetic force control.

Takeshi Hatsuzawa, Professor (FIRST)
MEMS/NENS application and development to bio-assay and diagnosis devices by interdisciplinary technology including mechanical and bio engineering.

Yasuko Yanagida, Professor (FIRST)
Development of MEMS/NENS and bioMEMS devices applied for bioscience, medical engineering and environmental analysis.

Tadashi Ishida, Associate Professor
Biomicrofluidic devices for drug discovery and medical applications by the combination of nano/micro technologies and cellular characteristics.

Kotaro Tadano, Associate Professor (FIRST)
Research and development of surgical robots for laparoscopic surgery, vitreous surgery and plastic surgery, human-machine interfaces and pneumatic systems.

Takasi Nisisako, Associate Professor (FIRST)
Innovative nano- and microfluidics for Lab-on-a-Chip applications and functional materials production, and their industrialization.

Tohru Yagi, Associate Professor
Our goal is to understand the neural mechanisms, and to exploit its findings in biomedical engineering applications, e.g., neural interfaces.

Hitoshi Kimura, Assistant Professor
Flexible robot system, biomechanics of sleep (Development of intelligent bedding system).

Jongho Park, Assistant Professor (FIRST)
Development of Point-of-Care diagnostic chip using porous silicon substrates, and multifunctional drug delivery patch using dissolveable microneedle arrays.

Frontier Technology Group
Human Centric Design Field

Masafumi Okada, Professor
Robot design and control from mathematical or physical point of view, and its application to human motion instruction.

Wataru Hijikata, Associate Professor
Study on medical device and mechanical system based on mechatronics and biomedical engineering, development of implantable power generator, artificial heart, wireless power transfer, control of muscle contraction.

Celine Mougenot, Associate Professor
Our goal is to understand “design” through a scientific approach and to create tools to support designers’ creativity and users’ involvement in co-design.

Takako Yoshida, Associate Professor
Brain science, human perception and psychophysics, visuo-haptic multimodal man-machine interface, attention/inattention.
Department of Systems and Control Engineering

The mission of the Department of Systems and Control Engineering is to promote valuable innovations based on education and research in systems analysis, measurement, control theory, and system integration.

Our modern life is supported by a huge number of artificial devices and complicated systems. To design valuable systems, we need to know dynamical properties of them so that they will safely work and surely satisfy our requirements. The Department of Systems and Control Engineering provides courses that entrain insight into dynamical systems in order for us to predict and control anything. Our interest includes not only artificial systems, e.g., robots, cars, planes, medical systems, and intelligent systems, but also life, society, and nature. We expect you will be innovators contributing to our society.

Research

A wide variety of technologies and techniques are required to design a system. Mathematical models take important roles in clarifying system structures so that we know dynamical properties of them. Control theory provides systematic design of control and measurement functions. We also need to find appropriate measurement methods, communication protocols, information processing, actuators, sensors, micro-controllers, and ways of integration. We have formed research groups and are conducting high level researches so that we achieve the ability to innovate novel systems to bring values into our society.

The department’s primary fields of research are as follows: systems control theory, network control, precision mechanical instrumentation, sensing theory, computer vision, image processing, wave application instrumentation, chaotic vibrations, stochastic dynamics, nonlinear dynamics, inverse analysis, smart power grids, biomechanics, biorobotics, combustion engines, combustion control, exhaust treatment, autonomous systems, signal processing, artificial intelligence, intelligent robots, rescue robots, and radiation biology.

Education

The Department of Systems and Control Engineering provides courses of control theory, instrumentation technology, system science, and engineering design for students to be specialists in systems and control engineering. Students at the department also study the necessary foundations of system analysis and development: mechanical engineering, electrical engineering, and information engineering. We cultivate in our students flexible, creative thinking they need to construct systems that offer new value through many unique educational initiatives that focus on the importance of projects and practical learning. Students can take classes in which they participate in robot contests, and classes through which they form teams to examine societal needs and to build systems that tackle those issues. Students proceed to research works in specific issues conducted at affiliated laboratories, and through their master’s thesis research they will acquire the technological and organizational skills needed to develop new systems. They learn not only research protocols and methods but also ethical attitudes to be responsible engineers contributing to make a better future.

Undergraduate programs
* 4th/5th Academic Groups
* Department of Systems and Control Engineering

Graduate programs
* Systems and Control Engineering
* Engineering Sciences and Design

Research Groups and Fields of Research

Control Theory Group
Researching cutting-edge systems theory targeting various systems, from next-generation robots to smart cities
- Intelligent Robot Field
- Cyber Physical Systems Field
- Complex Network Systems Field

Advanced Measurement Group
Researching cutting-edge measurement technologies that allow observation of objects both visible and invisible, to gain an understanding of various phenomena found in our world
- Mechanical Design and Functional Evaluation Field
- Computer Vision and Image Processing Field
- Applied Measurement Using Acoustic and Radio Waves Field

System Analysis Group
Using mathematical approaches to analyze systems both natural and artificial, and research methods that allow for deeper quantitative and qualitative understanding of their behavior
- Nonlinear and Stochastic Dynamics Field
- Computational Mechanics Field
- Power Systems for Transportation Field

System Integration Group
Realizing future robot systems based on various approaches, such as sports engineering, speech recognition, machine learning and biomimetics, in order to bring happiness to the people
- Bio-robot Field
- AI-robotics Field

Daisuke Kurabayashi
Department Chief
Faculty

Control Theory Group

Intelligent Robot Field

Mitsuji Sampel, Professor

Masaki Yamakita, Associate Professor
Theoretical studies on adaptive and learning control and state estimation and model predictive control for nonlinear systems, and their applications to robotic and industrial systems.

Tatsuya Ibuki, Assistant Professor

Control Theory Group

Cyber Physical Systems Field

Masayuki Fujita, Professor
Our Research lies in Cooperative Control and Distributed Learning in Human Robotic-Network Teaming with Visual Feedback.

Yoshihiro Miyake, Professor (Dept. Computer Science)
From Communication Science to Interface Creation

Takeshi Hatanaka, Associate Professor
Distributed control/optimization/learning for Cyber-Physical Systems including buildings, data centers and microgrids.

Complex Network Systems Field

Jun-ichi Imura, Professor
Development of control theory of large-scale complex network systems, and applications to smart grids, intelligent transportation systems, and biological systems.

Hiroshi Deguchi, Professor (Dept. Computer Science)
Agent Based Modeling & Simulation, IoT System as an Autonomous Distributed Cooperative System, Complex Systems with Decision Makers, Management Information System, Gaming Simulation, Social System, Data Analysis for Economic & Accounting System

Takao Terano, Professor (Dept. Computer Science)
Agent Base Modeling, Social Simulation, Big Data Analysis, Artificial Intelligence, Knowledge System, Busines$ Gaming

Tomohisa Hayakawa, Associate Professor
Nonlinear control and dynamical systems theory, adaptive and learning systems, control applications to aerospace systems, mechanisms design for social systems

Hideaki Ishii, Associate Professor (Dept. Computer Science)
Large-scale networked control, Coordinated control of multi-agent systems, Distributed algorithms for PageRank computation, Cyber security for power systems

Takayuki Ishizaki, Assistant Professor
Decentralized design of large-scale distributed control systems, Electricity market design under high penetration of storage and renewable energy resources

Shinji Hara, Visiting Professor
System control theory and its applications to social systems, Hierarchically decentralized control, Glocal control, Energy networks, Urban transportation, Water circulation systems

Advanced Measurement Group

Mechanical Design and Functional Evaluation Field

Tomonori Sadamoto, Professor (Specially-Appointed Assistant Professor)
Development of math-guided power system engineering via control theory for large-scale complex network systems

Kazuyuki Sasajima, Professor
Systematic Description in Mechanical Design Process Focused on Its Function Precisely, and Development the 3D Form and Surface Measurement to Evaluate its Functional Ability

Atsushi Hirata, Professor (Dept. Mechanical Engineering)
Ultra precision polishing, coating, laser processing, tribology and material characterization with micro/nano materials for surface function design

Seiichiro Hara, Associate Professor
Sensing method of surface texture and machining information, Processing and evaluation of measurement information, Design applying quality and sensitivity engineering, Modeling of surface texture

Yuko Aono, Associate Professor (Dept. Mechanical Engineering)
Laser modification of mechanical and chemical property, Digital manufacturing with shape and function design, Fabrication and application of functional film

Takahiro Nakano, Assistant Professor
Tribological Property of bacterial flagellar motor, Origin of solid friction, Mechanism of photocatalyst center by quantum chemical approach.

Computer Vision and Image Processing Field

Masatoshi Okutomi, Professor
Computer vision and image processing, covering both their theory and applications. Recent topics include 3D scene reconstruction, stereo vision, structure from motion, inverse rendering, multispectral imaging, computational imaging, and super resolution.

Masayuki Tanaka, Visiting Associate Professor
Image Analysis, Multispectral Imaging, Multi-Modal Image Fusion, Image Processing Based on Generative Model, Optimization and Machine Learning.

Akihiko Torii, Assistant Professor
Computer Vision, 3D Reconstruction, Image-Based Localization, Structure from Motion, Image and Feature Matching.

Applied Measurement Using Acoustic and Radio Waves Field

Hiroyuki Hachiya, Professor
Development of quantitative diagnosis method by ultrasound based on tissue structures and elastic property, and measurement methods in the ocean, air and ground.

Shinji Ohyama, Associate Professor
Measurement technology such as new localization system for sensor networks, CT system for visualization of temperature and wind speed distribution

Shinnosuke Hirata, Assistant Professor
An estimation method of physical properties of tissues or object’s position and motion by scattering or propagation properties of ultrasound
**Interdisciplinary Research Groups**

**Mechanical Engineering**
- Stochastic dynamics, Random vibration, Non-Gaussian stochastic process, Probabilistic approach, Flow induced vibration, Seismic engineering

**Electrical and Electronic Engineering**
- Nonlinear dynamics, Stochastic processes, Rhythmic phenomena, Self-organization phenomena

**Systems and Control Engineering**
- Computational neuroscience, Mathematical theory of neural networks, Data-driven science

**Economics**

**Communications Engineering**

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**System Analysis Group**

**Nonlinear and stochastic dynamics Field**

**Koji Kimura, Professor**
- Stochastic dynamics, Random vibration, Non-Gaussian stochastic process, Probabilistic approach, Flow induced vibration, Seismic engineering

**Hiroya Nakao, Associate Professor**
- Nonlinear dynamics, Stochastic processes, Rhythmic phenomena, Self-organization phenomena

**Toru Aonishi, Associate Professor (Dept. Computer Science)**
- Computational neuroscience, Mathematical theory of neural networks, Data-driven science

**Misako Takayasu, Associate Professor (Dept. Mathematical and Computing Science)**
- Analysis and modeling of socio-economic phenomena, big-data analysis, nonlinear transport, group motion, complex network, phase transition

**Takahiro Tsuchida, Assistant Professor**
- Investigation of random phenomena in various fields, Response analysis of non-Gaussian randomly excited systems, Dynamics of fractional-order systems

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**System Integration Group**

**Bio-robot Field**

**Daisuke Kurabayashi, Professor**

**Motomu Nakashima, Professor**
- Modeling of human motion in sports, Optimization of human motion as well as design and development of optimal tools and equipment using simulation and humanoid robot

**Hideyuki Tsukagoshi, Associate Professor**
- Study on fluid powered actuator referring to the muscular structure and the working principle of creatures, and their application to medical robot and rescue

**Masahiro Takei, Associate Professor**
- Construction and understanding of self-assembled artificial cell-like systems and molecular robots based on DNA nanotechnology and microfluidic technology

**Yuya Hattori, Assistant Professor**
- Analysis of radiation responses of cell population, Analysis of odor-source search behavior of C. elegans, Development of control method based on responses of micro-organisms population

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**System Analysis Group**

**Computational Mechanics Field**

**Kenji Amaya, Professor**
- Implementation of inverse analysis for industry, Electrical chemistry simulation such as Localized corrosion analysis, Electroplating analysis, Corrosion monitoring using data assimilation, Aberration analysis

**Yusuke Miyazaki, Associate Professor**

**Isao Ono, Associate Professor (Dept. Computer Science)**
- Development of evolutionary computation algorithms for various optimization problems and reinforcement learning algorithms for various tasks

**Yuki Onishi, Assistant Professor**
- Large deformation analysis using state-of-the-art FEM, Peeling analysis of plastic film, Electrodeposition of automobile body, Localized corrosion in saltwater

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**System Integration Group**

**AI-robotics Field**

**Kazuhiro Nakadai, Specially Appointed Professor**
- Key research topics are robot audition and computational scene analysis, and wide areas are covered such as robotics, signal and speech processing, AI, and machine learning

**Kiyohiko Nakamura, Professor (Dept. Computer Science)**
- Understanding intelligence as neural mechanisms, Mathematical modeling of cognitive functions and recording neural activity in animal brains

**Minoru Nakayama, Professor (Dept. Information and Communications Engineering)**
- Human visual perception is analyzed using behavioral metrics such as EEG, eye movement, pupil responses and other responses

**Masayuki Yamamura, Professor (Dept. Computer Science)**
- Artificial Intelligence with personality and emotion, Evolvable Digital Artificial Life, Wet Artificial Life enhanced by Synthetic Biology, Molecular Robots

**Osamu Hasegawa, Associate Professor**
- Artificial brain SOINN, Machine learning, Intelligent robotics

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**System Analysis Group**

**Power Systems for Transportation Field**

**Hidenori Kosaka, Professor**
- High Efficiency Mobility Systems, High Efficiency Clean Internal Combustion Engines, Investigation of Combustion via Laser Diagnostics, Combustion Control

**Susumu Sato, Associate Professor**
- Improvement of Environment Load in Transportation System, High Efficiency After-treatment System, Alternative Fuel Engines
The Department of Electrical and Electronic Engineering provides an education and conducts research into the core fields of energy technology, electronics, ICT, and more – the foundations upon which modern society and its continuous diversification and advancement are built.

Electrical and electronic engineering no longer concerns itself only with the study of electronic devices; it now serves as the foundation for all industries, including automobiles, robotics, and artificial intelligence. Students who learn electrical and electronic engineering as it is today are sought after not only by electronics manufacturers, but also by the automobile industry, societal infrastructure, and a wide variety of other fields. The Tokyo Institute of Technology has a long, proud tradition of successful research in the field, and the Department of Electrical and Electronic Engineering continues in that tradition, providing students with a solid academic foundation, a broad perspective, and creative thinking abilities they can harness to contribute to our society. We produce engineers and researchers of the highest level – individuals who can change the world.

At the Department of Electrical and Electronic Engineering, students acquire the fundamental knowledge and abilities required in this diverse field that studies large-scale electric energy production and control, information transmission systems that harness optical and radio wave phenomena, information processing and communication, the circuits and signal processing that serve as the foundation of computers, integrated circuits, and electronic devices. Classes teach students the fundamental theories the field is based upon, and provide a more practical understanding through a curriculum that offers simulation exercises, the opportunity to construct integrated circuits, and microprocessing experience. Our goal is to cultivate individuals who will become pioneering researchers, leading engineers and educators with open minds, creativity, and originality – individuals capable of succeeding in the related industries and fields of research and education.

Undergraduate programs
* 5th Academic Group * Electrical and Electronic Engineering
* Department of Electrical and Electronic Engineering

Graduate programs
* Electrical and Electronic Engineering
* Energy Science and Engineering
* Human Centered Science and Biomedical Engineering
* Nuclear Engineering

### Research Groups and Fields of Research

#### Research

The field of electrical and electronic engineering includes the study of hardware and software technologies that sustain electrical power, information processing and communications technology systems, and the physical properties, devices, and other elemental technologies that keep such systems working properly. The Department of Electrical and Electronic Engineering provides an education that serves as the core of the field of study, and conducts cutting-edge academic and practical research, the results of which are presented at top-level conferences and in leading journals around the world. This allows us to contribute to both academia, and through collaborations with industry and government bodies, to the resolution of issues faced by our society.

Our primary fields of research are as follows: power electronics, electric power systems, power mechatronics, plasma engineering, light wave communications, photonic devices, wireless communication engineering, electronic devices, magnetic devices, spintronics, semiconductor processes, semiconductor devices, sensor devices, solar cells, organic electronic materials/properties, organic electronics, nonlinear optics, analog-digital hybrid integrated circuits, electronic circuits, nanoelectronics, nanophotonics, applied properties, and more.

#### Education

#### Circuit Group

Studying the most sophisticated analog and digital circuit design technologies necessary for advanced electronic devices

#### Electric Power and Energy Group

Gaining a thorough understanding of advanced power systems, power conversion, electrical equipment, high voltage and environmental technologies

#### Electronic Materials Group

Developing cutting-edge devices and methods to control the physical properties of new functional materials

#### Photonics, Ultrasonics, and Communications Group

Researcching the hardware and software needed to build the next generation of communications networks

#### Device Group

Researching the innovative devices needed to create advanced low power and ultra-fast electronics

#### Undergraduate programs

* 5th Academic Group
* Department of Electrical and Electronic Engineering

#### Graduate programs

* Electrical and Electronic Engineering
* Energy Science and Engineering
* Human Centered Science and Biomedical Engineering
* Nuclear Engineering

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**Research Groups and Fields of Research**

- Interdisciplinary Research Groups
  - Mechanical Engineering
  - Systems and Control Engineering
  - Electrical and Electronic Engineering
  - Information and Communications Engineering
  - Industrial Engineering and Economics

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**Undergraduate programs**

- 5th Academic Group
- Department of Electrical and Electronic Engineering

**Graduate programs**

- Electrical and Electronic Engineering
- Energy Science and Engineering
- Human Centered Science and Biomedical Engineering
- Nuclear Engineering

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**Research Groups**

- Interdisciplinary Research Groups
- Mechanical Engineering
- Systems and Control Engineering
- Electrical and Electronic Engineering
- Information and Communications Engineering
- Industrial Engineering and Economics

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**Fields of Research**

- Electric Power and Energy Group
- Electronic Materials Group
- Device Group
- Photonics, Ultrasonics, and Communications Group
Faculty

Circuit Group

Integrated Circuit Field

Akira Matsuzawa, Professor
Mixed signal ICs, Data converters, Radio frequency ICs, Millimeter wave transceivers, Sensor circuits, and Automated analog IC design.

Kenichi Okada, Associate Professor
Millimeter-wave Wireless Transceiver /5G/Battery-less IoT Wireless Sensor Node/CMOS Integrated Circuits /PLL/Atomic Clock/Terahertz Communication&Sensing&Imaging

Kazuya Masu, Professor
R&D of RF-CMOS integrated circuit for wireless communication, CMOS-MEMS integrated circuit for ultra high sensitive inertia sensor, and its application of early diagnosis of Parkinson’s disease

Hiroyuki Ito, Associate Professor (FIRST)
Integrated Circuits, RF Circuits, Wireless Communication Circuits, Sensor Networks, Internet of Things, Cyber-Physical System

Daisuke Yamane, Assistant Professor (FIRST)
His research interests include integrated CMOS-MEMS technology, optical and RF MEMS technology, and highly-sensitive MEMS inertial sensor and its applications.

Photonics, Ultrasonics, and Communications Group

Wireless communications Field

Jiro Hirokawa, Professor
Millimeter-wave high-efficiency planar antenna, 2D beam-switching circuit, fast analysis for antenna design, 2D orthogonal multiplexing

Takashi Tomura, Specially Appointed Assistant Professor
Research based on electromagnetic engineering: large-scale EM analysis, near-field communication system, satellite onboard & phased array antennas.

Kei Sakaguchi, professor
Wireless communication engineering 5G/IoT/Millimeter-wave/Wireless energy transmission Connected car/Automated driving

Tran Gia Khanh, Assistant Professor
Next generation wireless communication networks/Next generation sensor networks

Fumio Watanabe, Visiting Professor
5G and Beyond 5G Mobile Systems/Mobile Radio Access Technologies/Antenna Engineering/Mobile Network Architecture

Takahiro Aoyagi, Associate Professor

Atsuhiro NISHIKATA, Associate Professor
EMC/RF material evaluation/EM shielding and absorption MWA’s biological thermal effect/Radio retroreflector EM source estimation/Spatial acoustics

Teruya Fujii, Specially Appointed Professor
Wireless transmission, cell design, radio propagation and network cooperation control technologies in mobile communication systems.

Hideki Omote, Specially Appointed Associate Professor
Radio propagation in mobile communication systems.

Photons, Ultrasonics, and Communications Group

Photonics Field

Shigehisa Arai, Professor (FIRST)
Optoelectronics, Optical Communications, Optical Interconnects, Semiconductor Lasers, Photonic Integrated Devices, GainAsP/InP, III-V on Si

Nobuhiro Nishiyama, Associate Professor
Photonic-electronic convergence integrated circuits based on heterogeneous integration/High-speed semiconductor lasers/Lidar system for car

Tomohiro Amemiya, Assistant Professor (FIRST)
Integrated optics, Metamaterials, Plasmonics, Semiconductor optical devices

Tetsuya Mizumoto, Professor
Lightwave circuits/Bonding of dissimilar materials and application to functional photonic devices/Photonic devices for optical fiber communication

Yuya Shoji, Associate Professor (FIRST)
Waveguide optical isolator/Magneto-optical signal processing device/Silicon photonics/Photonic integrated circuit/On-chip photonic network device

Fumio Koyama, Professor (FIRST)
VCSEL photonics, photonic integrated devices, high-speed semiconductor lasers, optical communications and interconnects, optical sensing for automotive applications, high power semiconductor lasers

Takahiro Sakaguchi, Assistant Professor (FIRST)
Opto-electronics/Distributed Bragg Reflector Vertical Cavity Surface Emitting Laser/Opto-photon module/ Semiconductor Devices

Masanori Nakahama, Assistant Professor (FIRST)

Hiroyuki Ueno, Associate Professor
We have been pursuing the optical routing/node systems and related photonic functional devices using optical signal processing with high-speed, low power consumption.

Tomoyuki Miyamoto, Associate Professor (FIRST)
Optical wireless power transmission system/photonics module/high performance surface emitting laser/photonic device fabrication technologies

Ultrasound Field

Kentaro Nakamura, Professor (FIRST)
Ultrasonic transducers and industrial applications of ultrasonicics: Medical applications of optical/ultrasonic methods; Optical fiber sensors and their applications

Yosuke Mizuno, Assistant Professor (FIRST)
Distributed sensing based on optics and ultrasonics, strain/temperature sensing using glass and plastic fibers, Brillouin scattering, nonlinear polymer optics

Marie Tabaru, Associate Professor (FIRST)
Biomedical Engineering Measurement/Agricultural Engineering Measurement/Medical Engineering/Wave Engineering/Advanced Diagnostic Imaging

Minoru Kuriyayashi, Associate Professor
Acoustics/Ultrasonics/Mechatronics/Transducers Surface acoustic wave motor/Piezoelectric device Energy harvesting/Hi-Fi audio/Passive intermodulation
**Device Group**

**Compound Semiconductor Device Field**

Yasuyuki Miyamoto, Professor
Compound Semiconductor electron devices / Steep Slope FET / Power electronics IC / InP / GaN / 2-D semiconductor / Crystal growth / Ultrafine process

Toru Kanazawa, Assistant Professor
Advanced Semiconductor Devices / III-V Compound Semiconductors / 2D Semiconductors / MOSFET / Nano Fabrication Technology / Semiconductor Process / Device Simulation

Koichi Fukuda, Visiting Professor
Semiconductor device modeling and simulation, especially device simulation, physical model and compact modeling for circuit simulation of tunnel FETs.

Masahiro Watanabe, Associate Professor
Nanostructure devices, Function design of electronic and photonic devices, Nanostructure-silicon photonics, Nonvolatile quantum effect memory, Advanced nano-heterostructure process technology

Hitoshi Wakabayashi, Professor
Electron Devices: Advanced 3D MISFET (Silicon) and 2D FET

Iriya Muneta, Assistant Professor
Spintronics / Transition-metal chalcogenides / 2D layered materials / Magnetism / Valleytronics / Electron correlation / Magnetoresistance / Spin injection

Kazuo Tsutsui, Professor (FIRST)
Semiconductor devices / process technology / GaN and Si power devices / atomic level analyses of doped impurities / crystal growth

Takuya Hoshii, Assistant Professor
Semiconductor devices / process technology / MISFET and MISHET / power devices / atomic level analyses of doped impurities

**Device Group**

**Quantum Functional Device Field**

Yukio Kawano, Associate Professor (FIRST)
Terahertz image sensors and their application to industrial and medical inspection, Terahertz and infrared plasmonic probes, Near-field terahertz and infrared spectroscopic imaging and material analysis

Takamasa Kawanago, Assistant Professor (FIRST)
Self-assembled molecule monolayer for gate dielectrics Transfer printing for building functional devices Organic/inorganic interfacial phenomena

Koji Ishibashi, Visiting Professor (RIKEN)
We fabricate nanoscale structures and study quantum effects. We try to manipulate the quantum states coherently towards quantum information technology.

**Device Group**

**Intelligent Device Field**

Shun-ichiro Ohmi, Professor
Semiconductor devices, Integrated electron device. Research on new functional device utilizing high-k and ferroelectric thin films

**Device Group**

**Terahertz Device Field**

Masahiro Asada, Professor (FIRST)
Semiconductor nano-devices / terahertz electronics, devices, and circuits / semiconductor terahertz sources / terahertz response of nanowire / resonant tunneling devices

Satumi Suzuki, Associate Professor
Terahertz electronic devices, High electron mobility transistor, Terahertz applications (Wireless communication, Spectroscopy, etc.)

**Device Group**

**Green Device Field**

Mutsuko Hatano, Professor
Quantum sensors and power devices using widegap semiconductors. Developing wide-field technologies from materials to systems for energy and medical applications.

Tetsuo Kodera, Associate Professor
Fundamental technologies toward quantum communication and quantum computers, Group IV semiconductor physics, Power devices, Sensing devices using quantum technologies.

Takayuki Iwasaki, Assistant Professor
Quantum sensing and quantum emitter using atomic-scale structures in diamond toward next-generation low-loss power devices and biological applications.

Dai Hisamoto, Visiting Professor

Kuniyuki Kakushima, Associate Professor
Interface control based on process and material development for semiconductor devices including memory, energy, power (Si, wide bandgap), medical imaging.

**Electronic Materials Group**

**Energy Electronics Field**

Akira Yamada, Professor
Development of high-efficiency thin-film solar cells, Cu(In,Ga)Se2, and Cu2ZnSn(S,Se)4 absorber materials, Developing tandem solar cells using a perovskite top cell

Shinsuke Miyajima, Associate Professor
Semiconductor / Photovoltaic conversion materials and devices / Group IV amorphous and nanocrystalline, Oxide, and Organic-inorganic perovskite materials

Kazuyoshi Nakada, Assistant Professor
Solar cell, Semiconductor physics, Crystalline silicon solar cells, Cu(In,Ga)Se2 solar cells, Cu(In,Ga)Se2 / perovskite tandem solar cells

**Electronic Materials Group**

**Spintronics Field**

Shigeki Nakagawa, Professor
Spintronics for perpendicular MRAM devices using Half-metallic films, Magnetic films with high magnetic anisotropy, Perpendicular magnetic recording technology

Yota Takamura, Assistant Professor
Spintronics (Half-metallic ferromagnets, Si-based devices, perpendicular magnetic anisotropy, Superconductors)

Pham Nam Hai, Associate Professor
Spintronics / Ferromagnetic semiconductor / Topological Insulator / Magnetoresistive Random Access Memory / Magnetic sensor / Semiconductor spin device
Electric Power and Energy Group

Power Electronics Field

Hideaki Fujita, Associate Professor
Power electronics circuits and systems for solar, wind, micro-hydro power generation, high-efficiency and multifunctional power converters for industrial motor drive and induction heating.

Makoto Hagiwara, Associate Professor
Application of power electronics to next-generation electric power systems, battery energy storage systems, electric vehicles and renewable energies.

Hirofumi Akagi, Specially Appointed Professor
Research interests include power conversion systems based on semiconductor switching devices, and their applications to industry, transportation, and utility.

Masaki Kuzumoto, Visiting Professor
Power Electronics/Power Device/Device Model/Si-SiC/MOSFET

Takeshi Horiguchi, Visiting Associate Professor
Power Electronics/Power Module/Power Device/Sh-IGBT/SIC-MOSFET/Power Device Model/Electro-Thermal Simulation

Electric Power and Energy Group

Electric Machinery Field

Akira Chiba, Professor
Power Mechatronics and Intelligent Drive: Bearingless motor drive with integrated motor and magnetic bearing functions. Switched reluctance motors for high efficiency and compactness for EV, hybrid vehicles, and next generation automobiles.

Hiroya Sugimoto, Assistant Professor
Electric Machines/Mechatronics/Control Engineering/Bearingless Motors/Magnetic Bearings/Rare-Earth Free Motors/Traction Motors for EVs

Electric Power and Energy Group

Plasma and Environment Field

Koichi Yasuoka, Professor
High-voltage and Plasma Engineering, Arcless hybrid switch for AC/DC power distribution, Mineralization of persistent organic substances for water reclamation

Shungo Zen, Assistant Professor
Atmospheric pressure plasma application/Plasma Engineering/High Voltage Engineering/Power Engineering/Energy Storage Material/Solar Cell/Hybrid DCCB

Nozomi Takeuchi, Visiting Associate Professor
Plasma Engineering/High Voltage Engineering/Electrostatic Engineering/Plasma in contact with liquid for advanced water treatment process and treatments of carbon materials/Electrohydrodynamics and its applications

Yoshiyuki Oguri, Professor, (LANE)
Interaction between ion beams and hot plasmas related to inertial fusion/Accelerator-based trace-element analysis/ Medical application of MeV ion beams

Hiroshi Akatsuka, Associate Professor (LANE)
Modeling of atomic-molecular processes in plasmas, spectroscopic measurement/Interaction with electromagnetic field/Astronautic or nuclear applications

Akitoshi Okino, Associate Professor (FIRST)
Development of brand-new atmospheric plasma sources and its applications for medical/analytical/material field

Hidekazu Miyahara, Specially Appointed Associate Professor (FIRST)
Applied research for social implementation by exploiting the possibility of atmospheric pressure plasma at life sciences including medical, agriculture, environment, new materials and others.

Electronic Materials Group

Nano- and Bio-photonics Field

Kotaro Kajikawa, Professor
Our group aims at developing the fields of nanophotonics, surface plasmon and metamaterials and the related for novel optical devices.

Haruhiko Ito, Associate Professor
We study Nanophotonics with near-field light and Atmophotonics for controlling laser-cooled atoms, and develop quantum-functional devices with atoms and spins.

Takayuki Okamoto, Specially Appointed Professor
Nanophotonics/Plasmonics/Optical devices/Organic light emitting diode/Organic thin-film solar cell/Broadband light absorber/Radiative cooling

Electronic Materials Group

Organic Electronics Field

Takaaki Manaka, Professor
Organic electronics/Organoic devices/Evaluation techniques for organic semiconductor/Organoic dielectric materials/Non-linear Optics/Liquid Crystals

Dai Taguchi, Assistant Professor
Analysis of electrical and electronic materials, and novel electrical and optical techniques for probing these materials based on dielectric physics.

Hiroaki Iino, Associate Professor (FIRST)
Organic electronics/Imaging devices/Liquid crystalline organic semiconductors/Organoic thin film transistors/Printed electronic/Molecular alignment

Takashi Kato, Specially Appointed Professor
Opto-electronic devices/Organic electronics/Photo functional materials/Organoic semiconductor/Molecular alignment/Display materials/Printed electronics

Electronic Materials Group

Integrated Electronics Field

Satoshi Sugahara, Associate Professor (FIRST)
Integrated Devices and Circuits/High-Speed and Low-Power Devices/Energy-Efficient Circuits/Wearable Electronics

Electronic Materials Group

Bioelectronics Field

Takamichi Nakamoto, Professor (Dept. Information and Communications Engineering)

Electric Power and Energy Group

Electric Power System Field

Toshiya Nanahara, Professor
Power system engineering/Power engineering/Generation control/Wind power/Photovoltaic power/Energy storage/Time-series analysis/Stochastic analysis

Kenichi Kawabe, Assistant Professor
Power system engineering/Power engineering/Wind power/Photovoltaic power/Energy storage/Power electronics-based devices/Mathematical Programming

Masahiko Nakade, Specially Appointed Professor
Power cable/High Voltage Engineering/Deterioration Mechanism/Development of Diagnosis Technology
Contributing to a richer, more sustainable society through research and education aimed at advanced information and communication technologies

One of the defining characteristics of our department is the interdisciplinary academic environment designed to aid in the development of information and communications technologies (ICT) designed for use by people. The curriculum covers a broad range of topics, from the hardware that is the foundation of information processing, to signal processing technologies, machine learning technologies need to achieve advanced intelligent processing, clarification of the mechanisms behind human recognition, human interfaces utilized in these fields of study, and medical technology. We are also actively engaged in collaborative research with corporations and research institutions in Japan and around the world, and provide students with numerous opportunities to experience that work first-hand. Information and communications technologies will continue to evolve, and the roles they play in society will likely increase as well. We are looking for students from all backgrounds—students with hopes and dreams and untamable vitality—to lead the drive towards a rich and exciting future.

The aim of the Department of Information and Communications Engineering is to contribute to the academic fields that study both fundamental and applicable hardware and software technologies that will allow us to build a sustainable and user-friendly ICT-based society. In order to construct human-centric ICT systems, we need a better understanding of human emotion and the cerebral mechanisms upon which those emotions are based. In addition, we must build structures that allow for effective communication between people and the machines they use, and mechanisms for advanced information processing beyond human capabilities. In order to realize these objectives, we require technologies that can process and transmit vast amounts of information quickly. It is for this reason that the Department of Information and Communications Engineering conducts research in a broad range of technical fields, and puts a strong focus on the intercommunication and exchange between those fields. In concrete terms, our research efforts are directed towards ICT study, in areas that include communications and networks, signal processing, very-large-scale integration (VLSI), computers, security, media information processing, biometric information processing, sense information processing, and intelligent information processing. ICT systems have the potential to change our lives greatly, and our goal is to continuously work towards expanding that potential from the very frontier of the fields.

Students in the master’s program gain a fundamental understanding and practical skills as we foster within them a broad overview of the ICT industry as a whole. They simultaneously engage in a variety of activities that provide them with a strong ethical stance needed when viewing the world from the global perspective and engaging in research and development. The aim of these efforts is to graduate future researchers and engineers with a level of competence that is world-class, resulting in leading individuals capable of working in industries around the globe. In the doctoral program, the aim is the help students develop these abilities and perspectives even further, and to cultivate further leaders who will carve a path to new frontiers of science and technology that will make our global society even richer.

Many students who graduate from this department and the specialty program that was its predecessor move on to work in jobs connected to electronic and electrical engineering and in corporations active in the field of ICT. Our graduates are active in a broad range of other fields as well, with some moving on to positions in the mechanical and automobile industries or in chemical/material related work, and some working in the fields of finance and consulting. Graduates of our doctoral degree program can also be found at universities and private research institutes both here in Japan and abroad.
Faculty

Human Information Systems Group
Sensory Information Processing Field

Makio Kashino, Specially Appointed Professor
Brain mechanisms of auditory perception, sensory characteristics in autism, decoding of mental states from biological signals, sports brain science

Hiroyuki Kaneko, Professor
Visual information processing, Psychophysics, Space perception, Stereopsis, Binocular disparity processing, Multisensory integration, Eye movements, Perceptual adaptation

Rumi Hisakata, Assistant Professor
Psychophysics/Human visual processing/Binocular vision and 3D perception/Motion perception/Visual illusions/small eye movements/visual stability

Yasuhiro Koike, Professor (Biointerfaces Unit)
Computational Neuroscience, Human Motor Control Theory, Human interface: Brain Machine Interface, Analysis of subjective feeling based on computational model

Natsue Yoshimura, Associate Professor (Biointerfaces Unit)
Brain activity information decoding (motor control, emotion, language, etc)/Brain-machine interfaces/Machine learning/EEG/IMRI

Hiroyuki Kambara, Assistant Professor (Biointerfaces Unit)
Computational Neuroscience: We proposed computational model for neural motor learning of reaching movements.

Imari Sato, Specially Appointed Professor
Computer vision, Computer graphics, Spectral imaging, Computational photography, and Modeling reality.

Junji Watanabe, Specially Appointed Associate Professor
He studies cognitive science and communication devices with applied perception. His fields of interests are visual and haptic perception and communications.

Petter Holme, Specially Appointed Professor (Biointerfaces Unit)
Network theory, computational social science

Human Information Systems Group
Intelligent Information Processing Field

Itsuo Kumazawa, Professor (FIRST)
Image Processing, Image Recognition, User Interface, Tactile Display, Optical Sensor, Virtual Reality, Artificial Neural Network.

Shunsuke Ono, Assistant Professor (FIRST)
Image Processing (recovery, regularization), Signal Processing (convex optimization), Optimization (proximal splitting)

Minoru Kuribayashi Kurosawa, Associate Professor
(Amazon Electronics, Mechatronics) Surface acoustic wave, device Energy harvesting, Hi-Fi audio, Passive intermodulation

Nobuhiko SUGINO, Associate Professor

Manabu Okumura, Professor (FIRST)
natural language processing, text summarization, computer assisted language learning, sentiment analysis, text data mining

Hiroya Takamura, Associate Professor (FIRST)
Computational Linguistics/Natural Language Processing/Machine learning

Takao Kobayashi, Professor
Speech processing/Statistical parametric speech synthesis/Expressive speech synthesis/Side language interface/Sign processing/Machine learning

Takahiro Shinozaki, Associate Professor
Speech information processing putting the focus on automatic speech recognition and understanding, statistical pattern recognition, machine learning.

Tomoki Koriyama, Assistant Professor
Nonparametric model speech synthesis based on Gaussian process regression: accent information estimation for automatic labeling of speech database

Takamichi Nakamoto, Professor (FIRST)
Human Olfactory Interface/Olfactory Display/Odor Sensing System/Sensory Information Processing/Embedded System/Biologically-inspired Sensing System

Katsuhito Akahane, Assistant Professor (FIRST)
Virtual reality/Human interface/Haptic display

Shoichi Hasegawa, Associate Professor (FIRST)
Virtual reality technologies, especially haptics and physics simulation and application to interactive embodied agents and entertainment

Hironori Mitake, Assistant Professor (FIRST)
Character Technology to Enrich Life: Conversational Agent with Social/Physical Presence, Touchable Virtual Creature, Motion Generation with Sensor/Motor Simulation etc.

Masahiro Yamaguchi, Professor
Optical imaging and display/Spectral imaging and display/Color reproduction/Image analysis for pathology/Holography/Light-field display/3D user interface

Tomoya Nakamura, Assistant Professor
Computational optics, Optical design, Image processing, Codified imaging, Holography
### Human Information Systems Group

#### Biological Information Processing Field

**Nagaaki Ohyama, Professor, ASIST**
My Number Card, Japanese Public Key Infrastructure, Medical information systems, Medical history management systems, Medical image processing, Information Security

**Takashi Obi, Associate Professor (FIRST)**
Medical information system, Medical information network, National e-ID, Medical image processing, Medical information analysis

**Hiroyuki Suzuki, Assistant Professor (FIRST)**
Biometric authentication, Optical information processing, Medical history management systems, Medical information analysis

**Marie Tabaru, Associate Professor (FIRST)**
Biomedical Engineering Measurement / Agricultural Engineering Measurement / Medical Engineering / Wave Engineering / Advanced Diagnostic Imaging

**Kentaro Nakamura, Professor (FIRST)**
Ultrasonics, High power ultrasonics, Optical instrumentation, Optical fiber sensors, Medical measurement and imaging with ultrasonic and optical methods

**Kenji Suzuki, Specially Appointed Professor (WRHI)**
We develop computational intelligence that learns, from image examples, physicians’ knowledge in interpreting images to help make smart decisions in biomedicine.

### Signal Processing Group

#### Media Signal Processing Field

**Minoru Nakayama, Professor**
Human visual perception and their characteristics in various aspects are analyzed using some behavioral metrics such as EEG, eye movement, pupil responses and other responses.

**Izumi Ito, Assistant Professor**
Signal processing/Image processing/Transforms and spectral techniques

### Signal Processing Group

#### Inverse Problems Field

**Isao Yamada, Professor**
Algorithms for Variety of Mathematical Problems in Signal Processing, Optimization, Inverse Problems and Data Science

**Masao Yamagishi, Assistant Professor**
Signal Processing/Optimization/Inverse Problems/Adaptive Filtering

### Communication, Networks, and Security Group

#### Communication Systems Field

**Kazuhiko Fukawa, Professor**
Transmission and network techniques for wireless communications by developing digital signal processing, adaptive filters, and statistical based algorithms.

**Yuyuan CHANG, Assistant Professor**
Mobile communication, millimeter wave communication, multiple input multiple output (MIMO) systems, multi-user MIMO (MU-MIMO) systems, user scheduling, wireless sensor network

#### Information Theory and Security Field

**Tomohiko Uyematsu, Professor**
New information measures for data compression or reliable communication/Source and channel coding/Random number generation/Network information theory

**Tetsunao Matsuta, Assistant Professor**
Multi-user information theory/Non-asymptotic analysis in information theory/Cache-aided communication/Non-asynchronous communication/Rumor source identification in networks

**Wakaha Ogata, Professor**
Cryptography, Encryption, Digital signature, User authentication, Secret sharing, Cryptographic protocol, Multi-party protocol

**Kenta Kasai, Associate Professor**
Coding Theory/LDPC Codes/Spatially-Coupled Codes/Graphical Models/Fountain Codes/Quantum Error Correcting Codes/Memory Channels

### Communication, Networks, and Security Group

#### Communication Networks Field

**Katsunori Yamaoka, Associate Professor**
Information and Communication Network/Internet Technology/Telecommunication Networking/Next and Future Network/Network Engineering for Multimedia and Application

**Yoshiaki Kitaguchi, Associate Professor (GSIC)**
Information and communication engineering/Next generation network operation and management/Network security/System dependability evaluation/Inter-cloud system
Integrated Circuit and Computer Group

Digital Integrated Circuits Field

Tsuyoshi Isshiki, Professor (GSIC)
System-on-Chip design verification automation, high-performance processor design automation, secure VLSI architecture

Rumiko Kondo, Assistant Professor
computer system management / computer network / information security

Dongju Li, Assistant Professor
Algorithm, SOC, and system solution of fingerprint authentication for information security in various applications, such as smartphone, mobile payment, IoT.

Shuichi Ueno, Professor
Theory of Parallel and VLSI Computation/Theory of Quantum and Nano Computation: Theoretical study to reveal the limit and possibility of emerging technology for integrated systems.

Satoshi Tayu, Assistant Professor
Graph algorithm / Combinatorial optimization

Atsushi Takahashi, Professor

Yuko Hara, Associate Professor
Embedded Systems, Internet-of-Things (IoT), High-Level Synthesis, Logic Synthesis, Hardware/Software Co-design, Computer Aided Design (CAD), Architecture/Microprocessor, FPGA

Integrated Circuit and Computer Group

Analog Integrated Circuits Field

Shigetaka Takagi, Professor
Our main research topics are analog integrated circuit designs for high linearity, high-speed operation, low supply voltage operation, reduction in power consumption, etc.

Hiroki Sato, Assistant Professor
CMOS Analog Integrated Circuit, Low-Voltage Circuit Technique, Signal Processing, IP Networking, Computer Security

Integrated Information and Communications Group

Distributed Information and Advanced Communication Systems Field

Hiroki Nakahara, Associate Professor
Reconfigurable System, FPGA, Deep Learning, Multi-Valued Logic

Shimpei Sato, Assistant Professor
Digital circuit design / Variable latency circuit / Computer architecture / Many-core processor / Network on Chip / Approximate computing
It is necessary to utilize scientific tools such as modelling, quantitative analysis and statistical processing to better respond to constantly changing financial and operational conditions. The knowledge and understanding gleaned using these tools can be used to build even better systems when we utilize the strengths of engineering approaches that have been honed through on-site experience.

This is the strength of the Department of Industrial Engineering and Economics – the ability to combine the theoretical base provided by science and engineering with practical skills and experience.

Research Groups and Fields of Research

**Research**

Our aim is to analyze various issues in corporate management and economics from the perspectives of mathematics, science, engineering, business administration, economics and various other fields of study, and attempt to find solutions. It is for this reason that the areas and topics of research undertaken in this department are so diverse.

Areas of study include: business strategy; capital procurement and investment; organization management; strategic and financial analysis of management activities through marketing and other means; production management; quality management; supply chain management; finding solutions to various corporate operational issues using management information systems; industrial engineering; ergonomics; cognitive engineering; psychological understanding of human behavior; operations research; optimization; development of mathematical problem solving methods such as analysis of big data; game theory; micro/macroeconomics; econometrics; experimental economics; economic behavioral analysis using mathematical and engineering approaches.

**Education**

Our curriculum is centered on four pillars of mathematics, economics, business administration, and management technology, and it is designed to provide a focus on specific subjects while helping students reach their educational goals. Our students are able to become engineers, researchers, and specialists with rich imaginations, with the ability to come up with theoretical structures that carve out new areas of research, and with open minds that enable them to put their ideas into practical use.

Approximately 70% of our undergraduates advance to graduate study, while the others start working after their undergraduate degree in various industries that include manufacturing and consulting, and financial industries such as banking, insurance, and securities. Graduates of the Department of Industrial Engineering and Economics have excellent mathematical abilities and are well-versed in both management and economics theory. They can be found in a broad array of fields, and they are highly thought of in all industries in which they work.

**Research Groups and Fields of Research**

**Advanced Management and Paradigm Creation Group**

Developing optimization methods through engineering analysis focused on industrial processes including development, production, and sales, and on human behavior in those processes.

- Industrial System Field
- Human Centered System Field
- Operations Management Field

**Analysis Method Creation Group**

Developing analytical methods for diverse types of information and optimization methods of management and economic activities, based on mathematical and statistical analysis and active utilization of AI.

- Mathematical Sciences and Informatics Field
- Operations Research Field
- Econometrics Field
- Cyber Physical System Field

**Corporate System Creation Group**

Conducting scientific analysis of corporations that act as drivers of innovation, and presentation of strategies for optimal corporate governance, management/organization, marketing, and capital.

- Corporate Governance System Field
- Management Strategy / Marketing Field

**Economic Science Group**

Analyzing economic and social systems based on economics, and designing and presenting policies and institutions that could achieve desirable economic and social situations.

- Macroeconomics/Cliometrics Field
- Microeconomics/Game Theory Field
- Humanomics Field
- Global Environmental Research Field
Faculty

**Advanced Management and Paradigm Creation Group**

**Industrial System Field**

Kenji Itoh, Professor  
Ergonomics/cognitive engineering/safety engineering/patient safety/Holistic Management System

Xiuzhu Gu, Assistant Professor  
Risk management / patient safety/healthcare operations management/applied ergonomics/occupational health and safety

**Advanced Management and Paradigm Creation Group**

**Human Centered System Field**

Hiroyuki Umemuro, Professor  
Products or services that provide affective experiences/technology and aging/human-robot(agent)-interaction/management considering affective experiences of stakeholders

Hirotaka Aoki, Associate Professor  
Cognitive ergonomics/cognitive task analysis applying eye tracking technique/usability and user experience evaluation/development of cognitive task analysis methods/industrial engineering

**Advanced Management and Paradigm Creation Group**

**Operations Management Field**

Masami Miyakawa, Professor  
Applied statistics/Multivariate analysis/Statistical causal inference/Design of Experiment/Taguchi method

Sadami Suzuki, Associate Professor  
Production management/operations management/logistics/supply chain management/customer satisfaction/customer value/service management

Shota Katayama, Assistant Professor  
High-Dimensional data analysis/Variable selection via sparse regularization/Model selection based on information criteria/Robust inference against outliers

**Analysis Method Creation Group**

**Operations Research Field**

Shinji Mizuno, Professor  
Modeling of problems in management science and engineering/approach by operations research/development and analysis of optimization algorithms/solution methods and evaluation

Kazuhide Nakata, Associate Professor  
We focus on operations research, machine learning, and optimization. In particular, we develop algorithms for precisely analyzing large scale models.

Tomonari Kitahara, Assistant Professor  

**Analysis Method Creation Group**

**Mathematical Sciences and Informatics Field**

Tomomi Matsui, Professor  
Optimization Algorithms based on Mathematics and Informatics/Discrete Optimization/Combinatorics/Operations Research/Algorithm

Akiyoshi Shioura, Associate Professor  
Theory of discrete convex analysis/efficient algorithms for discrete optimization problems/application to operations research, mathematical economics, etc.

Yasushi Kawase, Assistant Professor  
Discrete optimization/Competitive analysis for online optimization/Algorithmic Game Theory/Robust optimization/Community detection in networks

**Analysis Method Creation Group**

**Econometrics Field**

Yukitoshi Matsushita, Associate Professor  
Econometrics/Empirical Likelihood/Statistical Inference/Non-parametric model/Semiparametric Model

Tetsuya Shimane, Assistant Professor  
Applied econometrics/spatial econometrics/environmental economics/Spatial autocorrelation model/discrete choice model

**Analysis Method Creation Group**

**Cyber Physical System Field**

Junichi Iijima, Professor  
Enterprise Engineering consisting of Enterprise Ontology, Enterprise Governance and Enterprise Architecture. Especially, DEMO for Enterprise Ontology and IT-CMF for Enterprise Governance of IT.

Yoichiro Higuchi, Professor  
Econometrics, Spatial Econometrics, Development and Application of Spatial Interaction Data on Human Migration, Goods Distribution, Capital Circulation and Information Traffic

Jaehyun Park, Assistant Professor  
My research highlights three genres – (1) ICT-enabled innovations, (2) design thinking, and (3) smart cities & tourism in innovation, information systems, and design.
### Corporate System Creation Group

**Corporate Governance System Field**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Research Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kotaro Inoue</td>
<td>Professor</td>
<td>Corporate finance/corporate investment policy/financial policy/corporate governance/behavioral finance</td>
</tr>
<tr>
<td>Kyoko Nagata</td>
<td>Associate Professor</td>
<td>Corporate evaluation/corporate governance/profit adjustment/empirical research on capital market</td>
</tr>
<tr>
<td>Naoshi Ikeda</td>
<td>Assistant Professor</td>
<td>Corporate finance/investment policy/Financial policy/Payout policy/Initial public offering/Corporate governance/Capital market/Heterogeneous beliefs</td>
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**Management Strategy / Marketing Field**

<table>
<thead>
<tr>
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<th>Research Areas</th>
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</thead>
<tbody>
<tr>
<td>Yoshitoshi Tanaka</td>
<td>Professor</td>
<td>Intellectual property strategy/Integration of marketing and intellectual property rights/Patent portfolio with consumer needs/Basic patents and improvement patents/Patent information analysis</td>
</tr>
<tr>
<td>Chung Sulin</td>
<td>Associate Professor</td>
<td>Marketing/Distribution strategies/Retail internationalization (especially internationalization process and strategies of convenience store)/Modernization of the distribution industry</td>
</tr>
</tbody>
</table>

### Economic Science Group

**Macroeconomics/Cliometrics Field**

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Kyoko Yamamuro</td>
<td>Professor</td>
<td>Economic History/Cliometrics/Quantitative History/Historical Data Analysis/Edo era</td>
</tr>
<tr>
<td>Ryoji Ohdoi</td>
<td>Associate Professor</td>
<td>Development of economic growth models based on agents’ heterogeneity/analysis of international propagation of shocks/dynamic extension of trade models</td>
</tr>
<tr>
<td>Takeo Hori</td>
<td>Associate Professor</td>
<td>Macroeconomics/Economic Growth/Technical Progress/Structural Transformation/Heterogeneous Agents/Sustainability of Public Debts/Monetary Policy</td>
</tr>
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**Microeconomics / Game Theory Field**

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<tbody>
<tr>
<td>Takehiko Yamato</td>
<td>Professor</td>
<td>Economic mechanism design/Market and public goods provision mechanisms: theory and experiments/Behavioral game theory and implementation theory</td>
</tr>
<tr>
<td>Ryo Kawasaki</td>
<td>Associate Professor</td>
<td>Game theory/Mathematical economics/Application of stable sets in economics/Potential games and their applications/Analysis of markets with indivisibilities</td>
</tr>
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**Humanomics Field**

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<tr>
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</thead>
<tbody>
<tr>
<td>Dai Senoo</td>
<td>Professor</td>
<td>Theory of Organization, Strategy, Knowledge Management and Information Systems. Main projects are Creative Office, Open Innovation and Business Ecosystem.</td>
</tr>
<tr>
<td>Emiko Fukuda</td>
<td>Associate Professor</td>
<td>Industrial economics/experimental economics/numerical analysis of game theory model/congestion management/security and disaster-relief service</td>
</tr>
<tr>
<td>Jacqueline Urakami</td>
<td>Assistant Professor</td>
<td>Human Factors/culture and technology/cognitive ergonomics for interface design/technology for an aging society</td>
</tr>
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**Global Environmental Research Field**

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<tbody>
<tr>
<td>Toshihiko Masui</td>
<td>Professor</td>
<td>Development of integrated assessment model toward low-carbon and sustainable society, and quantification of future scenarios by using the developed model.</td>
</tr>
<tr>
<td>Yuko Kanamori</td>
<td>Associate Professor</td>
<td>Development and analysis of environmental model of household sector/lifestyle/population and household structure analysis</td>
</tr>
<tr>
<td>Yosuke Munesue</td>
<td>Assistant Professor</td>
<td>Impacts of food losses and waste on global food insecurity, natural resources, and greenhouse gas emissions/Food loss reduction in the Sustainable Development Goals</td>
</tr>
</tbody>
</table>
**Typical Research Projects**

### System Theory for Harmonized Power System Control Based on Photovoltaic Power Prediction

- **System framework of next generation power system control accepting 102GW PV power**
  - Realizes stable power supply from the perspectives of resilience, fairness, and comfort to users as well as economics/environmental friendliness
  - Power system control fully exploiting PV-prediction and electricity market

### JST-CREST

**Development of zero standby power consumption photonic router by integrating heterogeneous materials of magnetic materials, metals and semiconductors**

### Research Overview

**Research Overview**

The main purpose of this research project is to develop a system theory of more advanced generation power system control in order to achieve a harmonized power supply under a large penetration of photovoltaic (PV) power systems. More specifically, this project aims to develop a power system control framework and methodology fully exploiting PV/demand power prediction as well as focusing on functions and properties of a middle layer consisting of various kinds of power aggregators in addition to a system operation layer and a user layer. This research can thus provide a fundamental framework of a future power control system that allows us to continuously introduce up to 102GW of PV, setting 64GW, which is the target proposed by the Japanese government, as a checkpoint, and that can be further developed towards a stable supply under introduction of more than 102GW.

### Members

- **Jun-ichi Imura**, Prof. (Systems & Control Eng., p13)
- **Takayuki Ishizaki**, Assis. Prof. (Systems & Control Eng., p13)

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### PV Based Next Generation Smart Grid

**Research Overview**

The research project aims to develop a novel photonic router characterized by no standby power consumption. The router is realized by integrating heterogeneous materials such as magnetic materials, metals and semiconductors on a single silicon photonic circuit chip. It has the great advantage of accommodating an increase in traffic transmitting large-capacity contents together with small-sized contents generated by IoT (Internet of Things) while preventing an increase in power consumption. The router brings about a breakthrough in infrastructural technologies for communication networks.

### Members

- **Tetsuya Mizumoto**, Prof. (Electrical & Electronic Eng., p16)
- **Shigehisa Arai**, Prof. (Electrical & Electronic Eng. (FIRST, IIR), p16)
- **Nobuhiko Nishiyama**, Assoc. Prof. (Electrical & Electronic Eng., p16)
- **Yuya Shoji**, Assoc. Prof. (Electrical & Electronic Eng. (FIRST, IIR), p16)
- **Tomohiro Amemiya**, Assis. Prof. (Electrical & Electronic Eng. (FIRST, IIR), p16)
- **Kazuhiro Ikeda**, Dr. (National Institute of Advanced Industrial Science and Technology) 【Collaborator】
Under the tough robotics challenge of ImPACT program, Tokyo Tech group is making several researches aiming for tough robots that can work without faltering in real fields. By using a microphone array mounted on UAV (Unmanned Aerial Vehicle), we are developing sound source identification and UI technology to search disaster sites quickly where roads are severed and to detect voice of victims under rubbles. We also conduct R&D on technologies that present surrounding conditions effectively to operators even in bad conditions such as in fog by utilizing visible and far-infrared cameras. In addition, we are working in cooperation with several hydraulic manufacturers to develop hydraulic robot components with light weight, high output, high controllability, and high efficiency and to apply them to robots.

Members

Koichi Suzumori, Prof. (Mech.Eng., p10)
Masatoshi Okutomi, Prof. (System & Control Eng., p13)
Kazuhiro Nakadai, Spec.-Ap. Prof. (System & Control Eng., p14)
Masayuki Tanaka, Assoc. Prof. (System & Control Eng., p13)
Hiroyuki Nabae, Assis. Prof. (Mech. Eng., p10)

Improvement of thermal efficiency of internal combustion engines (ICE) for automobiles is required strongly for the energy security and global environmental preservation in the future. Council for Science Technology and Innovation took "Innovative Combustion Technology" as an important research issue in SIP program in response to this requirement. We conduct the fundamental researches on the improvement of thermal efficiency of ICE up to 50% in SIP. For this purpose, the super lean combustion technology is applied to SI engine, and ultra high pressure fuel injection is used for the control of PCCI combustion in CI engine.

Members

Hidenori Kosaka, Prof. (Systems & Control Eng., p14)
Susumu Sato, Assoc. Prof. (Systems & Control Eng., p14)

Models of ignition, flame propagation and heat transfer used in computational fluid dynamics (CFD) for practical combustors have great influences on the accuracy of simulations, and are desired to be suitable for ultra-lean and high pressure conditions to be used in the next generation gasoline engines for more than 50% thermal efficiency. In this research project, highly accurate models have been developed based on the combustion physics investigated by using massively parallelized direct numerical simulations (DNS) and combined laser diagnostics. The model is going to be integrated into HINOCA, which is the CFD software being developed in SIP and expected to be a platform for the industry.

Members

Mamoru Tanahashi, Prof. (Mech. Eng., p8)
Masayasu Shimura, Assoc. Prof. (Mech. Eng., p8)
Yuki Minamoto, Assis. Prof. (Mech. Eng., p8)

Overview

Research Overview

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Members

Mamoru Tanahashi, Prof. (Mech. Eng., p8)
Masayasu Shimura, Assoc. Prof. (Mech. Eng., p8)
Yuki Minamoto, Assis. Prof. (Mech. Eng., p8)
Research and Development of Power Electronic Systems Using the Next-Generation Power Semiconductor Modules

High-power density and high-efficiency power converters  
High-power and high-efficiency isolated dc-to-dc converters  
The next-generation hybrid dc circuit breakers  
SiC-based multilevel power converters for HVDC applications*  
Transformer-less converters for practical 6.6-kV distribution systems*

Research Overview

Power electronics is a key technology for further energy savings, being expected to make the competitiveness of the Japanese industry stronger in the world. The goal of this program is to expand and enhance the application of the next-generation power electronics technology based on power semiconductor modules using a new material of silicon carbide (SiC).

Nine universities and two manufacturers join this program to conduct 13 research themes. Tokyo Tech is responsible for five research themes. Two of them are collaborative research themes with the two manufacturers, as marked with "*" in the above list.

Tokyo Tech designed, constructed and tested a 750-Vdc, 100-kW isolated dc-to-dc converter using SiC-MOSFET modules. The converter recorded a power conversion efficiency as high as, or over, 98.3% in a wide range from 3% to 100%, which is the highest efficiency at present.

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Members

Hirofumi Akagi, Spe.-Ap. Prof. (Electrical & Electronic Eng., p.18)  
Hideaki Fujita, Assoc. Prof. (Electrical & Electronic Eng., p.18)  
Makoto Hagiwara, Assoc. Prof. (Electrical & Electronic Eng., p.18)  
Koichi Yatsuoka, Prof. (Electrical & Electronic Eng., p.18)  
Shungo Zen, Assis. Professor (Electrical & Electronic Eng., p.18)  
Toshiya Nanahara, Prof. (Electrical & Electronic Eng., p.18)  
Masaki Kuzumoto, Vis. Prof. (Electrical & Electronic Eng., p.18)  
Tomoyuki Miyamoto, Assoc. Prof. (Electrical & Electronic Eng., p.18, Inst. Innovative Res.)  
Shinsuke Miyajima, Assoc. Prof. (Electrical & Electronic Eng., p.17)  
Kazuyoshi Nakada, Assis. Prof. (Electrical & Electronic Eng., p.17)

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Japan Sports Agency High Performance Support Project

Research and Development Project (for Paralympics)

Research Overview

This project aimed to support the sport events, in which medals in the Paralympics were expected, from advanced sports science and medicine as well as information technology. The researches and developments of equipment for competitions and training for top para-athletes were conducted for two years, by a special team which consisted of 20 or more researchers in 14 organizations. This team was lead by Prof. Motomu Nakashima. The targeted events were swimming, wheelchair tennis, athletics, wheelchair rugby and so on. The left figure shows an example of the project for swimming. The research was conducted in consideration of each para-swimmer.

Members

Motomu Nakashima, Prof. (Systems & Control Eng., p.14)  
Yusuke Miyazaki, Assoc. Prof. (Systems & Control Eng., p.14)  
Takeo Maruyama, Assoc. Prof. (Inst. Liberal Arts)  
Yukio Takeda, Prof. (Mech. Eng., p.10)  
Daisuke Matsuura, Assis. Prof. (Mech. Eng., p.10)  
Shoichi Hasegawa, Assoc. Prof. (Inst. Innovative Res.)

---

PEFC Research and Development Program (NEDO)

Liquid Water Visualization & Catalyst Layer Fabrication of PEFCs

In-situ Visualization of Liquid Water within an Operating PEFC by using Wavelength-optimized X-ray Imaging Technique

Polymer Electrolyte Fuel Cells (PEFCs) are known as clean and high efficiency energy device. In PEFCs, water is generated by electrochemical reaction, and the water might impede transport of reactants to the catalyst site. Therefore, detailed understanding of the water transport phenomena within the PEFC is crucially important to reduce cost of the PEFC system.

In this project, laboratory-based in-situ X-ray imaging technique has been developed to visualize the micro-structure and the liquid water behavior within the PEFC. The figure clearly showed liquid water accumulation and discharge behavior within the PEFC, and the results has been used to understand the water behavior and design the high-performance component.

Research about catalyst layer fabrication process has been also promoted in the project. The obtained results has been used to realize better catalyst layer.

Members

Shuichiro Hirai, Prof. (Mech. Eng., p.10)  
Hidetoshi Matsumoto, Assoc. Prof. (Material Sci. & Eng.)  
Takashi Sasabe, Assoc. Prof. (Mech. Eng., p.10)  
Masatoshi Tokita, Assoc. Prof. (Material Sci. & Eng.)
Optimization Technology in Industrial Engineering and Economics

Research Overview
Various problems in practice are often written by a similar optimization model. For example, a problem to assign tasks in a factory to machines is called a matching problem, and a solution technique is used for assigning graduating medical students to their first hospital appointments and fusing databases with multiple sensors. It is known that facility location problems of fire departments have structures similar to those of electronic components location problems on electric circuit boards, container location problems at piers and distortion sensor location problems of buildings. Techniques for solving scheduling problems in the manufacturing industry are used for determining the delivery order of parcels and for determining the hole drilling order of electric circuit boards. The Analysis Method Creation Group aims to expand the scope of application as well as deepening the optimization theory.

Members
Tomomi Matsui, Prof. (Industrial Eng. & Econo., p24)
Akiyoshi Shionoya, Assoc. Prof. (Industrial Eng. & Econo., p24)
Tomonari Kitahara, Assis. Prof. (Industrial Eng. & Econo., p24)
Shinji Mizuno, Prof. (Industrial Eng. & Econo., p24)
Kazuhide Nakata, Assoc. Prof. (Industrial Eng. & Econo., p24)
Yasushi Kawase, Assis. Prof. (Industrial Eng. & Econo., p24)

Program for Advancing Strategic International Networks to Accelerate the Circulation of Talented Researchers (JSPS)

Computational Neuroscience connecting behavior and brain activities

Research Overview
In this research, we aimed to elucidate “How does the brain represent the body motion and solve the control problem. The objective this research is to open up a new field of “Computational brain/body imaging method ” which elucidate the brain’s theory of computation from EEG and body motion during motor task. We are conducting research toward realization a society that ensures the quality of life and realizes a safe and secure life by using new rehabilitation techniques and developing prosthesis integrated with the body, even if the possibility of having some disability increases as the aging.

Members
Yasuharu Koike, Prof. (Info. & Communi. Eng., p20)
Natsue Yoshimura, Assoc. Prof. (Info. & Communi. Eng., p20)
Hiroyuki Kambara, Assis. Prof. (Info. & Communi. Eng., p20)

Grant-in-Aid for Specially Promoted Research from Japan Society for the Promotion of Science

Exploration of breakthrough in terahertz-device performance by understanding the radiation mechanism from view point of electron travelling and transition

Research Overview
The terahertz (THz) frequency range of approximately 0.1-10 THz remains unexplored, but various applications are expected, such as ultrahigh-speed wireless communications, imaging, and spectroscopy, etc. Compact semi-conductor sources with high power and room-temperature operation are essential for these applications. Up to now, we have succeeded a room-temperature oscillation of resonant tunneling diodes above 1 THz as the first-time achievement in electronic single devices. Because the THz frequency range is located between light wave and millimeter wave, we have to establish comprehensive base of THz-device physics including the transport and transition of electrons in order to realize high-performance THz devices.

This project aims at establishment of THz-device physics and realization of high performance terahertz sources for various applications.

Members
Masahiro Asada, Prof. (Laboratory for Future Interdisciplinary Research of Sci. and Tech., Electrical & Electronic Eng., p17)
Yasuyuki Miyamoto, Prof. (Electrical & Electronic Eng., p17)
Nobuhiko Nishiyama, Assoc. Prof. (Electrical & Electronic Eng., p16)
Safumi Suzuki, Assoc. Prof. (Electrical & Electronic Eng., p17)
### Statistics

#### Number of Staff

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### Interdisciplinary Graduate Majors

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### Doctoral Course

(As of May 1, 2017)

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### Research Funds

**Grant-in-Aid for Scientific Research 2017**

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(As of May 31, 2017)

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For any inquiry regarding industry-university cooperation, contact us at:

**Industry-University Cooperation Office in School of Engineering**

E-mail: icu-seng@e.titech.ac.jp

**Joint Research Group, Industrial Cooperation Division, Research Promotion Department**

URL: http://www.sangaku.titech.ac.jp  
E-mail: san.kyo@jim.titech.ac.jp
**Location**

**Ookayama Campus**
2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550 Japan

**Suzukakedai Campus**
4259 Nagatsuta-cho, Midori-ku, Yokohama, Kanagawa 226-8503 Japan

---

**Ookayama Campus** is a 1-minute walk from Ookayama Station

**Suzukakedai Campus** is a 5-minute walk from Suzukakedai Station

**Tamachi Campus** is a 2-minute walk from Tamachi Station