国立大学法人
長岡技術科学大学
Nagaoka University of Technology

# OUTLINE OF DOCTORAL PROGRAM

## IN THE GRADUATE SCHOOL OF ENGINEERING

## 2026

# Contents



※ About the staff will be retired within three years

Note: In the "Name" column, * indicates the staff who will be retired on March 31,2026.

Note: In the "Name" column, ** indicates the staff who will be retired on March 31,2027.

Note: In the "Name" column, *** indicates the staff who will be retired on March 31,2028.

# Outline of Doctoral Program in the Graduate School of Engineering, Nagaoka University of Technology

## Ⅰ The Objective of the Doctoral Program

The aim of the Doctoral Program in the Graduate School of Engineering is to develop high-level research ability and prolific knowledge, which are indispensable for conducting self-reliant research in a specific field of study.

## Ⅱ Educational and Research Courses and Fields

Under the university's basic policy an integrated curriculum is provided as a unified course of study that begins in the undergraduate years and continues systematically through graduate studies.

On the other hand, The Doctoral Program has been organized by rebuilding it into a revolutionary system of education and research to allow even more advancement of an interdisciplinary nature and epoch-leading role. Accordingly, the Doctoral Program consists of four courses, i.e., Energy Engineering, Information Science and Control Engineering, Materials Science, and Civil Engineering and Bioengineering. These four courses are composed of many educational and research fields each of which, in turn, is organized by assembling several integrated chairs belonging to different disciplinary areas.

This system provides academic achievement in each field of study, vigorous development of new fields, advancement of the study itself and the training of high level researchers.

Details of the courses and the three fields in each are given below.

# 1. Energy Engineering

Human beings have established a highly-developed civilization through the progress of technology. In order to maintain this prosperous situation, we need to solve existing problems of population, cities, resources, and the environment to keep the balance between nature and our human society. There are two measures to do this: one is to develop new energy sources and advanced energy-related devices and systems, and the other to evolve methods for saving energy resources. The Energy Engineering course covers the following three fields, which all aim to keep the balance between nature and our human society.

### (1) Energy Systems Engineering

The exhaustion of fossil fuel is of an urgent issue. In order to solve this, we need not only to improve efficiency in the utilization of existing fuels, but also to develop new energy sources such as renewable energy. Addressed in this area are many problems that cannot be solved only by a method in any particular, established research field.

This field aims (i) to improve the performance of equipment through studies on particular energy technologies and methods (transportation, storage, and transformation) and on various energy types including heat, nuclear, electrical, and mechanical energies; (ii) to integrate related technologies in different research fields of environment, materials, control, etc.; and (iii) to systematize technologies and methods to build up a sustainable energy system, in which the concept of the system safety engineering is introduced to secure the safety, especially in the proper usage of nuclear energy.

### (2) Energy Conversion, Control Engineering

Thermal, electrical, and mechanical energy generated from energy sources is utilized through complex processes. These energies need to handle various conversion processes depending on the application. In addition, advanced control technology is required to improve the conversion efficiency and economic efficiency of various processes and systems. In this specialized area, research and development of energy conversion and control technologies are conducted for this purpose.

This field aims (i) energy conversion and control engineering to improve energy efficiency and economy of various energy systems, (ii) research and technology development for effective utilization of various energy sources; and (iii) control technology and safety engineering for safe and secure energy utilization.

### (3) Energy Materials Engineering

New material is required in the development in energy technology that contributes toward effective utilization and saving of energy sources and improvement in processes of transportation, storage, and transformation of energy. Newly developed materials can be applied to energy-related devices.

Aims of this field contain: (i) effective utilization of nuclear resources; (ii) chemical transformation of solar energy by photosynthesis; (iii) optimization of energy transmission; and (iv) development of functional materials for higher efficiency and saving of energy.

## University Staff and Fields of Research

### (1) Field of Study: Energy Engineering

### PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| JIANG, Weihua ** | Power engineering<br>Electron device<br>Plasma science | 1) Compact pulsed power generator<br>2) High power microwave generation<br>3) High energy-density science<br>4) Plasma Applications |
| SUEMATSU, Hisayuki | Inorganic materials<br>Physical properties | 1) Development of material preparation methods utilizing extreme conditions<br>2) Synthesis of novel superconductive, magnetic and other novel materials |
| SUZUKI, Masataro | Thermal engineering<br>Fluid engineering | 1) Fire Safety Engineering<br>2) Combustion<br>3) Reactive-Fluid Dynamics<br>4) Thermophoresis |
| SUZUKI, Tatsuya | Nuclear Chemistry<br>Radiochemistry | 1) Nuclide Separation & Partitioning<br>2) Isotope Effect / Isotope Separation<br>3) Plasma Chemistry<br>4) Nuclear Reprocessing Engineering<br>5) Nuclear Fuel Cycle Engineering |
| TAKAHASHI, Tsutomu ** | Fluids engineering | 1) Rheo-optic behavior of complex fluids<br>2) Elongation flow behavior of complex fluids<br>3) Flow of surfactant solutions, cosmetics and slurries<br>4) Control and effective utilization of Flow-induced vibration<br>5) Energy harvesting from wind and river flow |
| LI, Zhidong ** | System design for low-carbon society<br>Energy and environmental policy | 1) Low-carbon System<br>2) Energy Economics<br>3) Environmental Economics<br>4) Econometrics |

### ASSOCIATE PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| OHTA, Tomoko | Environmental radioactivity | 1) Environmental radioactivity<br>2) Groundwater dating<br>3) Forestry Hydrology<br>4) Backend |
| KATSUMI, Toshiyuki | Combustion Engineering<br>Aerospace Engineering | 1) Combustion energy<br>2) Combustion safety<br>3) Rocket propellant combustion |
| SUGAI, Taichi | Power engineering<br>Plasma science<br>Particle beam | 1) Pulsed power technology<br>2) High power radiation<br>3) Plasma application<br>4) Electric discharge |
| TAKEZAWA, Hiroki | Nuclear System Engineering | 1) Integrated numerical analysis of nuclear systems<br>2) Monte Carlo particle transport calculation<br>3) Small and micro reactors design<br>4) Criticality safety analysis<br>5) Nuclear batteries design |
| YAMAZAKI, Wataru | Computational Fluid Dynamics<br>Aerospace Engineering | 1) Aerodynamic Design<br>2) Optimization Algorithms<br>3) Airfoil and Wing<br>4) Fluid Machinery |

## (2) Field of Study: Energy Conversion, Control Engineering

### PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| ITOH, Jun-ichi | Power electronics<br>Power conversion<br>Motor drive system | 1) Development of simple, high efficiency and high performance power converter<br>2) Development of AC/AC direct power converter<br>3) High performance and simple Motor control |
| KIKUCHI, Takashi | Nuclear fusion science | 1) Beam Physics and Engineering<br>2) Nuclear Fusion<br>3) Computational Science<br>4) Plasma Science |
| SASAKI, Toru | High Energy Density Physics<br>Thermonuclear Fusion | 1) High Energy Density Physics<br>2) Pulsed Power Generation<br>3) Thermonuclear Fusion<br>4) Plasma Science and Applications |
| MIURA, Yushi | Power Engineering<br>Power System Engineering<br>Power Electronics | 1) Distributed Generations<br>2) Smart Grid<br>3) Microgrid<br>4) Applications of Power Electronics in Power System |
| MIYAZAKI, Toshimasa | Dynamics<br>Control | 1) Motion Control<br>2) Mechatronics<br>3) Robotics |
| YAMADA, Noboru | Energy Engineering<br>Thermal Engineering<br>Optics and Photonics | 1) Solar energy (photovoltaics and solar thermal applications)<br>2) Power generation from low-grade heat sources<br>3) Energy storage (mechanical battery, etc.)<br>4) Heat transfer |

### ASSOCIATE PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KUSAKA, Keisuke | Power Electronics | 1) Power converters<br>2) Wireless power transfer<br>3) Energy conversion |
| KOBAYASHI, Yasuhide | Control engineering<br>Dynamics<br>Control | 1) Robust active noise control of ducts<br>2) Disturbance attenuation control on water surface<br>3) Robust speed control of rotary systems |
| TAKAHASHI, Kazumasa | Ion beam engineering<br>Plasma science and engineering<br>Supersonic flow | 1) Laser ion source<br>2) Cluster ion beam<br>3) Gasdynamic window |
| YOKOKURA, Yuki | Motion Control<br>Motor Drive<br>Robotics | 1) Motion Control of Robotics and Mechanical System<br>2) High Performance Motor Drive<br>3) Vibration Suppression Control of Geared Motor System |

## (3) Field of Study: Energy Materials Engineering

### PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| SUZUKI, Tsuneo | Accelerator applications, novel material design | 1) Chemical analysis by electrostatic accelerator<br>2) Light ion implantation<br>3) Novel material design and synthesis of new material |

| | | |
|---|---|---|
| TAKEDA, Masatoshi | Functional materials | 1) Energy conversion materials<br>2) Energy conversion, system<br>3) Electronic properties of Boron-rich semiconductors |
| HONMA, Tsuyoshi | Functional glass materials | 1) Sodium Ion Batteries<br>2) Lithium Ion Batteries<br>3) Ionic Conductive Materials<br>4) Crystallization Mechanism of Glass Materials |

## ASSOCIATE PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| SHIRONITA, Sayoko | Metal Surface Science | 1) ChemistryPolymer Electrolyte Fuel Cell Materials<br>2) Safety of Secondary Battery Nano-sized Metal |
| TAGAYA, Motohiro | Biomaterials Engineering | 1) Nano-Bio Materials<br>2) Biomaterials Engineering<br>3) Bioceramics<br>4) Mesoporous Materials<br>5) Calcium Phosphate Compounds |

## 2. Information Science and Control Engineering

The focus of research in technology has shifted from concentrating on highly specialized areas of study to a multi-disciplinary approach. Space development, ocean development, and robotics are such examples.

This course adapts such an interdisciplinary approach. It includes the fields of knowledge/information engineering, information system technology, and control engineering. The aims of the course are:

(i) to improve computation, image processing, and radio and light wave technologies;

(ii) to improve super-precision measurement and control technology and super precision processing technology; and

(iii) to develop machine mechanisms and production system control technology through the integration of these technologies.

### (1) Knowledge and Information Systems Engineering

Knowledge engineering concerns the development of human abilities such as learning, skill, sense, and cognition. One of the achievements has been robotics. Sensing and cognition are yet to be developed. This field deals with technologies for processing pattern information and related intelligent information. It also attempts to improve mechanisms carrying a complex array of various elements including some aspects of industrial and management systems science.

### (2) Information Systems Technology

The development of high-speed transmission and processing technologies utilizing radio/optical wave engineering and high performance computers has contributed to the development of modern society and has become indispensable to every aspect of technology. This field aims to utilize this high-tech research to develop integrated technologies such as combining image processing, sound/speech processing, and electric waves and to contribute to these fast growing areas in the application of information technology.

### (3) Precision/Control Systems Engineering

This field is concerned with precision engineering, production engineering, and advanced control engineering using computer technology.

Recent research activities have focused on the following:

(i) dynamics and noise of machine elements, super-precision mechanisms and mechatronics devices;

(ii) super-precision material processing using laser beams, ion beams and electron beams, and solidification theory;

(iii) super-precision machining and grinding;

(iv) dynamic machine design theory and CAD/CAM systems;

(v) advanced control theory and its application to precision machines and industrial robots;

(vi) nanometer measurement technology;

(vii) texture measurement technology and its application to glacier dynamics.

This course also provides a program on “Safety Engineering”. This program aims to take a leading role in the development in safety certification, risk evaluation, development of safety technology based on global safety standards, safety design, risk management, safety management, and safety culture of organization

**University Staff and Fields of Research**

**(1) Field of Study: Knowledge and Information Systems Engineering**

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| ENDO, Takahiro | Control engineering<br>Haptics<br>Robotics | 1) Distributed control of swarm robots<br>2) Enhancement of Haptic sensation<br>3) Motor learning<br>4) Control of infinite dimensional systems |
| KIMURA, Tetsuya | System Safety | 1) Service robots safety<br>2) Standardization and utilization of disaster response robots<br>3) Risk assessment of a mobile robot |
| KURAHASHI, Takahiko | Computational Mechanics | 1) Numerical determination of optimal shape<br>2) State estimation based on filtering theory<br>3) Identification of material properties |
| DOI, Hirokazu | Cognitive Neuroscience<br>Neural Decoding<br>Affective/Attractiveness Computing | 1) Neural and cognitive mechanism of socio-emotional function<br>2) Biological and environmental basis of individual differences in socio-emotional function<br>3) Development of digital phenotyping technology for psychiatric conditions<br>4) Psychological state inference by measurement and mining of multimodal neurophysiological data |
| NOMURA, Shusaku | Ambient Biomedical Engineering<br>Ambient Feedback Systems<br>KANSEI Physiology<br>Bio-signal processing | 1) Development of Ambient Feedback Systems, which is an adaptive ambient control system based on human physiological information aiming at controlling humane mental and/or somatic state<br>2) Psychological stress evaluation with human hormonal secretion, and development of an apparatus to determine stress-related hormones with a non-invasive manner. |
| HAYAMA, Tessai | Media Informatics | 1) Computer-supported Collaborative work<br>2) Knowledge creation support<br>3) Educational technologies<br>4) Data mining and its applications |
| YAMAGATA, Hiroshi *** | System Safety Engineering | 1) Management, Organization, Culture for Safety<br>2) Safety Regulatory Policy<br>3) External Hazard |
| YUKAWA, Takashi *** | Intelligent Informatics | 1) Knowledge Processing<br>2) Information Retrieval<br>3) Text Processing<br>4) e-Learning<br>5) Parallel Computing |
| WATAHIKI, Nobumichi | Business administration<br>Sociology | 1) Industry-Academia collaboration<br>2) Industrial Cluster<br>3) Startup management |

## ASSOCIATE PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| AKIMOTO, Yoritaka | Cognitive Psychology,<br>Cognitive Neuroscience | 1) Neuroimaging<br>2) Language Comprehension<br>3) Social Cognition |
| OIWA, Kosuke | Medical-engineering collaboration<br>Biomedical engineering | 1) Kansei measurement for health care practitioners<br>2) Remote vital sign monitoring for patients |
| OHASHI, Satoshi | Sports Engineering and Informatics<br>Welfare Engineering | 1) Sports Equipment Development<br>2) Physical and Technical-Tactical Performance Metrics<br>3) Assistive Technology |
| OKUSHIMA, Dai | Sports and Applied physiology<br>Sports engineering<br>Sports informatics | 1) Integrated regulation of active muscle microcirculation and muscle deoxygenation.<br>2) Integrated regulation of whole-body respiratory and circulatory systems.<br>3) Development of physical/mental health and sports performance assessment system<br>4) Development of physical/mental health and sports performance assessment with informatics |
| SUZUKI, Nobutaka | Business administration | 1) Strategic Management<br>2) Technology Management<br>3) Manufacturing Management |
| NAKAHIRA, Katsuko, T. | Perceptual Informatics | 1) Service Informatics<br>2) Perceptual Informatics<br>3) Learning Support |
| NAMBU, Isao | Neural Engineering<br>Biosignal Processing | 1) Neuroimaging<br>2) Brain-Machine/Computer Interfaces<br>3) Body-Machine Interfaces |
| NISHIYAMA, Yuta | Living Systems | 1) Multi-sensory system<br>2) Collective behavior<br>3) Emergent computing<br>4) Adaptability<br>5) Self-organization |
| HOJO, Rieko *** | Behavior-based safety | 1) Occupational safety<br>2) Behavior Analysis<br>3) Experimental Psychology<br>4) Behavior-based safety |
| MASAGO, Hideki | System Safety, Maritime Safety, Innovation Safety | 1) Safety and performance evaluation of aquatic robots<br>2) Maritime safety<br>3) Safety management for research and innovation |

## LECTURER

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KUMOI, Gendo | Machine Learning / Data Science | 1) Theory of Machine Learning<br>2) Business Analytics<br>3) Statistical Science |

### (2) Field of Study: Information Systems Technology

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| IWAHASHI, Masahiro | Communication<br>Network engineering | 1) Signal processing<br>2) Multimedia<br>3) Information theory<br>4) Digital circuits and systems |
| TSUBONE, Tadashi | Nonlinear system engineering | 1) Nonlinear circuits<br>2) Nonlinear dynamical systems<br>3) Optimization<br>4) Artificial neural networks |
| HARA, Shin-ichiro | Geometry / Topology | 1) Algebraic Topology<br>2) Lie Groups |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| SUGITA, Yasunori | Communication<br>Network engineering | 1) Filter Design and Analysis<br>2) Image Processing<br>3) Acoustic Signal Processing |
| ZHANG, Kun | Knowledge and Information Engineering | 1) Safety data management<br>2) Injury information description framework<br>3) Market surveillance system for products<br>4) Products accident ontology<br>5) Utilization of safety big data |
| HARAKAWA, Ryosuke | Media informatics | 1) Data analysis<br>2) Machine learning<br>3) Multimedia<br>4) Web mining |
| HIRASAWA, Takeshi | Noninvasive imaging and sensing<br>Medical engineering | 1) Non-invasive imaging and sensing technology including photoacoustic imaging<br>2) Multicolor-three-dimensional image processing and analysis<br>3) Biomedical application of the imaging and sensing technology |
| MANADA, Akiko | Fundamentals for Computer Science | 1) Characteristics on data sequences<br>2) Coding for data storage media<br>3) Analysis on network topologies<br>4) Graph theory and its applications |
| YAMAMOTO, Kenichiro | Ergodic Theory<br>Dynamical System | 1) Large deviation principle<br>2) Equilibrium states |

**LECTURER**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| TOYODA, Mitsuru | System Control Engineering<br>Continuous Optimization | 1) Optimization algorithms in systems control<br>2) Control and optimization in engineering applications |

### (3) Field of Study: Precision/Control Systems Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| AKETAGAWA, Masato * | Information and control engineering (for Mechanical systems) | 1) Precision Engineering<br>2) Applied Optics<br>3) Nanometer measurement and control<br>4) Scanning Probe Microscope<br>5) Nanotechnology |
| ABE, Masajiro * | Dynamics<br>Design engineering<br>System Safety | 1) Machine Dynamics<br>2) Safety Design Engineering<br>3) Dynamics of Machinery-Environment System<br>4) Construction Machinery Engineering<br>5) Materials Handling Machinery Engineering |
| ISOBE, Hiromi | Production engineering<br>Mechanism<br>Machining | 1) Vibration Aided Machining<br>2) Non-contact Handling for Board |
| UNUMA, Takeya | Quantum semiconductor electronics | 1) Nanostructured semiconductors for optoelectronics<br>2) Organic semiconductors for flexible electronics<br>3) Terahertz spectroscopy with a femtosecond laser |
| OHTA, Hiroyuki | Design engineering<br>Machine functional elements<br>Tribology | 1) Sound and vibration of rolling bearings<br>2) Dynamics of linear ball bearings<br>3) Transmission errors of trochoidal gears |
| KATO, Ariyuki | Optical properties of condensed matter and applications | 1) Nano structured phosphor<br>2) Non-contact sensing<br>3) Photo-induced redox phenomenon<br>4) Artificial photosynthesis |
| TANAKA, Kunihiko | Optical properties of semiconductors and applications | 1) Nano structured solar cell<br>2) Thin film solar cell<br>3) High resolution spectroscopy<br>4) Time resolved spectroscopy |
| MIYOSHI, Takanori | Safety engineering<br>Control engineering<br>Robot engineering | 1) Machinery safety engineering<br>2) Tele-control<br>3) System safety<br>4) Man-machine interface<br>5) Risk assessment<br>6) Power-assistive control<br>7) Vibration control |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| WEI, Dong | Information and control engineering for Mechanical systems | 1) Precision Engineering<br>2) Applied Optics<br>3) Nanometer measurement and control<br>4) 3D measurement<br>5) Machine learning<br>6) Signal processing<br>7) Non-linear processing |
| YAMAZAKI, Hirohito | Nanoscale biological engineering<br>Nanotechnology<br>Nano-fluidics | 1) Nanopore sensing<br>2) Cell-free protein synthesis system<br>3) Nanopore fabrication<br>4) Bioengineering |

## 3. Materials Science

For promoting original and creative technologies, one key is to develop new materials which can bring forth innovations in technology. Requirements for materials nowadays have become wide and complicated, and the number of materials has become very large with the development of composite materials. In order to cover the requirements for materials, the materials science course provides the following three fields.

### (1) Structural Materials Engineering

Since the area of human activity has expanded to the polar and deep sea, or even to outer space, the requirements for structures and facilities have become highly elaborate and complicated. The materials which compose the structures and facilities are being used even in severe circumstances. In this field, mechanical properties of a number of materials are to be grasped systematically in view of macro-, micro- and nano-level analyses. Eventually, structural materials which process high specific strength properties are to be developed.

### (2) Functional Materials Engineering

As technology improves, materials with new highly performative functions need to be created. The functions of materials are determined by factors such as the kind of atoms, molecular structure, crystal structure, and electronic structure of its constituents. Recently the field of functional materials engineering has rapidly developed: e.g., 1) the development of (i) electronic devices such as a super fast semiconductive element, which was realized by virtue of new functional and artificial crystals, and (ii) light emitting devices with new functions; 2) high temperature oxide superconductors, and 3) realization of highly functional organic materials. This field concentrates on the following: (i) control of electronic and crystal structure based on condensed matters; (ii) organic materials with value-added function and useful high-polymer materials; (iii) performance evaluation; and (iv) creation and development of new functional materials and new function elements.

### (3) Intelligent Devices Engineering

In order to realize high functionality in various devices, machines, and equipment, it is necessary not only to process information obtained from sensors by feeding it into artificial intelligence and machine learning, but also to further enhance the functionality of sensing devices themselves and develop novel micro/nano devices that can be called intelligent devices. Through the development of new materials and processing technologies that contribute to sensing of electromagnetic waves (THz to X-rays) and high-density information transmission technology, force sensing and ultrasonic sensing, and innovative manufacturing and evaluation technologies related to micro/nano technology, we will conduct research and development on the creation, analysis design, and control of advanced materials and structures.

## University Staff and Fields of Research

### (1) Field of Study: Structural Materials Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KAWAHARA, Seiichi | Polymer<br>Rubber Materials | 1) Materials Chemistry<br>2) Rubber Materials<br>3) Organic Materials Engineering |
| NAKAYAMA, Tadachika | Nanostructural science<br>Applied materials science<br>Energy Harvesting<br>3D Nano Fabrication | 1) The Anisotropic Nano Ceramics, Nano Material Processing for Catalysts and Electric Devices<br>2) Materials Science for Energy Harvesting, Solar Cell, and other energy related materials<br>3) NanoBio Materials by Nanoimprint processing and Novel Plasma technology with Nanosec Pulsed Electric Power Supply |
| NANKO, Makoto | Structure<br>Functional materials<br>Material processing/treatments | 1) Thermodynamics and Diffusion of Metals and Oxides<br>2) High Temperature Oxidation/Corrosion<br>3) Hybrid Materials<br>4) Materials Processing |
| MIYASHITA, Yukio | Materials<br>Mechanics of materials | 1) Strength and fatigue of advanced materials<br>2) Joining process and strength of dissimilar materials joint<br>3) Fatigue of magnesium alloy<br>4) Joining of magnesium alloys<br>5) Laser welding of dissimilar materials, Laser cutting of brittle materials<br>6) Joining and material modification by using friction stir process |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| OTSUKA, Yuichi | Material<br>Mechanics of materials | 1) Strength and Fatigue of Engineering Materials<br>2) Reliability of Strength of Materials<br>3) Failure Analysis<br>4) Biomaterials<br>5) Strength in Corrosive Environment<br>6) Safety Design |
| NAKATA, Taiki | Structural materials<br>Material processing | 1) Development of wrought magnesium alloys<br>2) Tailoring microstructure and texture of magnesium alloys<br>3) Electron backscattered diffraction<br>4) Electron microscopy<br>5) Extrusion |
| HOMMA, Tomoyuki | Nanostructural analysis<br>Light metals<br>Phase transformation<br>Strength of materials<br>Diffraction physics<br>Creep of materials | 1) Development of high strength Ti alloys<br>2) Age-hardening behavior in light metals<br>3) Microstructural characterization of Ni base superalloy |

### (2) Field of Study: Functional Materials Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| AIDA, Hideo | Engineering of optoelectronics single crystals | 1) Growth of single crystals<br>2) Precision processing of single crystals |

| | | |
|---|---|---|
| ISHIBASHI, Takayuki | Condensed matter physics | 1) Holographic 3D Display<br>2) Magnetic Thin Films<br>3) Superconducting Thin Films<br>4) Magneto-optical Effects<br>5) Magnetic Imaging |
| IMAKUBO, Tatsuro | Functional materials chemistry | 1) Supramolecular solid state chemistry<br>2) Crystal design of organic conductors<br>3) Organic superconductors<br>4) Single-crystal device<br>5) Multi-functional organic conductors |
| SAITOH, Hidetoshi *** | Thin film process<br>Sensor materials<br>Optical functional materials<br>Carbon material | 1) Ceramic nanoarchitecture<br>2) Material design for CVD-film<br>3) Material design for carbon film |
| TANAKA, Satoshi | Science of inorganic materials | 1) Powder Processing of Ceramics<br>2) Design of Particle Packing of Powder Compact<br>3) Development of Novel Forming Method of Ceramics<br>4) Microstructure and Mechanical Property of Ceramics<br>5) Microstructure and Functional Property of Ceramics |
| MAEKAWA, Hirofumi | Synthetic chemistry<br>Organic chemistry | 1) Synthetic Organic Chemistry<br>2) Organic Electron Transfer Chemistry<br>3) Organic Electrochemistry |
| MATSUBARA, Hiroshi *** | Applied electrochemistry | 1) Electroless and electroplating<br>2) Nano-composite plating<br>3) Initial deposition process of electroless plating |

## ASSOCIATE PROFESSORS

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| OKAMOTO, Tomoichiro | Functional materials<br>Devices | 1) Electroceramics<br>2) Nano-carbons<br>3) Electronic devices<br>4) Optical devices<br>5) Sensors |
| KIMURA, Noritaka | Polymer/textile materials | 1) Structure and Properties of Cellulosic Derivatives and Mushroom Polysaccharides<br>2) Computer Simulation of Polysaccharides<br>3) Photobleaching of Japanese Paper |
| TAKAHASHI, Yukiko | Dye nanoparticles<br>Functional thin films<br>Sensors | 1) Dye nanoparticle coated test strips for ultra trace harmful ions<br>2) Photosensitizer dye nanoparticle coated membrane for generation of reactive oxygen species<br>3) Development of a massive and versatile production of organic dye nanoparticles |
| NISHIKAWA, Masami | Inorganic materials chemistry | 1) Thin film processes<br>2) Functional thin films<br>3) Photoelectrode, Photocatalysts |
| BABA, Masaaki | Functional Materials Engineering | 1) Development of Functional Materials for Thermal Management<br>2) Development of Materials and Systems for Energy Harvesting<br>3) Development of Functional Thin Films for Energy Management |
| FUNATSU, Asami | Surface chemistry<br>Interface chemistry | 1) Nanosheet<br>2) Surface analysis<br>3) Inorganic material chemistry |

### (3) Field of Study: Intelligent Devices Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| ONO, Hiroshi *** | Applied optics<br>Quantum optical Engineering | 1) Polarization holography (Three-dimensional vector hologram)<br>2) Highly-functionalized grating devices<br>3) Liquid crystals for photonics<br>4) Highly-functionalized optical films for polarization control |
| KIMURA, Munehiro | Electronic device<br>Electronic equipment | 1) Liquid Crystal Display Device<br>2) Physics of interfacial surface<br>3) Measurement method of surface anchoring energy of LCD<br>4) Ellipsometry |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| SAKAMOTO, Moritsugu | Applied optics<br>Singular optics<br>Polarization optics | 1) Optical vortex<br>2) Polarization vortex<br>3) Liquid crystal |
| SASAKI, Tomoyuki | Applied Optics<br>Terahertz Engineering | 1) Liquid Crystal<br>2) Control of Terahertz Waves<br>3) Vector holography |
| SHOJI, Kan | NanoBio Engineering<br>Microfluidics<br>Scanning Probe Microscopy (SPM)<br>Biohybrid Robotics | 1) Nanopore sensing with biological and DNA nanopores<br>2) Development of microchannel-based nanopore sensing platforms<br>3) Development of biological-inspired SPM<br>4) Insect biofuel cell driven micro wireless sensors |
| TAMAYAMA, Yasuhiro | Electromagnetic optics<br>Nonlinear optics | 1) Design and analysis of metamaterials<br>2) Controlling electromagnetic waves<br>3) Enhancement of local electromagnetic fields |
| MIZOSHIRI, Mizue | Optical material processing, laser microprocessing, micro/nano processing, microdevice, sensor | 1) 3D microfabrication by ultrafast laser processing<br>2) Thin-film thermoelectric generators by microfabrication process<br>3) Imaging of magnetic domains using optical devices |
| YAMASHITA, Tomoki | Condensed Matter Physics<br>Materials informatics | 1) Crystal structure prediction<br>2) Band calculation<br>3) Rechargeable battery |

## 4. Civil Engineering and Bioengineering

1. Advancements in science and technology have enabled humans to build an advanced civilization through industrial development. However, the cost of continued development focused on human convenience has been a major threat to social safety and environmental sustainability. Problems have arisen in terms of harmony between nature and human society, such as the occurrence of increasingly serious natural disasters, the deterioration of living environments and sanitary functions in the growing urban areas, and the destruction of the environment and loss of biodiversity on a global level. It is necessary to solve these problems and realize the construction of a sustainable society. Thus, social demand is increasing more than ever, such as the development and maintenance of social infrastructures, the establishment of advanced disaster prevention and mitigation technologies, energy conservation, and resource recycling technologies.

2. In order to solve the above-mentioned problems facing our society, we conduct research and education in the three fields, (i) Civil Infrastructure and Disaster Resilience System Engineering, (ii) Environmental Management Engineering, and (iii) Environmental and Biological Engineering. These fields, concerning the planning and maintenance of sustainable social infrastructure systems equipped with advanced disaster prevention and mitigation technologies, the development and operation of environmental technologies according to situations, and the development of technologies to utilize the functions of organisms and biological molecules to improve social life, including environmental preservation, medicine, and welfare.

### (1) Civil Infrastructure and Disaster Resilience System Engineering

It is important to properly plan, design, construct, and maintain social infrastructure facilities in order to enable us to live a cultured and humane life in an environment that is changing globally every day, such as global warming. The objective of the field of Civil Infrastructure and Disaster Resilience System Engineering is to build a better society and construct robust and sustainable civil infrastructural systems that are safe and secure against all kinds of disasters. For this purpose, the scope covers a wide range of topics, such as identifying and developing the characteristics of various materials used in social infrastructure, constructing simulation technology, upgrading disaster prevention systems by monitoring with information technologies, and predicting the future using big data and artificial intelligence. Practical and creative research will be carried out to construct next-generation social infrastructures in harmony with the environment.

### (2) Environmental Management Engineering

To realize a sustainable society in this age of highly advanced human activity, it is necessary to understand the global material cycle and to plan and implement projects from a comprehensive perspective that considers both the nature and the social environment. In the field of Environmental Management Engineering, we aim to develop the social systems that are adapted to the local climate. For this purpose, we will elucidate natural disasters, develop disaster prevention measures, and define the proper role of social facilities by

conducting a wide range of research, such as elucidating natural phenomena, the development of appropriate processing technologies, and simulation by modeling, in the field from the global water cycle to the regional circulation of resources and energy.

**(3) Environmental and Biological Engineering**

Biotechnology is expected to contribute to a sustainable society in various fields such as environmental preservation, energy production, medicine, and food production. The objective of the field of Environmental and Biological Engineering is to develop technologies to improve human life and the global environment by effectively utilizing the functions of living organisms and bio-derived molecules. Our field conducts a wide range of basic and applied research related to industrial waste removal, biomass utilization, environmental assessment and preservation, genome breeding, and the development of medical devices.

**University Staff and Fields of Research**

**(1) Field of Study: Civil Infrastructure and Disaster Resilience System Engineering**

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| IKEDA, Takaaki | Geotechnical and earthquake engineering<br>Strong ground motion seismology<br>Disaster mitigation | 1) Strong ground motion prediction<br>2) Source modeling<br>3) Nonlinear site effect<br>4) Seismic design |
| IWASAKI, Eiji *** | Structural engineering<br>Earthquake engineering<br>Maintenance management engineering | 1) Development of numerical methods of structural analysis<br>2) Optimal design and performance of shell structures and bridges<br>3) Design method of cable-stayed bridges<br>4) Performance of steel structures for corrosion by airborne salts |
| KAMIMURA, Seiji | Energy engineering<br>Natural disaster science<br>Thermal engineering | 1) Freezing process by radiation cooling<br>2) Snow storage for space cooling<br>3) Damage anticipation of earthquake and snow-hazards coupling<br>4) Thermal design of road snow-melting system |
| SANO, Kazushi *** | Transportation Planning<br>Traffic Engineering | 1) Public Transportation System<br>2) Micro Traffic Simulation<br>3) Urban Supply Chain Management |
| SHIMOMURA, Takumi | Civil engineering materials<br>Structural engineering<br>Maintenance management engineering | 1) Transport phenomena in concrete<br>2) Creep and shrinkage of concrete<br>3) Corrosion of reinforcement in concrete<br>4) Intervention of concrete structures |
| TAKAHASHI, Osamu *** | Civil engineering materials<br>Construction<br>Construction management | 1) Mix Design of Hot Mix Asphalt Mixtures<br>2) Mechanical Characterization of Asphalt Concrete |
| TOYOTA, Hirofumi | Geotechnical engineering | 1) Dynamic properties of soils<br>2) Mechanical properties of unsaturated soils<br>3) Slope stability during rainfall and earthquakes |
| HOSOYAMADA, Tokuzo ***d | Hydraulics<br>Coastal and Ocean engineering<br>Fluid mechanics | 1) Numerical simulation of flows in river and coastal waves<br>2) Sediment transport due to waves and currents in river and coastal area<br>3) Flood and avalanche<br>4) Fluid forces on structures |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| INUKAI, Naoyuki | Hydraulics<br>Coastal engineering<br>Fluid mechanics<br>Water rescue and survival research | 1) Investigate cause of water accident for water rescue and survival by fluid mechanics process.<br>2) Field survey and simulation about nearshore wave and current.<br>3) Analysis tsunami dynamics.<br>4) Analysis Mekong river dynamics. |
| NAKAMURA, Fuminori | Maintenance management engineering<br>Coastal engineering | 1) Durability of concrete structures<br>2) Numerical simulation of coastal waves and winds |
| HAYASHI, Gen | Steel structural engineering<br>Composite engineering<br>Maintenance management engineering<br>Vibration engineering | 1） Mechanical characterization of FRP composites and their application to civil structures<br>2） Elucidation and rationalization of the mechanical behavior of joint structures<br>3） Vibration-based structural health monitoring<br>4） Development of repair, reinforcement, and maintenance strategies for corroded steel bridges |
| MATSUKAWA, Toshiya | Urban planning | 1) Land Use Planning System<br>2) Town Planning in Local City<br>3) Master Plan<br>4) Zoning<br>5) Area Division |

**LECTURER**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KATO, Teppei | Transportation Planning<br>Traffic Engineering | 1) Transportation Network Analysis<br>2) Cost Benefit Analysis<br>3) Traffic Flow Theory |

## (2) Field of Study: Environmental Management Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KOMATSU, Toshiya *** | Environmental engineering | 1) Solid and hazardous waste management<br>2) Biomass utilization technology<br>3) Environmental bioassay evaluation |
| HIMENO, Shuji | Civil and environmental engineering | 1) Solid Waste Management<br>2) Sewerage Treatment<br>3) Chemical Engineering<br>4) Separation Engineering |
| YAMAGUCHI, Takashi | Civil and environmental Engineering<br>Environmental technology,<br>Environmental materials | 1) Environmental Protection Engineering<br>2) Environmental Microbiology<br>3) Environmental Biotechnology<br>4) Water and Wastewater Engineering<br>5) Solid Wastes Technology |
| LU, Minjiao * | Hydrology<br>Hydraulic engineering<br>Natural disaster science | 1) Hydrology<br>2) Hydrometeorology<br>3) Water Resources<br>4) Snow Engineering<br>5) GIS and remote sensing |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| KUMAKURA, Toshiro | Meteorology<br>Natural disaster science | 1) Snow science<br>2) Model simulations on atmosphere and snow pack<br>3) Storm and snow disaster analysis<br>4) Development of meteorological and snow observation technique |
| TAKAHASHI, Kazuyoshi | Remote Sensing Engineering and GIS<br>Agricultural Information Engineering | 1) Airborne LiDAR measurement<br>2) Crop Growth monitoring and estimation |
| HATAMOTO, Masashi | Civil and environmental engineering<br>Environmental biotechnology | 1) Waste water treatment<br>2) Microbial community analysis<br>3) Environmental microbiology<br>4) Isolation and detection of microorganisms |
| MAKI, Shinya | Environmental biotechnology | 1) Preservation technology of plant genetic resources<br>2) Food engineering<br>3) Horticulture technology<br>4) Water and Soil environmental technology |
| WATARI, Takahiro | Environmental Engineering | 1) Biological wastewater treatment |

## (3) Field of Study: Environmental and Biological Engineering

**PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| OGASAWARA, Wataru | Biorefinery<br>Development of filamentous fungi<br>Cellulosic Biomass<br>Microbial genome analysis<br>Cellulose and Protease | 1) Biorefinery<br>2) Biomass<br>3) Fungi<br>4) Bio-ethanol<br>5) Cellulose |
| TAKAHASHI, Shouji | Applied Biochemistry<br>Applied Microbiology | 1)Development of enzymatic screening methods for valuable microorganisms<br>2)Creation of valuable enzymes by protein engineering<br>3)Creation of valuable microorganisms by |
| TAKIMOTO, Koichi * | Molecular physiology<br>Cell biology | 1) EAG2 channel and cancer cell growth<br>2) Novel drugs affecting K+ channel inactivation<br>3) Plant-derived chemicals influencing adipogenesis |
| MASAI, Eiji | Applied Microbiology | 1) Bacterial catabolism of aromatic compounds, including lignin-derived compounds<br>2) Microbial technology for woody biomass (lignin) utilization |

**ASSOCIATE PROFESSORS**

| NAME | RESEARCH FIELD | RESEARCH TOPICS |
|---|---|---|
| OHNUMA, Kiyoshi | Tissue engineering<br>Regenerative medicine | 1) Human induced pluripotent stem cells (iPSCs)<br>2) Microfabrication, Microfluidic<br>3) Development and differentiation |
| KASAI, Daisuke | Applied Microbiology | 1) Biodegradation of environmental pollutants<br>2) Microbial degradation of rubber |

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|---|---|---|
| KAMIMURA, Naofumi | Applied Microbiology | 1) Bacterial catabolism of aromatic compounds, including lignin-derived compounds<br>2) Microbial technology for woody biomass (lignin) utilization<br>3) Bacterial sensor for the detection of lignin biodegradation |
| KUWAHARA, Takashi | Bioelectrochemistry | 1) Hybridization of synthetic polymers and bio-related substances<br>2) Modification of solid surface with bio-related substances (Application to biosensors and biofuel cells) |
| SATO, Takeshi | Glycobiology<br>Molecular Biology<br>Functional Biochemistry | 1) Development of effective system for suppression of malignant properties of cancer cells by manipulation of transcription factors<br>2) Elucidation of transcriptional mechanisms of glycogens<br>3) Study on effects of anti-cancer drugs on glycan structures |
| SHIDA, Yosuke | Applied microbiology<br>Gene regulation of fungi<br>Utilization of cellulosic biomass | 1) Gene regulation mechanism of filamentous fungi<br>2) Lipids and carotenoids production by oleaginous yeast<br>3) Conversion of cellulosic biomass into value added materials |
| SHIMODA, Yasushi | Neuroscience<br>Biochemistry | 1) Cell adhesion molecules in the regulation of neural function<br>2) Mechanism of psychiatric and developmental disorders<br>3) Regulation of neural function by protein engineering |
| TAKAHARA, Yoshinori | Breeding science | 1) Plant Biotechnology<br>2) Molecular Marker Assisted Selection<br>3) Genetic Transformation<br>4) Evolution |
| NISHIMURA, Taisuke | Plant molecular genetics | 1) Plant genetic engineering<br>2) Genomics<br>3) Epigenetics<br>4) Reprogramming |
| FUJIWARA, Ikuko | Actin polymerization and depolymerization dynamics<br>Regulatory mechanism for cytoskeleton<br>Molecular mechanism of cell motility | 1) Total Internal Reflection Fluorescence Microscope<br>2) Individual actin filaments polymerization and depolymerization<br>3) Real time observation of protein binding and dissociation related with cytoskeleton and cell motility |
| YAMAMOTO, Maki | Wild life Management<br>Bio-logging<br>Conservative Biology<br>Ecology | 1) Field Study for Wild Animals Using Bio-logging technique<br>2) GIS Analysis for Wildlife Management |

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