



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  
2023

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About the staff will be retired within three years

Note: In the "Name" column, \* indicates the staff who will be retired on March 31, 2023.

Note: In the "Name" column, \*\* indicates the staff who will be retired on March 31, 2024.

Note: In the "Name" column, \*\*\* indicates the staff who will be retired on March 31, 2025.

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

## **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.

## **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.

The Doctoral Program, on the other hand, has been organized by scrapping the undergraduate-to-master's programs and rebuilding them 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 Electron device Plasma science	1) Compact pulsed power generator 2) High power microwave generation 3) High energy-density science 4) Plasma Applications
SUEMATSU, Hisayuki	Inorganic materials Physical properties	1) Development of material preparation methods utilizing extreme conditions 2) Synthesis of novel superconductive, magnetic and other novel materials
SUZUKI, Tatsuya	Nuclear Chemistry Radiochemistry	1) Nuclide Separation & Partitioning 2) Isotope Effect / Isotope Separation 3) Plasma Chemistry 4) Nuclear Reprocessing Engineering 5) Nuclear Fuel Cycle Engineering
TAKAHASHI, Tsutomu	Fluids engineering	1) Rheo-optic behavior of complex fluids 2) Elongation flow behavior of complex fluids 3) Flow of surfactant solutions, cosmetics and slurries 4) Control and effective utilization of Flow-induced vibration 5) Energy harvesting from wind and river flow
LI, Zhidong	System design for low-carbon society Energy and environmental policy	1) Low-carbon System 2) Energy Economics 3) Environmental Economics 4) Econometrics

#### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
OHTA, Tomoko	Environmental radioactivity	1) Environmental radioactivity 2) Groundwater dating 3) Forestry Hydrology 4) Backend
KATSUMI, Toshiyuki	Combustion Engineering Aerospace Engineering	1) Combustion energy 2) Combustion safety 3) Rocket propellant combustion
SUZUKI, Masataro	Thermal engineering Fluid engineering	1) Fire Safety Engineering 2) Combustion 3) Reactive-Fluid Dynamics 4) Thermophoresis
Takezawa, Hiroki	Nuclear System Engineering	1) Integrated numerical analysis of nuclear systems 2) Monte Carlo particle transport calculation 3) Small and micro reactors design 4) Criticality safety analysis 5) Nuclear batteries design
YAMAZAKI, Wataru	Computational Fluid Dynamics Aerospace Engineering	1) Aerodynamic Design 2) Optimization Algorithms 3) Airfoil and Wing 4) Fluid Machinery
SATO, Daisuke	Thermal Engineering Safety Engineering Energy Engineering	1) Heat transfer 2) Combustion 3) Safety/Reliability design 4) Renewable energy conversion (solar, hydrogen, hydrocarbon) 5) Energy conversion device

**SPECIALLY APPOINTED ASSOCIATE PROFESSOR FOR ACADEMIA-INDUSTRY FUSION**

NAME	RESEARCH FIELD	RESEARCH TOPICS
FUJISAWA, Kei	Mechanical and Information Engineering	1) Industrial IoT 2) Automation 3) Numerical simulation

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

**PROFESSORS**

NAME	RESEARCH FIELD	RESEARCH TOPICS
MIURA, Yushi	Power Engineering Power System Engineering Power Electronics	1) Distributed Generations 2) Smart Grid 3) Microgrid 4) Applications of Power Electronics in Power System
MIYAZAKI, Toshimasa	Dynamics Control	1) Motion Control 2) Mechatronics 3) Robotics
YAMADA, Noboru	Energy Engineering Thermal Engineering Optics and Photonics	1) Solar energy (photovoltaics and solar thermal applications) 2) Power generation from low-grade heat sources 3) Energy storage (mechanical battery, etc.) 4) Heat transfer
OHISHI, Kiyoshi *	Motion Control/ Power Electronics/ Robotics	1) Motion Control of Robotics and Mechanical System 2) Power Electronics 3) Motor Drive System 4) Vibration Suppression Control of Motor and Gear System
ITOH, Jun-ichi	Power electronics Power conversion Motor drive system	1) Development of simple, high efficiency and high performance power converter 2) Development of AC/AC direct power converter 3) High performance and simple Motor control
KADOWAKI, Satoshi **	Thermal engineering Safety engineering	1) Combustion 2) System Safety 3) Fire & Explosion 4) Risk Assessment

**ASSOCIATE PROFESSORS**

NAME	RESEARCH FIELD	RESEARCH TOPICS
KOBAYASHI, Yasuhide	Control engineering Dynamics Control	1) Robust active noise control of ducts 2) Disturbance attenuation control on water surface 3) Robust speed control of rotary systems
SASAKI, Toru	High Energy Density Physics Thermonuclear Fusion	1) High Energy Density Physics 2) Pulsed Power Generation 3) Thermonuclear Fusion 4) Plasma Science and Applications
HAGA, Hitoshi	Power Electronics	1) Power Electronics 2) Motor drive 3) Applications of Power Electronics in Power System
YOKOKURA, Yuki	Motion Control Motor Drive Robotics	1) Motion Control of Robotics and Mechanical System 2) High Performance Motor Drive 3) Vibration Suppression Control of Geared Motor System

KIKUCHI, Takashi	Nuclear fusion science	1) Beam Physics and Engineering 2) Nuclear Fusion 3) Computational Science 4) Plasma Science
HIDAKA, Yuki	Motor, Motor drive Numerical simulation AI/AR applications	1) Development of high power, torque, efficiency motor 2) Advanced numerical simulation for motor designing using shape optimization, electrical circuit, mathematical model 3) Advanced motor design using AI/AR techniques

### **SPECIALLY APPOINTED ASSOCIATE PROFESSOR FOR ACADEMIA-INDUSTRY FUSION**

NAME	RESEARCH FIELD	RESEARCH TOPICS
KUSAKA, Keisuke	Power Electronics	1) Power converters 2) Wireless power transfer 3) Energy conversion

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

#### **PROFESSORS**

NAME	RESEARCH FIELD	RESEARCH TOPICS
TAKEDA, Masatoshi	Functional materials	1) Energy conversion materials 2) Energy conversion, system 3) Electronic properties of Boron-rich semiconductors

#### **ASSOCIATE PROFESSORS**

NAME	RESEARCH FIELD	RESEARCH TOPICS
SAITO, Nobuo	Functional materials chemistry Inorganic chemistry	1) Energy Conversion Materials 2) Functional Photocatalysts for Water Splitting 3) Removal of Heavy Metals Ion by Photocatalysis
HONMA, Tsuyoshi	Functional glass materials	1) Sodium Ion Batteries 2) Lithium Ion Batteries 3) Ionic Conductive Materials 4) Crystallization Mechanism of Glass Materials
TAGAYA, Motohiro	Biomaterials Engineering	1) Nano-Bio Materials 2) Biomaterials Engineering 3) Bioceramics 4) Mesoporous Materials 5) Calcium Phosphate Compounds
SHIRONITA, Sayoko	Metal Surface Science	1) Chemistry Polymer Electrolyte Fuel Cell Materials 2) Safety of Secondary Battery Nano-sized Metal
SUZUKI, Tsuneo	Accelerator applications, novel material design	1) Chemical analysis by electrostatic accelerator 2) Light ion implantation 3) Novel material design and synthesis of new material

## **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
ITO, Yoshihiro	Business Management	1) Strategic management 2) Business model 3) Marketing
KIMURA, Tetsuya	System Safety	1) Service robots safety 2) Standardization and utilization of disaster response robots 3) Risk assessment of a mobile robot
TSUBONE, Tadashi	Bio-system engineering	1) Nonlinear System Design 2) Nonlinear System Analysis
NOMURA, Shusaku	Ambient Biomedical Engineering Ambient Feedback Systems KANSEI Physiology 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 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 2) Knowledge creation support 3) Educational technologies 4) Data mining and its applications
YAMAGATA, Hiroshi	System Safety Engineering	1) Management, Organization, Culture for Safety 2) Safety Regulatory Policy 3) External Hazard
YUKAWA, Takashi	Intelligent Informatics	1) Knowledge Processing 2) Information Retrieval 3) Text Processing 4) e-Learning 5) Parallel Computing
WATAHIKI, Nobumichi	Business administration Sociology	1) Industry-Academia collaboration 2) Industrial Cluster 3) Startup management

#### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
AKIMOTO, Yoritaka	Cognitive Psychology, Cognitive Neuroscience	1) Neuroimaging 2) Language Comprehension 3) Social Cognition
OHASHI, Satoshi	Welfare Engineering and Assistive Technology	1) Biological signal processing 2) Sensing data analysis 3) Location information analysis 4) Image processing

KURAHASHI, Takahiko	Computational Mechanics	1) Numerical determination of optimal shape 2) State estimation based on filtering theory 3) Identification of material properties
SHIRAKAWA, Tomohiro	Intelligent Informatics, Life/Health/Medical Informatics, Biophysics	1) Artificial Intelligence 2) Machine Learning 3) Data Science, Bio-computing
SUZUKI, Nobutaka	Business administration	1) Strategic Management 2) Technology Management 3) Manufacturing Management
NAKAHIRA, Katsuko, T.	Perceptual Informatics	1) Service Informatics 2) Perceptual Informatics 3) Learning Support
NAMBU, Isao	Neural Engineering Biosignal Processing	1) Neuroimaging 2) Brain-Machine/Computer Interfaces 3) Body-Machine Interfaces
NISHIYAMA, Yuta	Theory of Life Internal Measurement Animal Behavior Embodied Cognition Complex Systems Performance Art	1) Swarm: Understand a wholeness of natural collective behavior and develop brand new swarm-inspired systems. 2) Bodily Self-Consciousness: Investigate indefiniteness of self-body and change it. 3) Performance Art: Express your life.
HOJO, Rieko	Behavior-based safety	1) Occupational safety 2) Behavior Analysis 3) Experimental Psychology 4) Behavior-based safety

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

### PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
IWAHASHI, Masahiro	Communication Network engineering	1) Signal processing 2) Multimedia 3) Information theory 4) Digital circuits and systems
YENDO, Tomohiro	Human interface Media informatics	1) 3D image display, AR display 2) Camera application system for human interface 3) Visible light communication
NAKAGAWA, Masahiro *	Sensibility informatics Soft computing	1) Chaos& Fractals Informatics 2) Brain Function Measurements 3) Brain Affective Interface 4) Sensibility Informatics and Technology 5) Chaos Neuro-Computing 6) Fractal Image Coding 7) Chaos and Fractal Bioassay
HARA, Shin-ichiro	Geometry / Topology	1) Algebraic Topology 2) Lie Groups

### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
SUGITA, Yasunori	Communication Network engineering	1) Filter Design and Analysis 2) Image Processing 3) Acoustic Signal Processing
ZHANG, Kun	Knowledge and Information Engineering	1) Safety data management 2) Injury information description framework 3) Market surveillance system for products 4) Products accident ontology 5) Utilization of safety big data

MANADA, Akiko	Fundamentals for Computer Science	1) Characteristics on data sequences 2) Coding for data storage media 3) Analysis on network topologies 4) Graph theory and its applications
YAMAMOTO, Kenichiro	Ergodic Theory Dynamical System	1) Large deviation principle 2) Equilibrium states
WATABE, Kohei	Communication Networks	1) Accurate Measurement 2) Network Modeling 3) Network Simulation 4) Internet of Things

### (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 2) Applied Optics 3) Nanometer measurement and control 4) Scanning Probe Microscope 5) Nanotechnology
ABE, Masajiro	Dynamics Design engineering System Safety	1) Machine Dynamics 2) Safety Design Engineering 3) Dynamics of Machinery-Environment System 4) Construction Machinery Engineering 5) Materials Handling Machinery Engineering
ISOBE, Hiromi	Production engineering Mechanism Machining	1) Vibration Aided Machining 2) Non-contact Handling for Board
OHTA, Hiroyuki	Design engineering Machine functional elements Tribology	1) Sound and vibration of rolling bearings 2) Dynamics of linear ball bearings 3) Transmission errors of trochoidal gears
KATO, Ariyuki	Optical properties of condensed matter and applications	Crystal growth of functional optoelectronic materials and its applications for optoelectronic devices
TANAKA, Kunihiko	Optical properties of semiconductors and applications	1) Solar cell 2) Growth of semiconductor thin films 3) Spectroscopy of semiconductors
MIYOSHI, Takanori	Safety engineering Control engineering Robot engineering	1) Machinery safety engineering 2) Tele-control 3) System safety 4) Man-machine interface 5) Risk assessment 6) Power-assistive control 7) Vibration control

## ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
WEI, Dong	Information and control engineering for Mechanical systems	1) Precision Engineering 2) Applied Optics 3) Nanometer measurement and control 4) 3D measurement 5) Machine learning 6) Signal processing 7) Non-linear processing
UNUMA, Takeya	Quantum semiconductor electronics	1) Nanostructured semiconductors for optoelectronics 2) Organic semiconductors for flexible electronics 3) Terahertz spectroscopy with a femtosecond laser

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

#### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
OTSUKA, Yuichi	Material Mechanics of materials	1) Strength and Fatigue of Engineering Materials 2) Reliability of Strength of Materials 3) Failure Analysis 4) Biomaterials 5) Strength in Corrosive Environment 6) Safety Design
HOMMA, Tomoyuki	Nanostructural analysis Light metals Phase transformation Strength of materials Diffraction physics Creep of materials	1) Development of high strength Ti alloys 2) Age-hardening behavior in light metals 3) Microstructural characterization of Ni base superalloy

#### SPECIALLY APPOINTED ASSOCIATE PROFESSOR FOR ACADEMIA-INDUSTRY FUSION

NAME	RESEARCH FIELD	RESEARCH TOPICS
NAKATA, Taiki	Structural materials Material processing	1) Development of wrought magnesium alloys 2) Tailoring microstructure and texture of magnesium alloys 3) Electron backscattered diffraction 4) Electron microscopy 5) Extrusion

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

### PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
ISHIBASHI, Takayuki	Condensed matter physics	1) Holographic 3D Display 2) Magnetic Thin Films 3) Superconducting Thin Films 4) Magneto-optical Effects 5) Magnetic Imaging
IMAKUBO, Tatsuro	Functional materials chemistry	1) Supramolecular solid state chemistry 2) Crystal design of organic conductors 3) Organic superconductors 4) Single-crystal device 5) Multi-functional organic conductors
KOBAYASHI, Takaomi **	Applied chemistry Polymer chemistry Functional materials Sonoprocesses Environmental chemistry Materials chemistry Biopolymer materials	1) Functional polymers with molecule recognition and separation 2) Sonoprocesses in Polymer Science 3) Intelligent materials 4) Applied Membrane Science 5) Biofunctional materials
SAITOH, Hidetoshi	Thin film process Sensor materials Optical functional materials Carbon material	1) Ceramic nanoarchitecture 2) Material design for CVD-film 3) Material design for carbon film
TAKENAKA, Katsuhiko ***	Polymer chemistry Polymer Textile materials	1) Synthesis and polymerization of 1,3-dienes containing functional groups 2) Synthesis of organic - inorganic hybrid polydiene-based materials
MAEKAWA, Hirofumi	Synthetic chemistry Organic chemistry	1) Synthetic Organic Chemistry 2) Organic Electron Transfer Chemistry 3) Organic Electrochemistry
MATSUBARA, Hiroshi	Applied electrochemistry	1) Electroless and electroplating 2) Nano-composite plating 3) Initial deposition process of electroless plating

### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
AIDA, Hideo	Engineering of optoelectronics single crystals	1) Growth of single crystals 2) Precision processing of single crystals
ITO, Haruhiko **	Physical chemistry Plasma chemistry Molecular spectroscopy	1) Studies on the electronic structure of the diatomic free radicals 2) Analysis of the plasma processes to synthesize amorphous carbon and related materials 3) Fabrication of super-hard carbon-related films in amorphous phase
UCHIDA, Nozomu **	Computational Chemistry Thermochemistry	1) Computational study on the characteristics of natural rubber 2) Computational study on the mechanism of CO <sub>2</sub> reduction with Pt catalyst 3) Computational study on the H <sub>2</sub> storage characteristics of graphite
OKAMOTO, Tomoichiro	Functional materials Devices	1) Electroceramics 2) Nano-carbons 3) Electronic devices 4) Optical devices 5) Sensors

KIMURA, Noritaka	Polymer/textile materials	1) Structure and Properties of Cellulosic Derivatives and Mushroom Polysaccharides 2) Computer Simulation of Polysaccharides 3) Photobleaching of Japanese Paper
TAKAHASHI, Yukiko	Dye nanoparticles Functional thin films Sensors	1) Dye nanoparticle coated test strips for ultra trace harmful ions 2) Photosensitizer dye nanoparticle coated membrane for generation of reactive oxygen species 3) Development of a massive and versatile production of organic dye nanoparticles
TANAKA, Satoshi	Science of inorganic materials	1) Powder Processing of Ceramics 2) Design of Particle Packing of Powder Compact 3) Development of Novel Forming Method of Ceramics 4) Microstructure and Mechanical Property of Ceramics 5) Microstructure and Functional Property of Ceramics
NISHIKAWA, Masami	Inorganic materials chemistry	1) Thin film processes 2) Functional thin films 3) Photoelectrode, Photocatalysts
FUNATSU, Asami	Surface chemistry Interface chemistry	1) Nanosheet 2) Surface analysis 3) Inorganic material chemistry

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

#### PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
IHARA, Ikuo ***	Materials Evaluations Nondestructive Sensing Mechanics of materials Measurement Engineering	1) Nondestructive Materials Evaluation 2) Ultrasonic Sensing 3) Industrial Processes Monitoring 4) Thin films and Coatings Characterizations 5) Nano-indentation Testing
ONO, Hiroshi	Applied optics Quantum optical Engineering	1) Polarization holography (Three-dimensional vector hologram) 2) Highly-functionalized grating devices 3) Liquid crystals for photonics 4) Highly-functionalized optical films for polarization control
KIMURA, Munehiro	Electronic device Electronic equipment	1) Liquid Crystal Display Device 2) Physics of interfacial surface 3) Measurement method of surface anchoring energy of LCD 4) Ellipsometry

#### ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
SAKAMOTO, Moritsugu	Applied optics Singular optics Polarization optics	1) Optical vortex 2) Polarization vortex 3) Liquid crystal
SASAKI, Tomoyuki	Applied Optics Terahertz Engineering	1) Liquid Crystal 2) Control of Terahertz Waves 3) Vector holography



SHOJI, Kan	NanoBio Engineering Microfluidics Scanning Probe Microscopy (SPM) Biohybrid Robotics	1) Nanopore sensing with biological and DNA nanopores 2) Development of microchannel-based nanopore sensing platforms 3) Development of biological-inspired SPM 4) Insect biofuel cell driven micro wireless sensors
TAMAYAMA, Yasuhiro	Electromagnetic optics Nonlinear optics	1) Design and analysis of metamaterials 2) Controlling electromagnetic waves 3) Enhancement of local electromagnetic fields
HARA, Keisuke	Production Engineering Machining	1) Precision Engineering 2) Cutting Technology / Abrasive Machining 3) Ultrasonic Aided Machining
MIZOSHIRI, Mizue	Optical material processing, laser microprocessing, micro/nano processing, microdevice, sensor	1) 3D microfabrication by ultrafast laser processing 2) Thin-film thermoelectric generators by microfabrication process 3) Imaging of magnetic domains using optical devices

### **SPECIALLY APPOINTED ASSOCIATE PROFESSOR FOR ACADEMIA-INDUSTRY FUSION**

NAME	RESEARCH FIELD	RESEARCH TOPICS
YAMASHITA, Tomoki	Condensed Matter Physics Materials informatics	1) Crystal structure prediction 2) Band calculation 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 Strong ground motion seismology Disaster mitigation	1) Strong ground motion prediction 2) Source modeling 3) Nonlinear site effect 4) Seismic design
IWASAKI, Eiji	Structural engineering Earthquake engineering Maintenance management engineering	1) Development of numerical methods of structural analysis 2) Optimal design and performance of shell structures and bridges 3) Design method of cable-stayed bridges 4) Performance of steel structures for corrosion by airborne salts
OHTSUKA, Satoru ***	Geotechnical Engineering Natural Disaster Prevention Engineering	1) Ground improvement technique against soil liquefaction 2) Soil water coupling stability analysis of earth structures 3) Stability evaluation of cut slope, landslide and artificial fill 4) Hazard maps for natural disasters by Geographic information system
KAMIMURA, Seiji	Energy engineering Natural disaster science Thermal engineering	1) Freezing process by radiation cooling 2) Snow storage for space cooling 3) Damage anticipation of earthquake and snow-hazards coupling 4) Thermal design of road snow-melting system
SANO, Kazushi	Transportation Planning Traffic Engineering	1) Public Transportation System 2) Micro Traffic Simulation 3) Urban Supply Chain Management
SHIMOMURA, Takumi	Civil engineering materials Structural engineering Maintenance management engineering	1) Transport phenomena in concrete 2) Creep and shrinkage of concrete 3) Corrosion of reinforcement in concrete 4) Intervention of concrete structures
TAKAHASHI, Osamu	Civil engineering materials Construction Construction management	1) Mix Design of Hot Mix Asphalt Mixtures 2) Mechanical Characterization of Asphalt Concrete

TOYOTA, Hirofumi	Geotechnical engineering	1) Dynamic properties of soils 2) Mechanical properties of unsaturated soils 3) Slope stability during rainfall and earthquakes
HOSOYAMADA, Tokuzo	Hydraulics Coastal and Ocean engineering Fluid mechanics	1) Numerical simulation of flows in river and coastal waves 2) Sediment transport due to waves and currents in river and coastal area 3) Flood and avalanche 4) Fluid forces on structures

## ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
INUKAI, Naoyuki	Hydraulics Coastal engineering Fluid mechanics Water rescue and survival research	1) Investigate cause of water accident for water rescue and survival by fluid mechanics process. 2) Field survey and simulation about nearshore wave and current. 3) Analysis tsunami dynamics. 4) Analysis Mekong river dynamics.
NAKAMURA, Fuminori	Maintenance management engineering Coastal engineering	1) Durability of concrete structures 2) Numerical simulation of coastal waves and winds
FUKUMOTO, Yutaka	Geotechnical engineering	1) Computational geomechanics 2) Granular mechanics
MATSUKAWA, Toshiya	Urban planning	1) Land Use Planning System 2) Town Planning in Local City 3) Master Plan 4) Zoning 5) Area Division
MATSUDA, Yoko	Disaster management	1) Participatory disaster planning 2) Disaster resilience 3) Case study and Fieldwork
MIYASHITA, Takeshi	Maintenance management Structural engineering	1) Structural health monitoring 2) Steel structural engineering
KATO, Teppei	Transportation Planning Traffic Engineering	1) Transportation Network Analysis 2) Cost Benefit Analysis 3) Traffic Flow Theory

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

### PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
YAMAGUCHI, Takashi	Civil and environmental Engineering Environmental technology, Environmental materials	1) Environmental Protection Engineering 2) Environmental Microbiology 3) Environmental Biotechnology 4) Water and Wastewater Engineering 5) Solid Wastes Technology
LU, Minjiao	Hydrology Hydraulic engineering Natural disaster science	1) Hydrology 2) Hydrometeorology 3) Water Resources 4) Snow Engineering 5) GIS and remote sensing

## ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
KUMAKURA, Toshiro	Meteorology Natural disaster science	1) Snow science 2) Model simulations on atmosphere and snow pack 3) Storm and snow disaster analysis 4) Development of meteorological and snow observation technique
KOMATSU, Toshiya	Environmental engineering	1) Solid and hazardous waste management 2) Biomass utilization technology 3) Environmental bioassay evaluation
TAKAHASHI, Kazuyoshi	Remote Sensing Engineering and GIS Agricultural Information Engineering	1) Airborne LiDAR measurement 2) Crop Growth monitoring and estimation
HATAMOTO, Masashi	Civil and environmental engineering Environmental biotechnology	1) Waste water treatment 2) Microbial community analysis 3) Environmental microbiology 4) Isolation and detection of microorganisms
HIMENO, Shuji	Civil and environmental engineering	1) Solid Waste Management 2) Sewerage Treatment 3) Chemical Engineering 4) Separation Engineering
MAKI, Shinya	Environmental biotechnology	1) Preservation technology of plant genetic resources 2) Food engineering 3) Horticulture technology 4) Water and Soil environmental technology

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

## PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
OGASAWARA, Wataru	Biorefinery Development of filamentous fungi Cellulosic Biomass Microbial genome analysis Cellulose and Protease	1) Biorefinery 2) Biomass 3) Fungi 4) Bio-ethanol 5) Cellulose
KIDOKORO, Shun-ichi **	Molecular Biophysics Protein Physics Statistical Biothermodynamics	1) Calorimetric evaluation of protein stability and molecular function 2) New methodology for the analysis of the physical properties and function 3) Rational molecular design of biological nanomachine
SHIONOYA, Akira **	Sports science and sports engineering Dynamics / Control	1) Development of the parallel measurement system for Mechanical parameter and physiological parameter 2) Development of the floating biofeedback system for mental health 3) Development of the Anaerobic Threshold Determination System 4) Development of sport-type wheel-chair
TAKAHASHI, Shouji	Applied Biochemistry Applied Microbiology	1) Engineering and application of D-amino acid-metabolizing enzymes 2) Microbial degradation of environmental pollutants 3) Molecular breeding of biotechnologically valuable yeasts

TAKIMOTO, Koichi	Molecular physiology Cell biology	1) EAG2 channel and cancer cell growth 2) Novel drugs affecting K <sup>+</sup> channel inactivation 3) Plant-derived chemicals influencing adipogenesis
HONDA, Hajime **	Cell Motility Biomotor Devices	1) Motor Protein 2) Fluorescent Microscopy 3) Biosensor Device 4) LSI
MASAI, Eiji	Applied Microbiology	1) Bacterial catabolism of aromatic compounds, including lignin-derived compounds 2) Microbial technology for woody biomass (lignin) utilization

## ASSOCIATE PROFESSORS

NAME	RESEARCH FIELD	RESEARCH TOPICS
OHNUMA, Kiyoshi	Tissue engineering Regenerative medicine	1) Human induced pluripotent stem cells (iPSCs) 2) Microfabrication, Microfluidic 3) Development and differentiation
KASAI, Daisuke	Applied Microbiology	1) Biodegradation of environmental pollutants 2) Microbial degradation of rubber
KAMIMURA, Naofumi	Applied Microbiology	1) Bacterial catabolism of aromatic compounds, including lignin-derived compounds 2) Microbial technology for woody biomass (lignin) utilization 3) Bacterial sensor for the detection of lignin biodegradation
KUWAHARA, Takashi	Bioelectrochemistry	1) Hybridization of synthetic polymers and bio-related substances 2) Modification of solid surface with bio-related substances (Application to biosensors and biofuel cells)
SATO, Takeshi	Glycobiology Molecular Biology Functional Biochemistry	1) Development of effective system for suppression of malignant properties of cancer cells by manipulation of transcription factors 2) Elucidation of transcriptional mechanisms of glycogens 3) Study on effects of anti-cancer drugs on glycan structures
SHIDA, Yosuke	Applied microbiology Gene regulation of fungi Utilization of cellulosic biomass	1) Gene regulation mechanism of filamentous fungi 2) Lipids and carotenoids production by oleaginous yeast 3) Conversion of cellulosic biomass into value added materials
SHIMODA, Yasushi	Neuroscience Biochemistry	1) Cell adhesion molecules in the regulation of neural function 2) Mechanism of psychiatric and developmental disorders 3) Regulation of neural function by protein engineering
TAKAHARA, Yoshinori	Breeding science	1) Plant Biotechnology 2) Molecular Marker Assisted Selection 3) Genetic Transformation 4) Evolution
NISHIMURA, Taisuke	Plant molecular genetics	1) Plant genetic engineering 2) Genomics 3) Epigenetics 4) Reprogramming

FUJIWARA, Ikuko	Actin polymerization and depolymerization dynamics Regulatory mechanism for cytoskeleton Molecular mechanism of cell motility	<ol style="list-style-type: none"> <li>1) Total Internal Reflection Fluorescence Microscope</li> <li>2) Individual actin filaments polymerization and depolymerization</li> <li>3) Real time observation of protein binding and dissociation related with cytoskeleton and cell motility</li> </ol>
YAMAMOTO, Maki	Wild life Management Bio-logging Conservative Biology Ecology	<ol style="list-style-type: none"> <li>1) Field Study for Wild Animals Using Bio-logging technique</li> <li>2) GIS Analysis for Wildlife Management</li> </ol>



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