

Mechanical Systems and Urban Innovation Sciences

Department of
Intelligent Mechanical Systems

Intelligent Systems Optimization



Our laboratory aims to develop basic theories and applications of intelligent systems optimization methodologies for supply chain management, scheduling, system science, and intelligent robotics. We are conducting research on new modeling, new optimization methods, artificial intelligence methods, efficient algorithms, modeling, analysis, and diagnosis for safe and optimized operations of large-scale industrial systems.

**Prof.
NISHI Tatsushi**

■ **Research Themes**
Systems optimization
/Artificial intelligence/
Supply chain management/
Scheduling/Robotics



**Assoc. Prof.
SATO Haruo**

■ **Research Themes**
Radioactive waste
disposal/Environmental
dynamics/Radiation safety

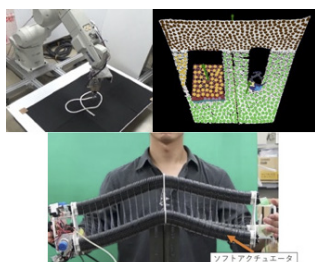


**Asst. Prof.
LIU Ziang**

■ **Research Themes**
Game theory/Decision
making/Inventory
management/Computational
intelligence/Machine learning



Intelligent Adaptive and Learning System



In our research field, our aim is to achieve robots capable of performing complex tasks, and we conduct fundamental research on advanced cognitive capabilities such as problem-solving, decision-making, and environment perception. Additionally, we strive for the social implementation of robots and engage in applied research in areas such as healthcare and rehabilitation.

Prof. MATSUNO Takayuki

■ **Research Themes**
Surgical assistive robot/Manipulator robot

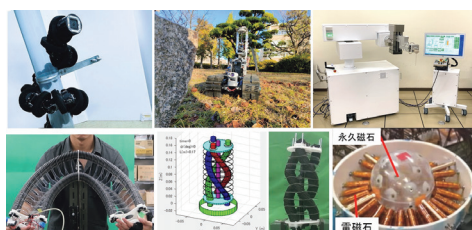


**Assoc. Prof.
TODA Yuuichirou**

■ **Research Themes**
Soft computing



Biorobotics



We research and develop robots that are highly adaptable to the environment like living organisms, robots that cooperate with humans, and robots that can be applied to humans. For example, we are researching and developing a snake-like robot that can move through various environments like a biological snake, and a rescue robot for disaster response. We are also developing a remote-controlled needle-puncturing medical robot and a rehabilitation device using soft actuators.

**Prof.
KAMEGAWA Tetsushi**

■ **Research Themes**
Robotics/Snake robots/Rescue robots/
Medical robots

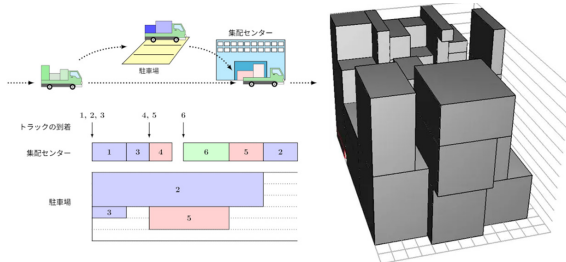


**Asst. Prof.
SHIMOOKA So**

■ **Research Themes**
Soft robotics/Mechatronics/Actuator/
Medical and welfare engineering



Production Intelligence



In the field of operations research, which is the mathematical and scientific process for better decision making for practical problems, we focus mainly on mathematical systems optimization to solve production, logistics and transportation problems. Specifically, we studies production scheduling problems in factories, stacking, premarshalling, and retrieval problems in warehouses, the three-dimensional truck loading

problem considering the retrieval order for package delivery, and so on.



**Prof.
TANAKA Shunji**

■ Research Themes

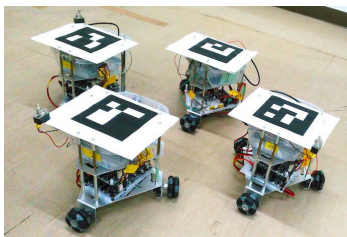
Operations research/Mathematical systems optimization/Scheduling/logistics

**Assoc. Prof.
YANAGAWA Yoshinari**

■ Research Themes

Decision Modeling/Production Management/Ergonomics

Intelligent Mechanical Control



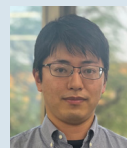
Control theory is one of the fundamental technologies supporting the current society. Its application field ranges widely from industrial apparatus to multi-agent systems. We focus on both theoretical and applied research on vast related topics including human-machine system like walking assistance device.



**Senior Asst. Prof.
NAKAMURA Yukinori**

■ Research Themes

Control theory/Control engineering/ Machine learning/Data science

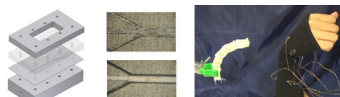
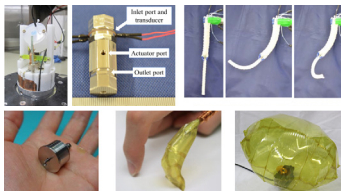


Asst. Prof. IKEZAKI Taichi

■ Research Themes

Control theory/Control engineering/ Machine learning/Data science

Sysetm Integration



Our research is about actuators and device for mechatronics and their system applications.

- Application of micro actuators and special environmental mechanisms
- Microreactors and microfluidic devices

- High-performance smart pneumatic artificial muscles, soft mechanisms, and medical and welfare equipment applications
- Research on actuators for extreme environments and devices for space probes using film processing technology

**Prof.
KANDA Takefumi**

■ Research Themes

Actuator/Sensor/Mechatronics/Softmechanism/Welfare device/Microsystem/Microreactor/Specific environment/Ultrasonics/Piezoelectricity/Microchannel



**Assoc. Prof.
WAKIMOTO Shuichi**

■ Research Themes

Actuator/Sensor/Mechatronics/Softactuator/Softmechanism/Medical device/Welfare device



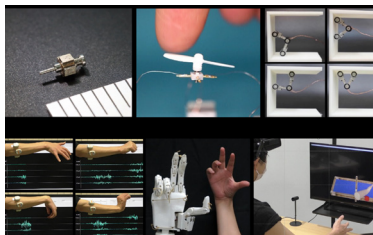
**Asst. Prof.
YAMAGUCHI Daisuke**

■ Research Themes

Actuator/Sensor/Mechatronics/Softactuator/Softmechanism/Microsystem/Specific environment/Extreme environment/Spacecraft/Lunar exploration/Pneumatics/Ultrasonics/Piezoelectricity



Mechatronic Systems

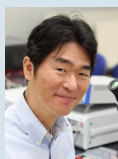


The Mechatronics Systems Laboratory is engaged in creative and fundamental research and development of new sensors and actuators, applied research and development of robot hands and medical diagnosis and measurement devices using these technologies, and research and development of peripheral technologies. In particular, we focus on sensors and actuators based on the piezoelectric effect as a driving principle, and our research ranges from basic research such as driving theory to design, development, and evaluation of new devices, as well as applied research such as robot control using these devices.

**Prof.
MASHIMO Tomoaki**

■ Research Themes

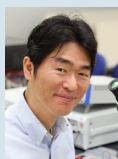
Microrobotics/Actuators/
Sensors/Ultrasonic motors



**Assoc. Prof.
SHIBANOKI Taro**

■ Research Themes

Microrobotics/Actuators/
Sensors/Ultrasonic motors



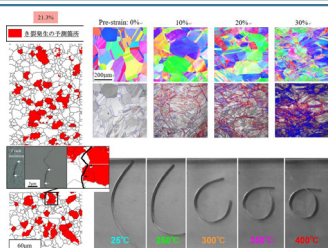
**Asst. Prof.
IZUHARA Shunsuke**

■ Research Themes

Microrobotics/Actuators/
Sensors/Ultrasonic motors



Structural Materials



Our research focuses on metallic materials, composite materials, and functional materials to create the required material properties by controlling their microstructures. With the motto "Seeing is believing," we emphasize the importance of observing, thinking about, and modeling phenomena by ourselves. Laboratory students have access to a variety of state-of-the-art electron microscopy systems and are able to learn micro-sampling techniques, as well as observation and analysis techniques at the atomic level.

Prof. OKAYASU Mitsuhiro

■ Research Themes

Structural Materials/
Composites/Functional
Materials/Microstructures



Assoc. Prof. TAKEMOTO Yoshito

■ Research Themes

Structural Materials/
Composites/Functional
Materials/Microstructures



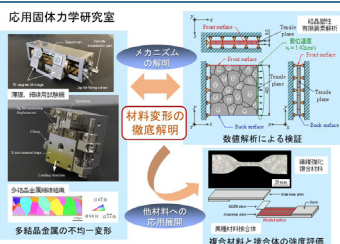
Asst. Prof. ARAKAWA Junta

■ Research Themes

Structural Materials/
Composites/Functional
Materials/Microstructures



Applied Solid Mechanics



The target of our research is deformation, damage and fracture of various practical materials, including metallic and polymeric materials. We conduct experimental observations of nonuniform deformations for the materials and the corresponding numerical simulations in various levels.

Prof. TADA Naoya

■ Research Themes

Fracture /
Damage / Deformation /
Solid mechanics



Assoc. Prof. UEMORI Takeshi

■ Research Themes

Constitutive equation /
Deformation / Numerical analysis /
Mechanics of plasticity



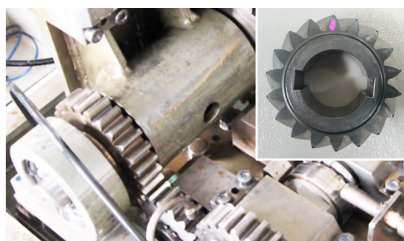
Asst. Prof. SAKAMOTO Junji

■ Research Themes

Fracture / Fatigue /
Vibration / Fracture mechanics



Machine Design and Tribology



In order to realize a carbon-neutral or decarbonized society, mechanical systems are required to be highly efficient, lightweight, and have a low environmental impact. At the mechanical design laboratory, we apply cutting-edge surface modification methods, coating methods and analysis methods to study technologies that dramatically improve the life, efficiency, and functionality of power transmission elements for EVs and various tribo-elements.



Prof. FUJII Masahiro

■ Research Themes

Mechanical element/Tribology/Gear/
Fatigue strength/Low friction and
wear/Surface modification/Coating

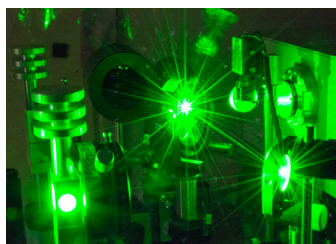


Assoc. Prof. SHIOTA Tadashi

■ Research Themes

Mechanical element/Tribology/Gear/
Fatigue strength/Low friction and
wear/Surface modification/Coating

Nontraditional Machining



Along with the rapid progress of industrial technology, various new materials with excellent properties have been developed. Most of these materials are difficult to machine by the conventional mechanical methods, and the demand for machining of fine complicated shapes has been increased. Our laboratory is researching on high-performance and high-functional nontraditional machining methods, such as Electron Discharge Machining (EDM), Electron Beam Machining (EBM), and Laser Beam Machining (LBM) with using electric, electronic, optical energies. In addition, we are developing novel machining methods for the next generation.

**Prof.
OKADA Akira**

■ **Research Themes**
Nontraditional
machining technology



**Assoc. Prof.
OKAMOTO Yasuhiro**

■ **Research Themes**
Laser beam
machining/Electrical
discharge machining

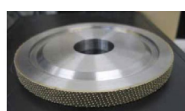


**Asst. Prof.
SHINONAGA Togo**

■ **Research Themes**
Electron beam
machining/Laser
beam machining



Manufacturing Engineering



Studies on high efficiency, high precision, high quality, optimization, and intelligent automation of machining, which is the basic technology of manufacturing, and its peripheral technologies are carried out. In particular, advanced manufacturing technology for both machine tool users and builders is being developed through studies on not only grinding, cutting and abrasive finishing or their evaluation technology, but also further development of AI / IoT technology specialized in the field of manufacturing.



**Prof.
OHASHI Kazuhito**

■ **Research Themes**
Manufacturing Engineering/
Grinding/Machining (Cutting)/
Abrasive Machining



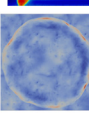
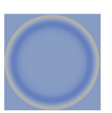
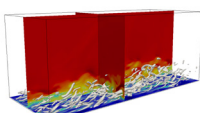
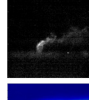
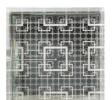
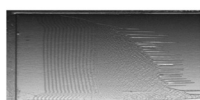
**Senior Asst. Prof.
KODAMA Hiroyuki**

■ **Research Themes**
Manufacturing Engineering/
Machining (Cutting)/Grinding/
Abrasive Machining/Data Mining

**Asst. Prof.
KANEKO Kazuki**

■ **Research Themes**
Mechanical Engineering/Manufacturing
Engineering/Grinding/Machining
(Cutting)/Abrasive Machining

Fluid Dynamics



Understanding and controlling the forces that an object receives from the air plays an important role in industrial products such as automobiles and airplanes. The Fluid Dynamics Laboratory conducts research on fluid dynamics with the aim of contributing to the improvement of the performance of current industrial products and the development of new products. The Fluid Dynamics Laboratory conducts research on relatively slow flows, such as those assumed for wind turbines and automobiles used in wind power generation, to fast flows that reproduce the flight environment of airplanes and rockets, based on experiments, numerical calculations, and AI techniques.

**Prof.
KOUCHI Toshinori**

■ **Research Themes**
Aerodynamics/
Aerospace Engineering/
Mechanical engineering



**Assoc. Prof.
SUZUKI Hiroki**

■ **Research Themes**
Aerodynamics/
Aerospace Engineering/
Mechanical engineering



**Asst. Prof.
TANAKA Kento**

■ **Research Themes**
Aerodynamics/
Aerospace Engineering/
Mechanical engineering



Heat Transfer Engineering



Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation

The Heat Transfer Engineering Laboratory conducts research on understanding the basic phenomena of heat and mass transfer for the effective use of thermal energy and developing products with industrial needs. Specifically, we are conducting a wide range of research such as thermal energy transport and storage using latent heat, development of a new desiccant air conditioning system, investigations of droplet condensation, evaporation and freezing behavior with controlling the surface properties of an object, microcapsules containing latent heat storage materials, and numerical analysis of absorption and reflection by generation and functional thermal radiation films.

**Prof.
HORIBE Akihiko**

■ Research Themes

Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation



**Senior Asst. Prof.
YAMADA Yutaka**

■ Research Themes

Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation



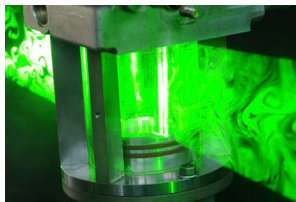
**Asst. Prof.
ISOBE Kazuma**

■ Research Themes

Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation



Heat Power Engineering



Heat Power Engineering Laboratory focuses on combustion research for improving thermal efficiency and reducing harmful exhaust emissions. In-cylinder gas flow, spray and combustion processes are measured with ultra high-speed imaging, spectroscopy of emissions from chemical reactions, and lasers. Furthermore, CFD simulations are performed to predict and to elucidate those processes. Effective use of hydrogen, e-fuels and bio-fuels that contribute to carbon neutrality are also targeted.

**Prof. KAWAHARA
Nobuyuki**

■ Research Themes

Thermal Engineering
/Internal Combustion
Engine/Combustion/Laser
Diagnostic/Numerical Simulation



**Assoc. Prof.
KOBASHI Yoshimitsu**

■ Research Themes

Thermal Engineering/
Internal Combustion
Engine/Combustion/Fuel/
Compression Ignition



**Asst. Prof.
TSUBOI Kazuya**

■ Research Themes

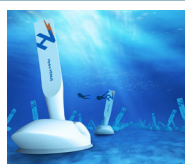
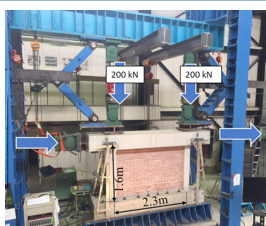
Thermal Engineering/
Combustion Engineering
& Science/Computational Fluid
Dynamics



Mechanical Systems and Urban Innovation Sciences

Department of Urban Environment Development

Aseismic Design of Structures



Wind Resistance Group

Wind and tidal power generation are being developed by applying flow-induced oscillations in structures such as bridges caused by wind and water currents.

Earthquake Resistance Group

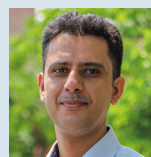
Our research is a combination of analytical simulation, earthquake damage surveys, and structural experiments in order to evaluate and improve the seismic performance of buildings for disaster mitigation and earthquake-resistant cities. Focusing on sustainability, we explore innovative earthquake-resistant structural systems, such as hybrid designs featuring CLT timber walls and reinforced concrete.



Prof. HIEJIMA Shinji

■ Research Themes

Wind engineering/Vibration engineering/
Wind power generation/Tidal current
power generation



**Assoc. Prof.
ALWASHALI Hamood**

■ Research Themes

Seismic evaluation of buildings/seismic
retrofit/performance assessment design/
building structure/seismic disaster mitigation

Design of Steel Structures



Research and education are conducted on the advanced methods of construction and maintenance of civil infrastructures. The types of infrastructures of our interest include railway, road, river, port, and soil structures such as tunnels, bridges, dams, banks. In terms of research topics, particular focuses are placed on the development of the state-of-the-art structural monitoring and nondestructive inspection techniques for the infrastructures under operation. To this end, we are developing physio-chemical models of structures, materials, and measurements, and validate the models and the monitoring/testing techniques built on them through computer simulations and experiments.



Prof. NISHIYAMA Satoshi

■ Research Themes

infrastructure/construction/maintenance/
steel structure/monitoring/nondestructive
inspection



Assoc. Prof. KIMOTO Kazushi

■ Research Themes

infrastructure/construction/maintenance/
steel structure/monitoring/nondestructive
inspection

Design of Timber Structures



Research and development of timber technologies and structural design methods for middle and high-rise timber structures.

Structural design utilizing the latest wood materials such as CLT and fire-resistant timber.

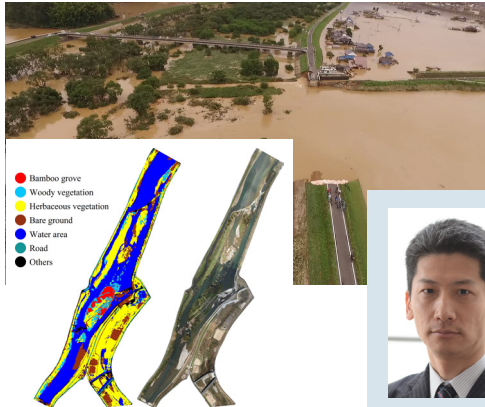


**Assoc. Prof.
FUKUMOTO Kouji**

■ Research Themes

Timber Structure/Timber
Construction/Hybrid Structure/
Strucuture Design

Hydraulic Engineering



We have conducted education and research on water flow analysis and hydraulic design methods for various hydraulic structures in rivers and coastal areas, which are related to the creation of diverse aquatic environments that can coexist with nature.



Assoc. Prof. YOSHIDA Keisuke
■ Research Themes
Hydraulic Engineering



Assoc. Prof. AKOH Ryosuke
■ Research Themes
Social Infrastructure(Civil Engineering/Architecture/Disaster Prevention)/Hydroengineering

Geotechnical and Groundwater Engineering



Study on Prediction of Slope Failure during Heavy Rainfall
Development of Monitoring and Numerical Modeling Methods for Safety Assessment of River Levees against Seepage



Prof. KOMATSU Mitsuru
■ Research Themes
Unsaturated soils/Analysis of seepage flow/Soil moisture



Assoc. Prof. FURUKAWA Zentaro
■ Research Themes
Geodisaster Prevention Engineering/Geoenvironmental Engineering/ Vegetation

Architectural Design and Theory



Development and Design Technical Practices of Design for Environmental Sustainability



Assoc. Prof. KAWANISHI Atsushi
■ Research Themes
Architectural Design/Architectural Theory/Design/Architectural Planning/Urban Planning

Wood-Based Materials



Although wood is a natural material with excellent mechanical properties, it has some weaknesses due to its biological origin. To overcome these weaknesses, previous researchers have developed various timber composite members and wood-based materials manufactured by gluing or connecting timber and small elements of wood. Now, to promote large-scale timber structure with a view to decarbonization, we will use the latest analytical and measurement techniques to provide theoretical support for fracture phenomena of existing wood-based materials and timber composite member; additionally, we will propose new combinations and forms of them on the basis of this analysis.



Asst. Prof. SUDO Ryutaro

■ **Research Themes**
Wood-Based Material/ Timber Engineering

Wood Resource Utilization



Wood is significantly different from other agricultural and marine products in that, with proper management, it can store carbon over the long term. Maximizing this capability could potentially help mitigate global warming. Our laboratory is working toward further mitigating global warming by recycling wood. Additionally, we are conducting research on the effective use of wood resources by combining recycled wood with adhesive technologies.



Prof. KORAI Hideaki

■ **Research Themes**
Wood resources/Wood-based materials/Wood adhesion/ Recycled wood/ Carbon storage

Urban and Building Environmental Engineering



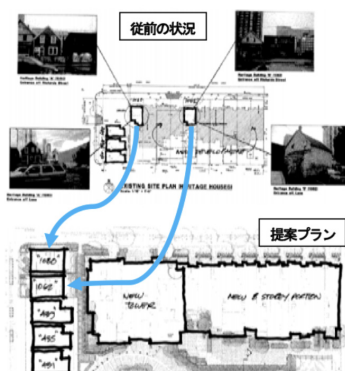
Energy is essential for maintaining human activity. However, consuming energy not only causes global environmental issues such as global warming and energy resource depletion, but also causes local (urban) environmental issues such as heat island phenomenon and air pollution. We have been researching in our laboratory to clarify the way urban structures and the related energy systems should be built in the near future in order to realize a comfortable urban environment while maintaining a sustainable earth.



Prof. NARUMI Daisuke

■ **Research Themes**
Sustainable Urban and Architectural Design/Carbon Neutral/Energy System/Heat Island

Architecture and Urban Spatial Planning



A mechanism for inheriting a housing as a good stock from a previous generation as a living housing for future generations, handing down the culture and the community or the characteristics in the district, and how to use them, how to control new development. We are proceeding with research, keeping in mind these ideas. So far, We are doing research on from the design control method of individual architecture to architectural planning / planning history and urban spatial planning, history related to architecture and planning / legal system and its implementation, in both Japan and overseas cities.



Assoc. Prof. HORI Hirofumi

■ Research Themes

Architecture and urban spatial planning/Architecture and urban design policies/Architecture and urban landscape/Area based management/Business improvement district



Senior Asst. Prof. HASHIDA Ryohei

■ Research Themes

Architectural plan/Housing theory / Modern history

Design of Concrete Structures



address the goals of a sustainable society from the concrete perspective.

Concrete is the foundation of social infrastructure that supports this substance civilization. However, the act of building a structure with concrete, or the act of building concrete itself is an act that destroys the natural environment. I want to own a car, I want to travel abroad, I want to live with a flush toilet, a TV, a cooler, but I also want to protect the natural environment. Developing a sustainable society may be the answer to this contradiction of humanity. In this laboratory, we



Prof. AYANO Toshiki

■ Research Themes

Construction material/Concrete engineering



Assoc. Prof. FUJII Takashi

■ Research Themes

Construction material/Concrete engineering

Urban and Transport Planning



Realizing Sustainable Cities: In Japan, Sustainable cities are required in a declining birthrate and aging society. To realize safe, secure, and vibrant cities and transportation, we are researching efficient urban and transportation planning that takes into consideration the environment and people's lives.

Specifically, We are conducting research on the following topics.

- 1) traffic safety 2) public transportation planning 3) barrier-free transportation planning
- 4) clarification of the actual situation of the spongification phenomenon that occurs in the process of population decline
- 5) compact city planning 6) landscape-oriented city planning
- 7) measures for city planning in line with the history of historical and cultural civil engineering heritage that take advantage of the uniqueness of the region.

Prof. HASHIMOTO Seiji

■ Research Themes

Urban Transportation Planning/Community Development by Transportation Policy/Traffic Calming



Assoc. Prof. HIGUCHI Teruhisa

■ Research Themes

Civil Engineering History/Historical Structures Preservation and Utilization/Visual Town Planning/Disaster Prevention



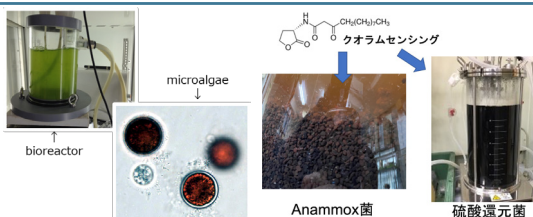
Assoc. Prof. UJIHARA Takehito

■ Research Themes

Urban Planning/Urban Environment /Urban Transportation

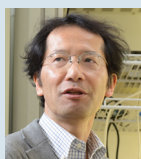


Water Environment and Sanitation



“Water” is essential for our lives and livelihoods, and also works as a medium of transporting substances on both local and global scales. Therefore, the sustainability of our life and ecosystem can be easily threatened by the excess usage and pollution of water resources. We are doing education and researches on “water quality control technology (water treatment)” and “relationship between

material transport and aquatic ecosystems” to solve or prevent such issues for water resources. We hope to make our society safe, comfortable, and sustainable.



Prof. NAGARE Hideaki

■ Research Themes

Water environment/Water treatment/
Resource recovery/Chemical substances



Asst. Prof. HASHIGUCHI Ayumi

■ Research Themes

Water environment/Water treatment/
Resource recovery/Chemical substances