Department of Civil and Environmental Engineering

Department of Civil and Environmental Engineering consists of following Core and Cooperative Laboratories.
[The number of laboratories is indicated in parentheses.]

① Core Laboratories

Mathematical System Design (1), Infrastructural Materials (3),
Engineering Mechanics of Infrastructures (2), Water Environmental Engineering and Science (4),
Science of Regional Systems (2)

② Cooperative Laboratories

International Research Institute of Disaster Science [5 Laboratories]

Tsunami Engineering, Disaster Geo-informatics,
Regional Resilience Planning, Spatial Design Strategies
Computational Safety Engineering

Laboratory	Professor / Associate Professor	Theme of research
Mathematical System Design	Associate Professor Yuki YAMAKAWA	In the mathematical system design laboratory, theoretical and computational methodologies for predicting and evaluating the strength and stability of structural systems and the deformation and failure characteristics of materials are studied using the approach based on continuum mechanics, elastoplasticity theory, and computational mechanics. Through these researches, we aim to contribute to solving various mechanical problems associated with the design, maintenance, and management of infrastructures with robustness, resilience, and longevity. Our research interests include constitutive laws for finite deformations, bifurcation and instability phenomena in materials and structures, as well as damage mechanisms and repair techniques of structures such as power transmission towers.
Infrastructural Materials (Mechanics of Materials)	Professor Takashi KYOYA Associate Professor Shotaro YAMADA	Accurate predictions and evaluations of the mechanical behavior of heterogeneous materials, such as soil, rock, concrete and other various composites, are extremely important for a rational design of infrastructure. With this background, this research institute aims to construct numerical models for rational design considering the heterogeneity of materials based on continuum mechanics and computational mechanics. These are compared with experiments from a viewpoint of multi-scale/multi-physics phenomena.
Infrastructural Materials (Concrete Engineering)	Professor Makoto HISADA Associate Professor Hiroshi MINAGAWA	Concrete is one of the most widely used construction materials. The performance of concrete changes according to the production procedure even when the same materials are used. In addition, the requirements for the performance of concrete should be decided by considering the environment factors. The research topics of our laboratory are to clarify the nature of concrete, and to develop the production procedure of concrete to satisfy the required performance. In addition, research on new concrete structural members also is carried out.
Infrastructural Materials (Geotechnical Engineering)	Professor Motoki KAZAMA Associate Professor Tadashi KAWAI	Human activities are closely related to the ground (the soils and the rocks) that forms the surface of the earth. The geotechnical engineering field is an interdisciplinary academic field that ranges from the mechanical properties of soils and rocks to ground related environmental problems. Our laboratory is specifically focused on earthquake geotechnical engineering (seismic motion amplification in the soft ground, liquefaction phenomena, etc.) and geo-environmental problems (ground settlement, soil pollution, the effective use of by-products, such as earth materials, etc.). We conduct actual case studies and also develop methods to elucidate and predict various phenomena by both experimental and analytical approaches.

Engineering Mechanics of Infrastructures (Structural Mechanics)	Associate Professor Isao SAIKI	In order to design structural members and structural systems mainly composed of steel materials, we have to mechanically examine the functions they are required to have, predict their load carrying capacity and create new structural forms. For this purpose, it is necessary to accurately predict mechanical behavior based on the characteristics of steel structure, such as slender and thin-walled. We make new proposals for structural systems and structural materials in accordance with the ultimate behavior of structures predicted mainly through our numerical simulations.

Laboratory	Professor / Associate Professor	Theme of research
Engineering Mechanics of Infrastructures (Structural Design Engineering)	Professor Shigeki UNJOH Associate Professor Hideki NAITO	Throughout their lifetime, civil structures are subjected to various loads and actions including earthquake ground motions and environmental effects. Although the loads and actions involve significant uncertainties, the structures have to be designed and maintained to ensure the necessary safety and functionality. Establishing a design concept which integrates quantitative evaluations of uncertainties of earthquake ground motions, the mechanical properties of members and overall structures and the long-term performance is essential to achieve these purposes. Target safety performance levels need to be set up, and the necessary design safety factors must be evaluated, and technology must be developed for the purpose of inspection and damage detection. This laboratory conducts the research and development necessary to propose new design concepts, methodologies for safety evaluation, and technologies to maintain the long-term performance over the whole lifetime of structures.
Water Environmental Engineering and Science (Hydro-Environment System)	Professor So KAZAMA Associate Professor Daisuke KOMORI	The evaluation of the water environment on the earth is fundamental technology for analysis of water resources and disasters. This laboratory investigates the spatial distribution of water environment and water resources using GIS, remote sensing technology, and observes water cycle (rainfall, snow, and evapotranspiration), water quality, and the ecology in the field. Numerical models are also developed to estimate the above amounts and are used to understand the interaction between human activities and water.
Water Environmental Engineering and Science (Environmental Hydrodynamics)	Professor Hitoshi TANAKA*	Aquatic zones such as rivers and coasts play an important role in our society as harbors and waterways, and the water is used for domestic, agricultural, and industrial purposes. It is, therefore, critical to keep and manage a good environment in and around those aquatic areas. By combining a hydrodynamic approach and knowledge of environmental science, our group studies sediment and material transport, and ecosystem dynamics in and around rivers, lakes, and coasts.
Water Environmental Engineering and Science (Environmental Protection Engineering)	Professor Yu-You LI Associate Professor Kengo KUBOTA	In other to realize the carbon neutral and recycle-oriented society, it is very important to develop new environmental protection technologies and planning methods for minimizing the load on the natural environment. The research in this laboratory is focused on managing wastewater and the solid waste produced from the living and industry activities of human beings. The research interests of this lab are (1) the biological treatment of wastewater and solid waste, (2) bioenergy and resource recovery using anaerobic biotechnologies, including methane fermentation and hydrogen production, (3) innovative environmental system design, and (4) environmental pollution control. We conduct fundamental and applied process studies in environmental engineering based on the science of environmental microbiology, environmental chemistry and environmental system engineering.
Water Environmental Engineering and Science (Water Quality Engineering)	Professor Daisuke SANO	The diverse water pollutants, including pathogens and toxic chemicals, are emerging in association with changes in life style, which do not allow us to manage health risks in water usage or to protect our water environment appropriately with conventional water quality indicators. In order to create a sustainable system for water quality management and control, the members of the water quality engineering laboratory are devoted to analyzying the fate of water pollutants in water environments, and to improving their removal efficiency in water/wastewater treatment processes.
Science of Regional Systems (Advanced Infrastructure Systems)	Associate Professor Yu OTAKE	In recent years, the distribution of sensors in various structures and across cities has enabled the collection of high-dimensional spatiotemporal information. The Advanced Infrastructure Systems Laboratory capitalizes on all available data science technology to develop design and control methods that make effective use of high-dimensional information. Specifically, we are working on the prediction of the complex mechanical behavior of structures and elucidation of mechanisms by integrating data-oriented and physical modeling. Furthermore, we are developing a method for real-time prediction and detection of structural anomalies and damage at the time of a disaster in order to improve the robustness and resilience of structures and urban systems.

Laboratory	Professor / Associate Professor	Theme of research
Science of Regional Systems (Ecological Engineering)	Professor Osamu NISHIMURA Associate Professor Takashi SAKAMAKI	To mitigate human impacts on aquatic ecosystems and achieve sustainable use of various ecological services, our laboratory aims to enhance the understanding of structures and functions of ecosystems and their applications. The current major research interests of our laboratory are, - The analysis of material dynamics in coastal ecosystems with the aim of developing sound management systems for ecosystems and aquacultures - The sustainable design of water treatment systems based on ecological functions (e.g., heavy metal removal using biomass, microbial treatment systems) - The development of assessment protocols of ecological toxicities of chemical pollutants on aquatic biota.
<Cooperative Laboratories> International Research Institute of Disaster Science (Tsunami Engineering)	Professor Fumihiko IMAMURA Associate Professor Anawat SUPPASRI	The TEL (Tsunami Engineering Laboratory) conducts research from an engineering perspective on tsunamis, the natural disaster most representative of Japan, which are characterized by a low frequency and high impact. The safety and security of the community has been considering as one of the most important issues from the reconstruction and rehabilitation after the 2011 Great East Japan Earthquake. Numerical analysis techniques are developed for the reproduction and prediction of tsunamis and the development of evacuation simulations by adopting cognitive science. These technologies are applicable at a domestic level and are expected to expand to the international level. The final purpose of the TEL is to perform research to protect human life and reduce property loss in societies with complicated human activities and increased informatization.
<Cooperative Laboratories> International Research Institute of Disaster Science (Disaster Geo-informatics, Environmental Change Risk Analysis)	Associate Professor Keiko UDO	The Environmental Change Risk Laboratory aims to clarify destructive mechanisms of disasters in coastal areas and rivers caused by high waves, storm surges, and floods including the climate change effect for quantification of disaster risks and development of efficient disaster prevention/mitigation measures. We analyze field data, carry out numerical simulations of disasters, and do remote sensing using satellite images. Economic evaluations are also a focus of our research work.
<Cooperative Laboratories> International Research Institute of Disaster Science (Disaster Geo-informatics, Real-time Geo-informatics for Disaster Management)	Professor Shunichi KOSHIMURA Associate Professor Erick MAS	With use of advanced sensing and modern computing power, we establish a new framework of real-time disaster science that aims to identify the social impact of natural disaster by integrating real-time computing, damage/loss estimation models, remote sensing and geo-informatics. Our mission is to achieve a technological contribution to enhancing disaster resilience throughout the efforts of real-time geo-informatics research.
<Cooperative Laboratories> International Research Institute of Disaster Science (Regional Resilience Planning)	Professor Makoto OKUMURA	Our research intends to provide inputs for planning policies that aim to make cities and regions more resilient against natural disasters. We provide data, tools and methods to regions to adapt and respond properly to natural disasters for disaster impact reduction. We also explore mechanisms and theories to recover better from disasters by addressing social and economic issues existed prior to disasters. We investigate impacts of natural disasters on socioeconomic activities and explore rebuilding processes using quantitative and qualitative techniques.
<Cooperative Laboratories> International Research Institute of Disaster Science (Spatial Design Strategies)	Associate Professor Katsuya HIRANO	In order to make an attractive and vital city, we study the meaning and image of the place and landscape with infrastructure based on cognitive scientific methodology. This knowledge is being used to develop new practices in town planning and civil engineering structure design. In recent years, special focus has been on developing methods for disaster prevention town planning based on assistance given to disaster-stricken areas for recovery in the wake of the Great East Japan Earthquake disaster.
<Cooperative Laboratories> International Research Institute of Disaster Science (Computational Safety Engineering)	Professor Kenjiro TERADA Associate Professor Shuji MORIGUCHI	We develop innovative technologies for the safety assessment of regional and urban areas within the framework of computational engineering. Specifically, various simulation techniques are developed for designing resilient infrastructures based on a variety of theories and methodologies. These techniques enable us to evaluate the durability of materials and structures using multi-scale/multi-physics modeling concepts, clarify the mechanisms of their deterioration and failure and assess the disaster risks by taking the uncertainties and interactions between structures, ground, and fluids, etc., into consideration.

Note: For more detailed information, please contact the student office. [TEL+81-22-795-7489]

Note: Professor with * mark will retire on March 2022