Department of Civil and Environmental Engineering

The Department of Civil and Environmental Engineering consists of the 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 (1), 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/ Real-time Geo-informatics for Disaster Management,
      Regional Resilience Planning, Spatial Design Strategies, Computational Safety Engineering

Laboratory	Professor / Associate Professor	Theme of research
Mathematical System Design	Professor Yuki YAMAKAWA Assistant Professor Kumpei TSUJI	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 and a natural hazard simulation with particle-based fluid-soil-structure coupling method.
Infrastructural Materials (Advanced Computational Mechanics)	Professor Kenjiro TERADA Associate Professor Seishiro MATSUBARA Assistant Professor Soma HIDANO	We are working on the development of advanced theory and technology to reproduce phenomena precisely by applying various discretization methods to mathematical models that describe the mechanical behavior of structures and materials by eliminating simplification as much as possible. In particular, we are developing the world's most advanced computational mechanics methods for simulating and visualizing the mechanical behavior of various materials and structures such as soils, concrete, and various composite materials, their interaction with fluids, and complex physical phenomena such as transformation behavior in digital space from a multi-scale and multi-physics perspective. The scope of our research covers a wide range of areas, including materials design, structural optimization, and fracture/disaster simulation using finite element methods, material point method, quantum computing, etc.
Sustainable Infrastructure Materials Engineering (Concrete Engineering)	Professor Makoto HISADA Associate Professor Shintaro Miyamoto	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 environmental 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 (Geosphere and Geotechnical Engineering)	Professor Shotaro YAMADA Associate Professor Akiyoshi KAMURA	The mission of the division of Geosphere and Geotechnical Engineering is to conduct education and research that contribute to the survey, design, construction, and maintenance of infrastructures related to the geosphere and ground, prevention and mitigation of geohazards, and creation and utilization of the geosphere environment. This division explores the mechanisms of earth activities and unravels the linkage between earth activities and geotechnical engineering issues. We also aim to elucidate the mechanisms of geo-disasters and to develop effective disaster prevention and mitigation measures. Furthermore, we actively utilize innovative digital technologies and data-driven approaches to promote research based on soil mechanics and geotechnical engineering.

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Engineering Mechanics of Infrastructures (Creative Design Engineering for Structural Systems)	Associate Professor Hideki NAITO Assistant Professor Xinhao HE	It is of importance to maintain the long-term function of infrastructures to support the safe and prosperous national life and sustainable socio-economic activities. Throughout their lifetime, infrastructures 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/improving design concepts which integrate quantitative evaluations of the uncertainties of loads and actions, the mechanical properties of members and overall structures, and the long-term performance is essential to achieve these purposes. This laboratory conducts the research and development to create new design concepts for structural systems for the purpose to maintain the long-term performance over the whole lifetime of structures using new materials and smart/high strength/high durable structural systems as well as monitoring and diagnosis systems utilizing data science and AI technologies.
Water Environmental Engineering and Science (Hydro-Environment System)	Professor So KAZAMA Assistant Professor Yusuke HIRAGA	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 (Hydro-Environmental Informatics)	Professor Keiko UDO	The Hydro-Environmental Informatics Laboratory aims to assess and evaluate disaster mechanisms in riverine and coastal areas caused by floods, storm surges, and high waves with geospatial big data for quantifying disaster risks and developing efficient disaster mitigation measures. We analyze past, present, and future land, climate, and social data, carry out numerical simulations of disasters, and employ remote sensing techniques using satellite images. Developing economic evaluation methods for sustainable climate change adaptation is another key focus of our research.
Water Environmental Engineering and Science (Environmental Protection Engineering)	Professor Yu-You LI Associate Professor Kengo KUBOTA Assistant Professor Yu QIN Assistant Professor Chen YUJIE	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 Associate Professor Mohan AMARASIRI Assistant Professor Wakana OISHI Assistant Professor Sewwandi BANDARA	The sustainability of water utilization systems is at risk due to the increasing diversity of water contaminants, including pathogens and chemicals, driven by changes in lifestyle, as well as the rapid deterioration of water and wastewater-related infrastructure in recent years. In order to establish new water quality management and control systems that should be implemented in future society, this laboratory is conducting studies to develop technologies for predicting the deterioration of water and wastewater-related infrastructure, elucidate the environmental dynamics and removal characteristics in water treatment of pathogens and micropollutants, estimate the causal relationships between water quality and diseases, and optimize the water utilization with the mixture of centralized and decentralized systems.

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Science of Regional Systems (Advanced Infrastructure Systems)	Associate Professor Yu OTAKE Assistant Professor Daijiro MIZUTANI	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 and optimal control theory 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 i) 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, and ii) asset management methods to realize value from aging infrastructure.
Science of Regional Systems (Ecological Engineering)	Professor Osamu NISHIMURA Associate Professor Takashi SAKAMAKI Assistant Professor Munehiro NOMURA	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. Major research interests： Analysis of organic matter and nutrient dynamics for proper management and utilization of watersheds and coastal areas / Carrying capacity and fishery operations for sustainable non-feeding aquaculture / Analysis of the production and decomposition processes of seaweed and other marine biomass, and evaluation of their carbon fixation / Ecosystem monitoring methods based on information on the high-dimensional chemical composition of individual organisms in coastal waters.
\<Cooperative Laboratories\> International Research Institute of Disaster Science (Tsunami Engineering)	Professor Fumihiko IMAMURA Associate Professor Anawat SUPPASRI Associate Professor Shosuke SATO	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)	Professor Shunichi KOSHIMURA Associate Professor Erick MAS Associate Professor Bruno ADRIANO	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 disasters 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)	Associate Professor Shuji MORIGUCHI Assistant Professor Reika NOMURA	We develop innovative technologies aimed at assessing the safety of regional and urban areas within the realm of computational engineering. Specifically, various simulation techniques for the disaster risk assessment considering uncertainties and complex interactions between structures, ground, and fluids, digital twins for disaster prevention and mitigation covering a wide area, and frameworks for rapid disaster assessment combining numerical simulations and observation are developed for designing resilient infrastructures. Additionally, our studies expand to the risk assessment of actual disasters that have occurred or are feared to occur in the future.

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