Graduate School of Advanced Science and Engineering (Master's Course / Doctoral Course)
Division of Advanced Science and Engineering
Lists of Academic Supervisors

October 1, 2026

(Note 1) The following lists are current as of the above date, and include faculty members who may not be able to accept students due to retirement or other reasons at the time of admission.

(Note 2) The faculty members marked with * can only accept Master's students as of the above date, and they cannot accept Doctoral students.

Science Programs

Mathematics Program

Specialty	Research Fields	Academic Staff
Algebra	Number Theory, Algebraic Geometry, Arithmetic Geometry, Motives, Singularities, Group Theory, Representation Theory, Commutative Algebra, Coding Theory, Cryptography.	SHIMADA, Ichiro KIMURA, Shun-ichi TAKAHASHI, Nobuyoshi MATSUI, Hiroki
Geometry and Topology	Differential Geometry, Topology, Manifolds, 3 and 4 Dimensional Mathematics, Knots, Hyperbolic Geometry, Homogeneous Spaces, Symmetric Spaces, Representation Theory of Lie Groups, Singularities.	ISHIHARA, Kai FUJIMORI, Shoichi OKUDA, Takayuki MURAO, Tomo TERAGAITO, Masakazu
Mathematical Analysis	Differential Equations, Nonlinear Analysis, Dynamical Systems, Potential Theory, Real Analysis, Scattering Theory.	KAWASHITA, Mishio NAITO, Yuki TAKIMOTO, Kazuhiro HIRATA, Kentaro SHIMOMURA,Tetsu IKEHATA, Ryo
Probability Theory and Mathematical Statistics	Probability Theory, Stochastic Processes, Stochastic Calculus, Random Fields, Stochastic Partial Differential Equations, Theory for Multivariate Data Analysis and its Applications, Statistical Inference, Asymptotic Expansion for Statistical Distributions, Resampling Methods, Mathematical Statistics.	WAKAKI, Hirofumi OKAMOTO, Mamoru IMORI, Shinpei ODA, Ryoya
Mathematical Sciences	Differential Geometry, Differential Equations, Bayesian Statistics, Knot Theory	MIZUMACHI,Tetsu HASHIMOTO, Shintaro SHIBUYA, Kazuhiro KOTORII, Yuka

Faculty members whose names are underlined also serve in the WPI-SKCM^2 Graduate Specific Program.

For more information, please see here.

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Physics Program

Specialty	Research Fields	Academic Staff
Theoretical Particle and Hadron Physics	Quest for fundamental law of elementary particle and hadron physics. Physics of mesons and baryons. Lattice QCD. Effective theory of QCD. QCD phase diagram, Phenomenological analyses on relativistic heavy ion collisions. Dynamical symmetry breaking. Origin of mass and CP violation.	NONAKA, Chiho ISHIKAWA, Ken-ichi INAGAKI, Tomohiro
Astrophysics	Theoretical and observational research on astrophysics. The main research fields are as follows. Gravitational lensing, observational cosmology, dark matter, baryonic physics, galaxy clusters, black holes, neutron stars, pulsar magnetosphere, particle acceleration, gravitational waves, gravitational-wave cosmology, tests of gravity in extreme environments, and fundamental particle searches.	OKABE, Nobuhiro NISHIZAWA, Atsushi KISAKA, Shota
Quark Physics	Experimental study of an exotic state of matter, quark-gluon plasma, utilizing nuclear collisions at the energy frontier. Investigation of properties and space-time evolution of such a quark matter, which filled the universe in 10 micro-seconds after the Big-Bang. Search for dark matter/energy and new phenomena arising from ultra-intense fields. Computational magneto-hydrodynamics and interdisciplinary plasma physics. R&D of new particle detectors. High-performance computing and data analysis.	SHIGAKI, Kenta YAMAGUCHI, Yorito HOMMA, Kensuke MIYOSHI, Takahiro* YANO, Satoshi*
High-Energy Astrophysics	Study of high-energy astrophysical phenomena through cosmic X-ray and gamma-ray observations with Fermi GeV gamma-ray satellite, X-ray satellites, TeV gamma-ray telescopes, and so on. Astronomical objects of interest are neutron stars, black holes of various masses, supernova remnants, galaxies and clusters, and gamma-ray bursts. Together with Kanata telescope, multiwavelength and multimessenger observations are performed. Future X-ray and gamma-ray projects. Development of new radiation detectors is also an important research target.	FUKAZAWA, Yasushi MIZUNO, Tsunefumi TAKAHASHI, Hiromitsu SUDA, Yusuke
Optical and Infrared Astronomy	We study astrophysical phenomena, mainly based on optical and infrared observations, using our 1.5m 'Kanata' Telescope at the Higashi-Hiroshima Observatory, the James Webb Space Telescope, and other facilities. These data are further combined with multi-wavelength observations taken with the ALMA observatory and X-ray/gamma-ray satellites. We also promote research and development of new astronomical instruments, including future telescopes and satellites.	KAWABATA, Koji UEMURA, Makoto INAMI, Hanae
Materials Structure Physics	We conduct structure–property studies to understand the relationship between crystal structures, their fluctuations (dynamics), and physical properties using synchrotron radiation X-ray diffraction (SXRD) and laser spectroscopy. Our research focuses on elucidating the mechanisms of functional property emergence and phase transitions at the atomic level through electron density analysis and time-resolved structural analysis. We develop advanced measurement techniques and analytical methods for SXRD-based structural characterization.	KUROIWA, Yoshihiro MORIYOSHI, Chikako TSUKADA, Shinya KIM, Sangwook*
Electronic Properties of Solids	Study of correlation between electronic states and physical properties in magnetic materials and/or dielectric materials by means of X-ray spectroscopy (XAS, MCD, XLD, PES, XES) and X-ray diffractometry using synchrotron radiation. Investigation of the physical properties under extreme conditions.	KIMURA, Akio (Concurrent post) NAKAJIMA, Nobuo
Synchrotron Radiation Physics of Solids	Studying topologically non-trivial electronic band structures of Weyl semimetals, nodal-line semimetals and related spintronic materials by spin- and angle- resolved photoelectron spectroscopy utilizing synchrotron and laser radiation. Unraveling origins of superconductivity, metal-insulator transition and multipoles in strongly correlated systems.	KIMURA, Akio KURODA, Kenta
Molecular Photoscience	Atomic-level elucidation of functions, properties, and reaction dynamics of nanomaterials and bio molecules using advanced quantum beams such as synchrotron radiation, free electron lasers, and ultrafast pulsed lasers. Interdisciplinary physics with chemistry and biology based on the interaction between light and matter. Basic research on synthesis of new materials.	MORIYOSHI, Chikako (Concurrent post) SEKITANI, Tetsuji
Synchrotron Radiation Materials Science	Investigation of electronic and spin structures of materials by high-resolution photoemission spectroscopy, highly efficient spin- and angle-resolved photoemission spectroscopy, and soft X-ray magnetic circular dichroism using synchrotron radiation (SR) in the ultraviolet and soft X-ray region, study of biomolecule structures using vacuum-ultraviolet circular-dichroism spectroscopy, and the development of advanced SR instruments for materials science at Research Institute for Synchrotron Radiation Science (HiSOR).	OKUDA, Taichi SHIMADA, Kenya TAKAHASHI, Osamu MATSUO, Koichi IDETA, Shin-ichiro MIYAMOTO, Koji SATO, Hitoshi SAWADA, Masahiro SUMIDA Kazuki SAKHYA, Anup Pradhan

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Specialty	Research Fields	Academic Staff
Physics of Synchrotron Radiation	Researches on particle accelerators, particularly synchrotron light sources. Beam physics studies on electron dynamics and electromagnetic radiation in synchrotrons. Researches and developments of accelerator technology for advanced light sources.	KATOH, Masahiro

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Quantum information theory concerning e.g. quantum entanglement and quantum communication	ISHIZAKA, Satoshi
	Crystal growth and pattern formation of softmatter	TAGUCHI, Ken
	Physics of complex systems, such as active matter and non-equilibrium ordering	TANAKA, Shinpei
	Physics Education Research, Molecular Dynamics Simulation of Liquids	MUNEJIRI, Shuji
	Physics of Disordered Materials (liquids and glasses)	KAJIHARA, Yukio
	Circuit quantum gravity theory concerning e.g. circuit analogue black holes	KATAYAMA, Haruna*

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Earth and Planetary Systems Science Program

Specialty	Research Fields	Academic Staff
Earth and Planetary Material Science	Tectonics of East Asia, Continental evolution, Deformation microstructure, Internal structure of the Earth, Mineral physics, Water-rock interaction, Crystal chemistry	ANDO, Jun-ichi DAS, Kaushik OKAZAKI, Keishi OKAWA, Makio
Earth and Planetary Chemistry	Magma genesis, Astrobiology, Space exploration, Earth environmental change, Microbial mineralization, Planetary collision process, Thermochemical state of Earth's oceanic plate	SHIBATA, Tomoyuki (Retirement at the end of March 2027) SHIRAISHI, Fumito YABUTA, Hikaru AKIZAWA, Norikatsu KOIKE, Mizuho MIYAHARA, Masaaki
Earth and Planetary Physics	Slow earthquake, Material transport, Mantle convection, Deep magma genesis, Deep Earth water, Deep Earth Rheology, High pressure hydrous minerals	INOUE, Toru SUDA, Naoki (Retirement at the end of March 2028) KAWAZOE, Takaaki NAKAKUKI, Tomoeki
Integrated Earth and Ocean Sciences	Development of high-precision and microanalytical techniques for investigating surface environments and interior material cycling of the Earth and planets Physico-chemical processes in earthquake fault zones Microbiological and geochemical explorations of subseafloor biosphere Diversity and ecology of microbes inhabiting the deep-biosphere	TOMIOKA, Naotaka (Visiting Prof.) HIROSE, Takehiro (Visiting Prof.) MORONO, Yuki (Visiting Prof.) HOSHINO, Tatsuhiko (Visiting Prof.) NAKADA, Ryoichi (Visiting Assoc.prof.)

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Hydrologic transport of earth surface materials: hydrogeomorphology and biogeochemistry	ONODERA, Shin-ichi
	Thermodynamics of the global climate and fluid systems, dissipative structures of non-equilibrium systems	OZAWA, Hisashi
	Environment-geology-ecosystem interactions in terrestrial to coastal waters	SAITO, Mitsuyo
	Reaction and transport relevant to rock weathering	YOKOYAMA, Tadashi

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Chemistry Program

Specialty	Research Fields	Academic Staff
Structural Physical Chemistry	Laser spectroscopic studies on a variety of molecular ions (host-guest complexes, chemical intermediates, cluster compounds, etc.) isolated under cold gas-phase conditions.	INOKUCHI, Yoshiya MURAMATSU, Satoru
Solid Material Chemistry	Synthesis, crystal structure, magnetic, optical, and conducting properties for molecule-based materials, studied by SQUID, magnetic resonance, MCD, and X-ray diffraction. Studies on materials development using synthetic chemical methods (organic synthesis, coordination synthesis, Polymer synthesis, etc.). In addition, research on the development of materials showing physical properties that are inaccessible with single molecules. In particular, research on material synthesis and functional investigation focusing on porous and mechanical functions.	INOUE, Katsuya LEONOV, Andrey SATO, Hiroshi
Integrated Chemistry	Synthesis, architecture, and physical characteristics of functional molecules inspired by biological functions. Design and development of devices with integrated functional molecules.	NISHIHARA, Sadafumi
Coordination Chemistry	Preparation, structures, and properties of transition metal complexes having phosphorus ligand(s) with novel functionality. Design and dynamic behavior of interfacial molecule–metal architectures for efficient catalysis.	MIZUTA, Tsutomu (Retirement at the end of March 2028) KUME, Shoko
Analytical Chemistry	Studies on the physical and chemical responses or phenomena of single particles levitated in air by means of a laser trapping technique.	ISHIZAKA, Shoji MATSUBARA, Hiroki MIYAGAWA, Akihisa
Organic Stereochemistry	Study on the developments of supramolecular assembly and polymer generated from hetero- and homotopic monomers linked through multiple non-covalent forces, and their innovative functions.	HAINO, Takeharu HIRAO, Takehiro
Photochemistry of Advanced Materials	Advanced nanomaterials synthesis based on physical chemistry method. Optoelectrical properties of nanostructured material. Development of basic structure for next-generation photovoltaic and LED. Optical properties of condensed phase.	SAITOW, Ken-ichi
Physical Chemistry of Kinetics	Chemical reaction dynamics study based on quantum state-resolved scattering and laser spectroscopy. Soft X-ray spectroscopic approach to solvation structure. Molecular spectroscopic study on ice surface aimed at astrochemistry and cold chemistry.	KOHGUCHI, Hiroshi OKADA, Kazumasa TSUGE, Masashi
Synthetic Organic Chemistry	New reactions-, new reagents-, and new catalysts-based synthetic organic chemistry, and creation of new functional molecules therefrom. Studies on the synthesis and reaction mechanism of organic compounds of main group elements. Chemistry of hypervalent molecules.	YOSHIDA, Hiroto NAKAMOTO, Masaaki
Organic Reaction Chemistry	Organic photochemistry, reactive intermediate chemistry, synthesis of biologically active compounds, artificial Photosynthesis, photochemistry of metal complexes. Synthetic chemistry of π-conjugated middle molecules and macromolecules with new structures.	ABE, Manabu ISHITANI, Osamu (Retirement at the end of March 2029) KAYAHARA, Eiichi TAKAGI, Ryukichi
Radiation Reaction Chemistry	Chemistry related to radiation and radioactive materials. Environmental chemistry, chemistry of exotic atoms and development of a new analysis method using radiation.	NINOMIYA, Kazuhiko
Quantum Chemistry	Study on elucidating structure–electronic state–property–function relationships, and the mechanisms of spatiotemporal dynamics and quantum-derived functions, in π-conjugated molecular materials, using theoretical chemistry based on quantum mechanics. Study on proposing design guidelines for novel quantum-functional molecular materials. Study on developing theories, models, and computational methods for these purposes.	KISHI, Ryohei

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Engineering Programs & Informatics and Data Science Program

Applied Chemistry Program

Specialty	Research Fields	Academic Staff
Organic Supramolecular Chemistry	Education and research on development of synthetic reactions and supramolecular complexes applied for creating functional organic molecules in everyday life, medicinal field, and high technology.	IKEDA, Atsushi KAWASAKI, Riku
Polymer Chemistry	Education and research on polymer chemistry, especially, precision polymerization catalyzed by transition metal complex and development of new polymers from renewable biomass.	OSAKA, Itaru (Concurrent post) TANAKA, Ryo
Organic π-Conjugated Materials Chemistry	Education and research on novel organic functional and semiconducting materials such as π-conjugated polymers, and their application to energy and/or electronic devices such as organic solar cells. Education and research on novel organic synthetic methodology by developing new reactions, reagents, and catalyst, and their application to syntheses of various organic functional materials and pharmaceuticals.	OSAKA, Itaru MIKIE, Tsubasa*
Functional Dye Chemistry	Development of novel functional dye and polymer materials with epoch-making optoelectronic characteristics, fluorescence sensing ability and therapeutic activity. Education and research on new functions of organic/inorganic materials and their applications to novel electronic/optoelectronic devices	OOYAMA, Yousuke IMATO, Keiichi
Inorganic and Hybrid Materials Chemistry	Research and education on ceramics, with main interests on molecular design, synthesis, characterization, and applications of new inorganic or inorganic-organic hybrid materials having functional nano-structures.	INUMARU, Kei KATAGIRI, Kiyofumi TARUTANI, Naoki
Catalytic Materials Chemistry	Synthesis and characterization of novel functional metal oxide materials such as metal oxide clusters, zeolites, and related materials, and their application to catalysts and adsorbents in environmental and energy research fields.	SADAKANE, Masahiro MINATO, Takuo
Functional Materials Chemistry	Education and research on elucidation of relationships between structure and function of materials from a chemical viewpoint, and creation of novel functional materials through collaboration among research groups in organic, polymer, inorganic, and analytical chemistry.	KATAGIRI, Kiyofumi (Concurrent post) KOMAGUCHI, Kenji IMAE, Ichiro NAKAYAMA, Yuushou FUKUOKA, Hiroshi*

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Smart Innovation Program (Applied Chemistry)	Element-Based Organic Materials Chemistry	Education and research on element-based materials, in particular synthesis and applications of polymers with inorganic elements, and development of functional materials with epoch-making optoelectronic characteristics.	OHSHITA, Joji ADACHI, Yohei
	Computational Materials Science	Education and research on computational chemistry, in particular understanding of chemical and physical phenomena based on molecular simulation and applications using data science.	ISHIMOTO, Takayoshi KANEMATSU, Yusuke

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Chemical Engineering Program

Specialty	Research Fields	Academic Staff
Thermal-Fluid Engineering	Development of self-healing coating for industrial materials, printable electronics using metal complex (conductive, power storage, power generation materials). Synthesis of nanoparticles and nanostructured particles.	OGI, Takashi HIRANO, Tomoyuki
High-Pressure Fluid Property	Measurement and modeling of the equilibrium and transport properties for supercritical fluid + polymer systems. Development of innovative material processing technology for functional organic and inorganic materials utilizing particular characteristics of supercritical fluids.	YABUKI, Akihiro (Concurrent post) USHIKI, Ikuo
Soft Materials Processing	Basic research to elucidate the relationship between engineering processing, hierarchical structuring, and functionalization of soft materials (polymers such as plastics and rubbers) through measurement and modeling of their physical properties, and applied research to create functional organic and inorganic materials using these materials.	NAKAI, Satoshi (Concurrent post) KIHARA, Shinichi
Separation Technology	Development and characterization of nano- or subnano-porous ceramic membranes, and their application to gas separation, pervaporation / vapor permeation, nanofiltration / reverse osmotic processes, and catalytic membrane reactors. Sol-gel and plasma-enhanced CVD for functionalized materials. Transport mechanism of gas/liquid molecules through microporous membranes. Evaluation of membrane-based separation processes.	KANEZASHI, Masakoto NAGASAWA, Hiroki MORIYAMA, Norihiro
Fine Particle Technology	Development of novel high-performance classification system. Development of powder treatment process using microwave heating method. Improvement and life prediction of bag filter system. Recycling of particulate waste. Interfacial characterization of particles and biological cells. Rheological analysis of particle suspensions. Component separation processes using vibrating fluidized beds.	FUKUI, Kunihiro FUKASAWA, Tomonori
Computational Multiphase Flow	Numerical analysis of transport phenomena in chemical processes. Modeling and numerical simulation of dispersed flows and complex fluids. Fast prediction of transport phenomena using deep learning–based surrogate models. Optimal design of processes, equipment, and materials using machine learning. Development of digital twins for chemical processes.	ISHIGAMI, Toru
Interfacial Systems Process Engineering	Development of processes for the continuous synthesis and morphological control of metal-organic frameworks (MOFs); Evaluation of adsorption and separation properties in gas and liquid phases using MOF powders and thin films; and Understanding the kinetics of MOF synthesis reactions and adsorption	ISHIGAMI, Toru (Concurrent post) KUBO, Masaru
Sustainable Materials Process Engineering	Development of self-healing coating for industrial materials, printable electronics using metal complex (conductive, power storage, power generation materials). Electrochemical reduction of carbon dioxide using copper electrodes.	YABUKI, Akihiro
Green Process Engineering	Education and research on treatment of waste and wastewater, evaluation of environmental impacts of the human activities and its reduction by greenization of chemical processes, ecological engineering for conservation and restoration of damaged ecosystems, research on the synthesis of functional polymers, and its application to separation, reaction, and culture processes.	NISHIJIMA, Wataru NAKAI, Satoshi GOTOH, Takehiko SUENAGA, Toshikazu UMEHARA, Akira

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Electrical, Systems, and Control Engineering Program

Specialty	Research Fields	Academic Staff
Social Informatics	Research grounded in fundamental theories of mathematical optimization and decision-making, with a focus on addressing challenges in complex social and industrial systems through the integration of advanced mathematical and AI-based methods. Applied research aimed at improving real-world systems, including the operation and management of production systems and the optimization of social infrastructure such as electric power systems. Promotion of the application of mathematical and AI technologies to practical problems, including system optimization, and advancement of their real-world deployment through collaboration with multiple companies.	HAYASHIDA, Tomohiro SEKIZAKI, Shinya MORIKAWA, Katsumi
Mathematics	Research on inverse problems of differential equations. Mathematical analysis of linear PDEs. Dynamical systems and ergodic theory. Research on nonlinear elliptic and parabolic differential equations, and applications to the dynamical system and phenomenological theory. Statistical physics of neural networks.	TSUGE, Naoki YOSHIKAWA, Shuji KAWASHITA, Wakako CHUNG, Yong Moo WAKASUGI, Yuta UCHIYAMA, Satoki*
Electric Power and Energy System	Research on large-scale, complex and nonlinear electric power systems, including problems of operation, planning, stability analysis, and control. Recent topics include the construction of smart microgrid using new type of converter under development (hardware) and its control technologies (software). Keywords: renewable energy, distributed power generation, battery, vehicle-to-grid, optimization technique, artificial intelligence (AI) application, control system design, analysis technology, reliable ICT application, algorithm development.	ZOKA, Yoshifumi SASAKI, Yutaka TAOKA, Satoshi
Mechatronics	Research on mechatronics systems that contribute to solving societal challenges, based on robot mechanisms incorporating intelligence and bio-inspired control methods, spanning from legged robots and drones to manipulators and sensing technologies.	TAKAKI, Takeshi AMBE, Yuichi
Human Systems Augmentation	Research on the measurement, analysis, and modeling of biological functions, as well as their engineering applications. Our goal is to expand human potential and contribute to a more vibrant society through a deeper understanding of sensory, motor, and brain functions. Key areas of focus include biomedical signal processing, human-machine systems, haptics, virtual reality, human interaction, medical engineering, human augmentation, and brain-tech systems.	KURITA, Yuichi SOH, Zu TAKEMI, Mitsuaki
Applications of Cybernetics	Research on the modeling and application of a complicated phenomenon. For example, measurement and diagnosis for the living body information and system integration, engineering application, etc.	KOMINE, Hidehiko MIYATA, Natsuki

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Smart Innovation Program (Electrical, Systems, and Control Engineering)	Control Systems Engineering	Research and education on system control technology and digital signal processing. Specifically, adaptive & learning control system technology for industrial systems, Cyber-Physical Systems (CPS), Model Based Development (MBD) and digital signal processing for communication systems and image processing.	YAMAMOTO, Toru WAKITANI, Shin KINOSHITA, Takuya NAKAMOTO, Masayoshi
	Sensing Informatics	Education and research in sensing informatics that visualize otherwise imperceptible real-world dynamics and address on-site challenges through data-driven approaches. This includes foundational sensing technologies such as high-speed vision, vibration sensing, AI-based tracking of moving objects, and robotic sensing, as well as 4D digital twin applications for human and biological systems and industrial systems.	ISHII, Idaku SHIMASAKI, Kohei

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Mechanical Engineering Program

Specialty	Research Fields	Academic Staff
Machinery Dynamics	Analysis, design, control, and simulation of mechanical systems, such as robotics and mechatronics systems. Specific themes include: force control and teleoperation for industrial robots; safer control techniques for robots collaborating with humans; teleoperation of bipedal robots; control and motion planning for hydraulic excavators; periodic/aperiodic separation for control and diagnosis; development of mobile robots; and analysis and control of human-robot interaction.	KIKUUWE, Ryo MURAMATSU, Hisayoshi
Mechanics of Materials	Experimental study on impact thermo-mechanical and fracture behavior of materials with phase transformation and characterization by observation of microstructure; Development of new members with high collision energy absorption by using material with high impact energy absorption; Development and modification of impact testing methods; Multi-scale analysis of steel with phase transformation based on the homogenization technique; Dislocation mechanics by the microforce concept and coupling with a transformation-crystal plasticity theory; Simulation of interface motion driven by phase transformation using microforce balance equation; Mesh free method such as GIMP for impact and phase transformation problems.	IWAMOTO, Takeshi
Control Engineering	Research on analysis, estimation, and control of dynamical systems and their applications to mechatronic systems. Specifically, this includes robust control, optimal control, model predictive control, data-driven control, simultaneous state and parameter estimation, development of driver-assistance systems, and battery management systems.	WADA, Nobutaka
Machine Intelligence and Systems A	Realization of machine intelligence. In particular, the collective intelligence generation, control and analysis based on the concept of decentralized autonomous systems by building swarm robotic systems or conducting large-scaled computer simulations with emerging techniques in the field of biomimetics and computational intelligence.	OHKURA, Kazuhiro
Machine Intelligence and Systems B	Research on design, planning and control of manufacturing systems; Research on optimum/intelligent production planning and scheduling.	EGUCHI, Toru
Mechanical Design and Systems	Motion accuracy measurement and control for mechatronics systems in manufacturing; Three-dimensional measurement of the motion of machine tools and robots; Industrial robots of higher accuracy for automation, New applications for industrial robots; Kinematic modelling and control of positioning systems; Three-dimensional geometric measurement.	IBARAKI, Soichi
Machining and Machining System	The sensing technology and the components for machine tools; Machining for the difficult-to-cut materials; Development of the free-cutting steels and the new cutting tools; Laser assisted machining process; Laser processing of brittle materials.	YAMADA, Keiji TANAKA, Ryutaro
Materials Physics	Elucidation of physics phenomena in development and laser precision machining of high-functional and high-performance advanced material, Data-driven material development combining high-precision structural observation/structural quantification with machine learning, Optimization of material development and processing by structural control, Material development and high-performance processing using numerical simulations (first-principles calculation, Monte Carlo method, finite element method, etc.).	OKAMOTO, Yasuhiro
Properties Control for Mechanical Materials	Analyses and micro-macro modeling for materials fabrication process, and development of materials property control by their techniques: (1) Casting using the material control technology, the alloying using the sintering method, and a diplo-phasing and compositing; (2) Thermal and mechanical conditions of the material engineering quality of the material by the analysis of a material process, research-and-development; (3) Nano-meso scale by the mechanical engineering techniques, such as control of the dynamic or control.	MATSUGI, Kazuhiro CHOI, Yongbum
Strength and Fracture of Mechanical Materials	The microscopy of the fatigue crack growth mechanism by using high-resolution microscope; The evaluation of material strength of advanced structural materials; Evaluation of fatigue strength and damage mechanism of joints welded by various joining methods (resistance spot welding, laser welding, friction stir welding, adhesive joining); Establishment of fatigue life estimation method under actual loading; Nondestructive inspection and fatigue damage evaluation of joints using infrared measurement.	AKEBONO, Hiroyuki OGAWA, Yuki
Materials Forming Science and Engineering	Experimental investigation of elastic-plastic (or viscoplastic) behavior and fracture limit of metallic materials, Material modeling and material parameter identification based on theory of elasto-plasticity, Investigation and prediction of forming limit and springback of difficult-to-form sheet metals, Development of hot and warm incremental sheet forming technology, Numerical analysis and optimization problems in metal forming.	HINO, Ryutaro

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Specialty	Research Fields	Academic Staff
Materials Joining Science and Engineering	Development of high-quality / high-efficiency welding and joining processes using hot-wire method with several heat sources (laser, GMA and GTA); Evaluation of hot cracking susceptibility and elucidation of mechanism of hot cracking during welding using in-situ observation technique with high-speed cameras and multi-sensor camera; Prediction of hot cracking initiation and distortion during welding using computational simulation; Development of novel joints based on microstructure formation and strength analysis of welded joints; Development of automation and defect detection technologies combining various sensors and machine learning.	YAMAMOTO, Motomichi MARUMOTO, Keita*
Materials Engineering for Energy Conversion and Storage	Research and development of energy conversion materials which are in particular related to: Secondary battery materials (Li-Ion and Ni-MH); Fuel cell with non-conventional mechanisms, energy conversion systems (thermochemical hydrogen production and electrolysis of NH_3 and H_2O), and/or solid state hydrogen storage materials; Energy recovery from waste and biomass.	ICHIKAWA, Takayuki GUO, Fangqin*
Thermal Engineering	Production of hydrogen from biomass using supercritical water; Heat transfer and chemical reactions in supercritical water; Hydrothermal pretreatment of biomass; Chemical heat pump; Structural analysis of nanocrystal; Fundamental research of carbon nanotube.	MATSUMURA, Yukihiko ZHANG, Mengli
Fluid Engineering	Plasma experiments, developments of plasma control system, and computer simulation for magnetic confinement fusion plasmas; Development of carbon-neutral energy using plasma; Development of new imaging diagnostics for turbulence and its applications; Numerical analysis and measurement to elucidate wall heat transfer mechanism in turbulent flow in pipes, and characteristics of gas-liquid two-phase flows such as liquid jets and fuel sprays for loss reduction technology; Development of new research areas on medical science and engineering using mathematical model and data-driven science	SUZUKI, Yasuhiro OGATA, Yoichi
Combustion Engineering	Construction of reaction mechanisms for practical combustion; Improvement of IC engine combustion based on detailed kinetic analysis; Measurements of ignition properties of fuel components and mixtures; Improvement of combustion based on the ignition characteristics of fuels; Low NOx, low SPM tubular combustion; Micro combustor; Fire safety.	SHIMOKURI, Daisuke
Reactive Gas Dynamics	Fundamental studies on high-speed reactive gas flows such as detonations or explosions; Development of new internal combustion engines or heat sources using high-speed combustion; Fundamental studies on laser ignition; Numerical studies on laser-plasma physics such as laser fusion or laser-plasma x-ray sources; Physics and chemistry of explosions in gas-phase or solid-gas-mixed-phase fluids.	ENDO, Takuma JOHZAKI, Tomoyuki KIM, Wookyung
Plasma Science	Applications of high-density arc plasmas to scientific and engineering fields; Development of plasma window for separation between vacuum and atmosphere; Development of coherent/incoherent bright X-ray sources driven by lasers; plasma spectroscopy. Turbulence observation and analysis in fusion plasma.	NAMBA, Shinichi YAMASAKI, Kotaro
Quantum Energy Applications	Monte Carlo simulation on interactions of radiations with matter; Microdosimetry of radiations; Dosimetry of Radiation Hazards; Medical and Engineering Applications of Radiation; Measurement of nuclear reaction cross sections in high and medium energy radiations; Measurement of gamma radiations, alpha and beta particles and environmental radioactivities.	ENDO, Satoru KAJIMOTO, Tsuyoshi

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Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Research and development of hydrogen production, hydrogen storage, and material conversion	MIYAOKA, Hiroki

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Transportation and Environmental Systems Program

Specialty	Research Fields	Academic Staff
Structural Systems	Buckling and ultimate strength evaluations Fracture and fatigue strength evaluations Computational Mechanics, Applied Mechanics, Solid/Structural Analysis Research on a floating structure for offshore wind power generation Energy harvesting using mechanical vibration Nondestructive inspection, Numerical electromagnetic field analysis	HAMADA, Kunihiro (Concurrent post)
Structural Innovation	Research on novel structures and manufacturing technology and new materials (e.g., CFRP) for aerospace, ships, etc. Advancement of semiconductor device fabrication process Research on the deterioration/failure prediction of infrastructure Research on the mechanical properties and damage behavior of composite materials for aerospace structures Research on the methods for enhancing the strength and toughness of advanced composite materials	KATAGIRI, Kazuaki MOHAMMAD, Fikry
System Safety	Research on safety assessment and maintenance for structures and transportation equipment systems. Development of sensors for dynamic load and deformation measurement. Development of instrumentation system for structural safety management. Automatic control and planning of ship equipments and systems.	SHINTAKU, Eiji TANAKA, Yoshikazu
Transportation System Innovation	Research on planning and design methodology for transportation systems using ICT Design and planning of new transportation system using maritime logistics big data Development of efficient construction system using factory monitoring Ocean monitoring and observational physical oceanography Data assimilation and ocean environment prediction	HAMADA, Kunihiro TANIGUCHI, Naokazu
Ocean Sensing	Research on the remote sensing technology for marine environment Research on the sensing technology for maritime transportation	SAKUNO, Yuji
Fluid Dynamics for Transportation and Environmental Systems	Research on the reduction of wind resistance acting on a bridge of ship Research on seakeeping performance of a ship in nonlinear wave Research on aerodynamics of an automobile in the real world Assessment and prediction of ocean-atmosphere environment due to vehicle transportation Research on an advanced technology of electrical energy generated by renewable energy (wind, ocean power, vibration) Research on a technology of energy harvesting Research on CFD technology by using Particle Based Method	MUTSUDA, Hidemi NAKASHIMA, Takuji
Air Transportation and Ocean Systems	Research on the aerodynamic properties of WIG flying over the waves Research on the passive control of the wind turbine with elastic composit material Research on the human-powered aircraft Theoretical and experimental researches on Ship seakeeping Ship weather routing with forecast uncertainty Route optimization using NWP models and AI Ship behavior analysis using AIS and environmental data	IWASHITA, Hidetsugu CHEN, Chen
Ship Design Innovation	Development of an environment friendly marine vehicle Research on prediction of performances of marine vehicle Research on marine navigation safety Research on a new energy transportation	HAMADA, Kunihiro (Concurrent post) Yasukawa, Hironori (Collaborative Research Laboratory)

Note: The faculty members marked with * are only in charge of Master's Course.

Architecture Program

(Building Engineering Field)

Specialty	Research Fields	Academic Staff
Building Materials and Components	A (Timber Structure) : Study on large-scale wooden construction using wooden materials including CLT Research on development of wooden semi-rigid frame structure Evaluating method of residual seismic performance of existing wooden construction Long term performance evaluation of wooden materials and buildings	MORI, Takuro
	B (Concrete Engineering) : Durability of concrete materials and structures Mechanisms governing long-term volumetric stability of cementitious materials Carbon fixation and utilization in cement-based materials Microstructure-performance relationships in cementitious materials	AILI, Abudushalamu
Structural Mechanics of Building	Research on structural system preventing deformation concentration Study on low damage building structure against severe earthquake Performance evaluation and design of vibration-controlled structures Method for evaluating and enhancing seismic resilience of buildings	CHEN, Xingchen
Building Structures	Seismic design of steel structures Vibration control system of steel structures Beam-to-column connections and column-bases of steel structures Buckling analysis and design of steel frames Seismic retrofit of existing structures	TAGAWA, Hiroshi
Disaster Prevention Engineering	Earthquake strong motion prediction technology Ground motion evaluation Building damage estimation for scenario earthquakes Remote sensing for disaster response Spatial data analysis for disaster risk evaluation	MIURA, Hiroyuki
Earthquake and Structural Engineering	Seismic response evaluation of reinforced concrete buildings Seismic retrofit method of existing concrete buildings Post-earthquake residual capacity evaluation of reinforced concrete buildings Seismic performance evaluation of buildings with brick masonry walls	SUZUKI, Tomomi

(Architecture Field)

Specialty	Research Fields	Academic Staff
Urban and Architectural Planning	A (Urban Planning) : Urban environmental planning (green, wind, water, climate, hazard, energy, and built environment). Compact city design with population decrease. Sustainable urban design with using GIS and AI. Attractiveness and urban design.	TANAKA, Takahiro
	B (Architectural Planning) : Planning of social welfare and community facilities. Planning of building construction, production systems for regional housing. Human resources, organizations and networks for building stock societies. Methods for cultivating creativity in architectural production.	SUMIKURA, Hideaki ISHIGAKI, Aya
Architectural History and Design Theory	Theory on peace architecture and urban design. Theory on environment and landscape design. History of modern architecture and modern urbanism in Japan and World. Research and planning for the conservation of buildings and towns.	MIZUTA, Susumu
Architectural Environment	Relationships between indoor environment and housing design and occupant behavior Optimization of renewable energy utilization in buildings AI-based visualization of building heat loads Energy planning for carbon-neutral university campuses	KINDAICHI, Sayaka
Architectural Project	Design of an environmentally conscious architecture Architectural design using BIM and CFD analysis Design of temporary shelters immediately after the disaster Study on wooden buildings using domestic solid wood	NAKAZONO, Tetsuya

Note: The faculty members marked with * are only in charge of Master's Course.

Specialty	Research Fields	Academic Staff
Architecture and Urban Environment Design	Architecture and urban design, landscape design, nature park planning, Ramsar Convention Wetlands and World Heritage Site. Cognitive engineering, human factors, and kansei engineering/affective engineering in architecture and urban environments. Human physiology and psychology influenced by interactions with the environment. UI/UX (User Interface/ User Experience) design based on BMI, BCI, etc. Interaction design based on the brain and VR, etc.	TANG, Shouni

Supervisor below in charge of plural programs takes charge of the program in the following table, including Architecture Field of this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Building and urban environmental science for achieving sustainable development in developing world.	KUBOTA, Tetsu

Note: The faculty members marked with * are only in charge of Master's Course.

Civil and Environmental Engineering Program

Specialty	Research Fields	Academic Staff
Structural Materials and Concrete Structures	Education and research on the physicochemical characteristics of cementitious materials, the mechanical and durability performance evaluation of plain, reinforced and prestressed concretes, effective utilization of resources, environmental impact evaluation of concrete, and maintenance of concrete structures.	KAWAI, Kenji (Retirement at the end of March 2027) OGAWA, Yuko
Structural Engineering	Education and research on evaluation of structural performance and durability of concrete structures, strength development and deterioration of cement-treated soils, and cementitious engineered barrier for nuclear waste management. Education and research on mathematical structural design and structural optimization by FEM etc., bifurcation buckling of structures, dynamics problems and fluid-structure interaction problems, and multiple folding stability problems such as bridges, bridge damage survey analysis and development due to natural disasters.	NAKARAI, Kenichiro ARIO, Ichiro* NGUYEN, Huu May*
Geotechnical Engineering	Evaluation of mechanical property of soft ground, Ground improvement techniques, Engineering properties of cement treated clay and recycled geo-materials, Development of new construction technology for waste disposal facility in coastal areas, In-situ testing of weathered granite soil and the application on disaster prevention of natural slopes in heavy rainfall, Estimation and countermeasures of sand liquefaction by earthquakes, Evaluation of seismic site response of ground, Earthquake resistant design of geotechnical works, Maintenance and condition evaluation method for road pavement and geotechnical structures, Conservation of historic structures based on geotechnical engineering, Clarification and modeling of multiscale behavior of geomaterials and soil-structure interaction.	HATA, Toshiro KIDO, Ryunosuke
Infrastructure Management	Structural analysis and simulation, damage identification and deterioration diagnosis of infrastructures	KHAJI, Naser
Global Environment and Planning	Development of planning methodology, and analysis for following themes; recycling and low-carbon society, urban transportation system by making full use of an economical evaluation, a statistical model, and a mathematical planning, a travel behavior model, or network science. Researches on material flows for scarce metals, market share forecast on low emission vehicles, development of statistical model for "big-data", on consensus building by statistical approach for text data	TSUKAI, Makoto
Environmental Preservation Engineering	Biological wastewater treatment. Energy recovery from biomass by microbes. Nitrogen and Phosphorous removal. Microbial community analysis. Application of membrane filtration technique on wastewater treatment.	KINDAICHI, Tomonori KIMURA, Zenichiro
Hydraulic Engineering	Flood forecast; interactions among flood flow, vegetation and morphology in rivers; multi-scale phenomena of flow and sediment transport in a dynamic fluvial system; sedimentation sorting and variation in porosity and sediment volume in rivers; tsunami dynamics in rivers; multi-phase flows with sediment transport around river structures; sediment-flood inundation and sediment capacity in rivers	UCHIDA, Tatsuhiko
Coastal Engineering	Development of technology to improve environment in river bank Practical use of "sediment microbial fuel cells" more than solar batteries Research on groundwater and tidal flat environment in tidal estuaries	HIBINO, Tadashi (Retirement at the end of March 2027)

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Smart urban infrastructure, transportation planning, urban planning, travel behavior analysis, travel survey design, transport network analysis, resilience research, risk analysis	CHIKARAISHI, Makoto
	Renewable energy evaluation and management in developing countries, Numerical models for coastal hazards・disaster prevention・mitigation, Evaluation of climate changes on natural hazards and renewable energy environment.	LEE, Han Soo

Note: The faculty members marked with * are only in charge of Master's Course.

Informatics and Data Science Program

Specialty	Research Fields	Academic Staff
Computer Systems	Research on novel computer architectures, systems, and computing techniques for machine learning and combinatorial optimization. In particular, we use GPUs, FPGAs, and quantum computers for accelerating machine learning and for solving combinational optimization problems.	NAKANO, Koji PARQUE, Victor
Intelligent Systems	Machine learning, High-performance computing, Parallel and distributed computing, Quantum computing, Embedded system	ITO, Yasuaki
Foundation of Computer Science	Cryptography and information security. In particular, privacy-enhancing authentications and network services, and implementations based on elliptic curve cryptosystems. Mobile and ubiquitous computing. In particular, communication, activity recognition, and location sensing using wireless devices. AI security and privacy. In particular, privacy-preserving machine learning, detection and defense against poisoning attacks, and methods for protecting data privacy.	NAKANISHI, Toru KITASUKA, Teruaki LIAN, Zhuotao*
Dependable Systems	Reliability and Maintenance, Dependable computing, Fault tolerant computing, Computer security, Performance evaluation, Operations research, Software reliability engineering, Formal engineering methods for software development, Software testing and formal verification, Intelligent software engineering environment	DOHI, Tadashi OKAMURA, Hiroyuki ZHENG, Junjun
Distributed Systems	Theory and practice on parallel and distributed systems, such as secure and efficient resource sharing schemes, real-time file exploration in wide area networks, high-performance computing using PC clusters, contents delivery in service providing networks, and environment monitoring systems based on wireless sensor networks.	FUJITA, Satoshi
Advanced Network	Research on the technologies of the Internet architecture, network applications, decentralized computing, and information security, especially including mobility technology, virtualization / cloud infrastructure technology, IoT, operation management, distributed ledger technology, digital identity management, access control, formal methods, and distributed deep learning.	KONDO, Tohru OGAWA, Kohichi* DING, Yepeng*
Information Security	Research on the application of information security technologies to network systems and computer systems, the construction of management system and its operation to maintain information security, and the education for administrators and users to operate and use them properly.	NISHIMURA, Kouji
Social Computing	Algorithm for processing and utilizing "big data". Data mining for SNS, Web, IoT, GPS, etc. Recommendation system, Personalization, Database marketing, Privacy-preserving information retrieval, Parallel and distributed algorithms, Graph learning, etc.	MORIMOTO, Yasuhiko KAMEI, Sayaka LOU, Yang
Computational Complexity Theory	Computational complexity theory, hierarchies of complexity classes, combinational computational geometry, visibility problems and art gallery theorems, design and analysis of algorithms.	IWAMOTO, Chuzo
Survival Analysis	We develop new statistical methods for survival analysis. In particular, we use copulas for modeling multivariate survival data.	EMURA, Takeshi
Intelligent Information and Communication	Research on information communication networks, mobile networks, and wireless communications and sensing. Our work focuses on leveraging AI and quantum computing technologies for network control, resource allocation, optimization, as well as the integration of communication and sensing in B5G/6G.	WEI, Bo

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Graduate School / Program	Research Fields	Academic Staff
Graduate School of Advanced Science and Engineering / Transdisciplinary Science and Engineering Program	Research on Media Communication Services	KODAMA, Mei
	Cybersecurity, Confidential Computing	WATANABE, Hidenobu

Note: The faculty members marked with * are only in charge of Master's Course.

Digital Innovation Science Program (Note: Doctoral students will be admitted to Informatics and Data Science Program.)

Specialty	Research Fields	Academic Staff
Visual Information Science	Computer graphics, visualization, image processing, image recognition and understanding, computer vision, machine learning, deep learning, brain-inspired computing and various applications of these technologies, such as biomedical imaging and image analysis, optical design, vision and language-based information fusion (computer vision and natural language processing), autonomous driving, video surveillance and human-computer interaction.	RAYTCHEV, Bisser HIGAKI, Toru GU, Yanlei
Learning Engineering	Research on technology-enhanced learning systems designed based on knowledge modeling, implemented with artificial intelligence, multimedia and web technologies, and then practiced from viewpoint of education and psychology.	HIRASHIMA, Tsukasa HAYASHI, Yuusuke DAI, Yiling*
Data Analytics and Modeling	Statistical machine learning (including Bayesian modeling and deep learning) and its applications to large-scale, complex and/or dynamic data analysis and generation (especially focusing on natural languages, networks, financial data, brain data, and multimodal data).	EGUCHI, Koji ANDRADE, Daniel FUKUSHIMA, Makoto YU, Yi
Informatics and Mathematical Science	System theory and intelligent information processing, Stabilization and optimization for stochastic systems, Numerical analysis and optimal design for mechatronic systems.	MUKAIDANI, Hiroaki
Pattern Recognition	Development of pattern recognition and machine learning algorithms for image understanding, image synthesis, 3D understanding, etc.	AIZAWA, Hiroaki
Leaning Analytics	Analysis of learning data including bio-behavioral data. Design and development of learning support systems.	SUMIYA, Takahiro ADILIN ANUARDI
Intelligent Control Systems	We conduct research on intelligent systems for the social implementation of artificial intelligence. Our work includes foundational research in areas like machine learning, optimal control, multi-agent systems, and cyber-physical systems, as well as applied research on social systems such as drones, power management, medical big data, and smart mobility.	NAGAHARA, Masaaki LI, Mengmou
Financial Data Science	We combine various models and techniques of quantitative finance with machine learning for achieving superior investment returns while taming the risk. We apply the state-space model and other methods to analyze financial time series. We also look into different correlation structures and perform feature importance analysis, examine optimal clustering, construct novel portfolios, estimate financial risk exposures, and propose new investment and trading strategies.	TING, Hian Ann (Retirement at the end of March 2027)
Complex Systems Science	Modelling, analysis, and control of complex systems including swarm systems, natural phenomena, cyber-physical systems, and social networks using the tools from machine learning, control theory, optimization, and self-organization.	OGURA, Masaki
Bayesian Statistics and Inference	Research on Bayesian inference, with focus on hypothesis testing procedures. Also, research on item response theory models for data from educational or psychological backgrounds.	TENDEIRO, Jorge
Multivariate Analysis and Modeling	Theoretical and Applicational study of Multivariate Data Analysis. Research related to Psychometrics, Biostatistics and Medical Statistics.	MONDEN, Rei
Intelligent Biosignal Informatics	Research on the measurement, analysis, and modeling of human biosignal information and its machine learning applications. Topics include biosignal processing for EMG, EEG, ECG etc., probabilistic modeling, machine learning, deep learning, human-machine interface, robotic prostheses, biomedical image analysis, motion analysis, etc.	FURUI, Akira
Applied Computational Science	Research on computational science, numerical modeling, and optimal design. In particular, we focus on developing and analyzing numerical methods for wave phenomena such as acoustic, elastic, and electromagnetic waves, as well as on applying optimal design theory to the creation of novel materials and structures.	MATSUSHIMA, Kei
Systems and Control	Research on smart systems integrating control theory and machine learning, with a focus on scalable design for large-scale networks.	KAWANO, Yu

Faculty members whose names are underlined also serve in the WPI-SKCM^2 Graduate Specific Program.

For more information, please see here.

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Graduate School / Program	Research Fields	Academic Staff
Graduate School of Humanities and Social Sciences / Psychology Program	Social psychological research on human behavior. Especially, research on inter-personal communication using indirect meanings.	HIRAKAWA, Makoto

Note: The faculty members marked with * are only in charge of Master's Course.

Smart Innovation Program

(Applied Chemistry)

Specialty	Research Fields	Academic Staff
Element-Based Organic Materials Chemistry	Education and research on element-based materials, in particular synthesis and applications of polymers with inorganic elements, and development of functional materials with epoch-making optoelectronic characteristics.	OHSHITA, Joji ADACHI, Yohei
Computational Materials Science	Education and research on computational chemistry, in particular understanding of chemical and physical phenomena based on molecular simulation and applications using data science.	ISHIMOTO, Takayoshi KANEMATSU, Yusuke

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Applied Chemistry Program	Organic Supramolecular Chemistry	Education and research on development of synthetic reactions and supamolecular complexes applied for creating functional organic molecules in everyday life, medicinal field, and high technology.	IKEDA, Atsushi KAWASAKI, Riku
	Polymer Chemistry	Education and research on polymer chemistry, especially, precision polymerization catalyzed by transition metal complex and development of new polymers from renewable biomass.	OSAKA, Itaru (Concurrent post) TANAKA, Ryo
	Organic π-Conjugated Materials Chemistry	Education and research on novel organic functional and semiconducting materials such as π-conjugated polymers, and their application to energy and/or electronic devices such as organic solar cells. Education and research on novel organic synthetic methodology by developing new reactions, reagents, and catalyst, and their application to syntheses of various organic functional materials and pharmaceuticals.	OSAKA, Itaru MIKIE, Tsubasa*
	Functional Dye Chemistry	Development of novel functional dye and polymer materials with epoch-making optoelectronic characteristics, fluorescence sensing ability and therapeutic activity. Education and research on new functions of organic/inorganic materials and their applications to novel electronic/optoelectronic devices	OOYAMA, Yousuke IMATO, Keiichi
	Inorganic and Hybrid Materials Chemistry	Research and education on ceramics, with main interests on molecular design, synthesis, characterization, and applications of new inorganic or inorganic-organic hybrid materials having functional nano-structures.	INUMARU, Kei KATAGIRI, Kiyofumi TARUTANI, Naoki
	Catalytic Materials Chemistry	Synthesis and characterization of novel functional metal oxide materials such as metal oxide clusters, zeolites, and related materials, and their application to catalysts and adsorbents in environmental and energy research fields.	SADAKANE, Masahiro MINATO, Takuo
	Functional Materials Chemistry	Education and research on elucidation of relationships between structure and function of materials from a chemical viewpoint, and creation of novel functional materials through collaboration among research groups in organic, polymer, inorganic, and analytical chemistry.	KATAGIRI, Kiyofumi (Concurrent post) KOMAGUCHI, Kenji IMAE, Ichiro NAKAYAMA, Yuushou FUKUOKA, Hiroshi*

Note: The faculty members marked with * are only in charge of Master's Course.

(Electrical, Systems, and Control Engineering)

Specialty	Research Fields	Academic Staff
Control Systems Engineering	Research and education on system control technology and digital signal processing. Specifically, adaptive & learning control system technology for industrial systems, Cyber-Physical Systems(CPS), Model Based Development (MBD) and digital signal processing for communication systems and image processing.	YAMAMOTO, Toru WAKITANI, Shin KINOSHITA, Takuya NAKAMOTO, Masayoshi
Sensing Informatics	Education and research in sensing informatics that visualize otherwise imperceptible real-world dynamics and address on-site challenges through data-driven approaches. This includes foundational sensing technologies such as high-speed vision, vibration sensing, AI-based tracking of moving objects, and robotic sensing, as well as 4D digital twin applications for human and biological systems and industrial systems.	ISHII, Idaku SHIMASAKI, Kohei

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Electrical, Systems, and Control Engineering Program	Social Informatics	Research grounded in fundamental theories of mathematical optimization and decision-making, with a focus on addressing challenges in complex social and industrial systems through the integration of advanced mathematical and AI-based methods. Applied research aimed at improving real-world systems, including the operation and management of production systems and the optimization of social infrastructure such as electric power systems. Promotion of the application of mathematical and AI technologies to practical problems, including system optimization, and advancement of their real-world deployment through collaboration with multiple companies.	HAYASHIDA, Tomohiro SEKIZAKI, Shinya MORIKAWA, Katsumi
	Mathematics	Research on inverse problems of differential equations. Mathematical analysis of linear PDEs. Dynamical systems and ergodic theory. Research on nonlinear elliptic and parabolic differential equations, and applications to the dynamical system and phenomenological theory. Statistical physics of neural networks.	TSUGE, Naoki YOSHIKAWA, Shuji KAWASHITA, Wakako YONG, Moo Chung WAKASUGI, Yuta UCHIYAMA, Satoki*
	Electric Power and Energy System	Research on large-scale, complex and nonlinear electric power systems, including problems of operation, planning, stability analysis, and control. Recent topics include the construction of smart microgrid using new type of converter under development (hardware) and its control technologies (software). Keywords: renewable energy, distributed power generation, battery, vehicle-to-grid, optimization technique, artificial intelligence (AI) application, control system design, analysis technology, reliable ICT application, algorithm development.	ZOKA, Yoshifumi SASAKI, Yutaka TAOKA, Satoshi
	Mechatronics	Research on mechatronics systems that contribute to solving societal challenges, based on robot mechanisms incorporating intelligence and bio-inspired control methods, spanning from legged robots and drones to manipulators and sensing technologies.	TAKAKI, Takeshi AMBE, Yuichi
	Human Systems Augmentation	Research on the measurement, analysis, and modeling of biological functions, as well as their engineering applications. Our goal is to expand human potential and contribute to a more vibrant society through a deeper understanding of sensory, motor, and brain functions. Key areas of focus include biomedical signal processing, human-machine systems, haptics, virtual reality, human interaction, medical engineering, human augmentation, and brain-tech systems.	KURITA, Yuichi SOH, Zu TAKEMI, Mitsuaki
	Applications of Cybernetics	Research on the modeling and application of a complicated phenomenon. For example, measurement and diagnosis for the living body information and system integration, engineering application, etc.	KOMINE, Hidehiko MIYATA, Natsuki

Note: The faculty members marked with * are only in charge of Master's Course.

Quantum Matter Program

Physics Field

Specialty	Research Fields	Academic Staff
Electron Theory of Solids	Mechanism of anisotropic superconductivity and interplay between magnetism and superconductivity in strongly correlated electron systems and quasi - lowdimensional systems. Superconductivity in high magnetic fields including the Fulde-Ferrell-Larkin-Ovchinnikov state. Magnetism in low and quasi-low dimensional systems.	SHIMAHARA, Hiroshi
	Theoretical studies on the 3d and 4f electrons and high-energy spectroscopies in transition-metal and rare-earth compounds.	TANAKA, Arata
Computational Physics	Development of the energy band theory beyond the density functional theory and its application to solids.	HIGUCHI, Katsuhiko
	Condensed matter theory and statistical physics. Theoretical studies on topological systems, Dirac semimetals, superconductivity, and magnetism including spin liquids.	TADA, Yasuhiro
Strongly Correlated Electron Physics	Experimental study on ordered structures and fluctuations of charge, spin, orbital, and higher multipole moments in strongly correlated electron systems by means of neutron and resonant x-ray scatterings. Also, by studying thermal and transport properties, we aim at total understanding from microscopic and macroscopic points of view.	MATSUMURA, Takeshi
	Experimental study on cross-correlation phenomena in quantum materials with broken symmetry. We aim to elucidate the origin of cross-correlation phenomena by measuring fundamental physical properties under multiple extreme conditions of electric field, magnetic field, and pressure.	AOYAMA, Takuya
Magnetism	Experimental research on magnetic property of rare-earth compounds and thermal property of clathrate compounds. Macroscopic measurements and neutron scattering experiments are performed to reveal origins of new phenomena.	ONIMARU, Takahiro
	Single crystal growth of new rare-earth compounds and measurements for magnetic/thermal properties at very-low temperature mainly below 1 K, to find exotic phase transition and anomalous metallic state.	SHIMURA, Yasuyuki
Low Temperature Physics	Exploration of novel materials such as superconductors and quantum magnets consisting of transition metal elements with strong electron correlations and heavy elements with strong relativistic effects, and search for exotic quantum states.	NOHARA, Minoru
	Experimental investigation of nano-scale physics. Quantum coherence, single electron phenomena and non-equilibrium transport are studied by fabricating extremely small structures and measuring low-temperature transport.	YAGI, Ryuta
	Experimental studies on the strongly correlated electron systems by means of ultrasonic spectroscopy. Our research focuses on novel physical properties originating from magnetism, multipoles, and structural chirality under multiple extreme conditions.	ISHII, Isao
High Energy Physics	Experimental studies on quantum optics and its application; applications to quantum information science, fundamental physics, and bioengineering by quantum optical methods and techniques.	IINUMA, Masataka*
Beam Physics	Experimental research on trapped charged particles and related physics. Production of low energy particle beams and their application for atomic physics, plasma physics, and beam physics research.	HIGAKI, Hiroyuki
	Experimental study on collective motions in charged particle systems. Application of non-neutral plasma systems to beam physics. Production of nano-ion beam sources.	ITO, Kiyokazu*
Accelerator Physics	Theoretical and experimental study for beam dynamics. Research and development of high energy accelerator and its applications for light source, Xray source. Research for high brightness (polarized) electron and (polarized) positron sources and study for photo-cathode and laser as key technologies of the high brightness particle sources.	KURIKI, Masao
	Theoretical and experimental study of accelerator dynamics and applications. Beam improvement and background reduction in colliders. R&D for future accelerators. Development of polarized electron sources.	LIPTAK, Zachary John
Quantum Properties	Studies of the thermal, transport and magnetic properties of rare-earth and transition-metal compounds under high pressures. Main research subjects are pressure-induced quantum critical phenomena of heavy-fermion systems, anomalous magnetism in geometrically frustrated systems under pressure, and pressure dependence of the quasi-localized vibrational modes in clathrates.	UMEO, Kazunori

Faculty members whose names are underlined also serve in the WPI-SKCM^2 Graduate Specific Program.

For more information, please see here.

Note: The faculty members marked with * are only in charge of Master's Course.

Supervisor below in charge of plural programs takes charge of the program in the following table, including Physics Field of this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Condensed matter physics under multiple extreme conditions (very high pressure, ultra-low temperature, strong magnetic field) by laser spectroscopy method	OGITA, Norio
	Condensed Matter Theory on Superconductivity and Superfluidity	HIGASHITANI, Seiji
	Lattice dynamics in condensed matter investigated by inelastic scattering of Quantum beam and first-principles calculation	HASEGAWA, Takumi
	Experimental-nanoscale physics on superconductors and related materials with scanning probe microscopy/spectroscopy	SUGIMOTO, Akira

Note: The faculty members marked with * are only in charge of Master's Course.

Electronic Engineering Field

Specialty	Research Fields	Academic Staff
Mesoscopic Physics Theory	Theory of quantum electron transport in mesoscopic systems and lowdimensional electron systems.	TAKANE, Yositake
	Theoretical study of resonant optical response produced by surface plasmons in metallic nano-structures, and development of fast electromagnetic simulation softwares.	NISHIDA, Munehiro
Semiconductor Quantum Optics	Theoretical research on quantum optics and quantum information; quantum computation and communication using highly non-classical states of light	Holger F. HOFMANN
	Crystal growth of semiconductor thin films and quantum structures, investigation of their optical characteristics, and development of novel optical devices.	TOMINAGA, Yoriko
Material Science of Nanotechnology	Experimental study of the mechanisms of self-assembled/self-organized structures consisting of organic molecules with scanning probe microscopes and their application for nanotechnology. Development of new analysis methods of organic molecules and/or bio-molecules and new application techniques of bio-molecules (motor protein, etc.) using micro/nano structures.	SUZUKI, Hitoshi
	Experimental studies on the fabrication of the surfaces and films with new properties by using 2- or 3-dimensional self-assembled integration of molecules and nanoparticles.	SAKAUE, Hiroyuki*
Semiconductor Electronics	Research on novel thin-film semiconductor processing techniques such as crystalline growth, low-temperature deposition of insulator films, and junction formation and their application to large-area electronics (solar cells, flat panel displays, etc) and ULSI devices.	HIGASHI, Seiichiro
	Development of new thin-film structure formation technology and research of its application to quantum-effect devices.	HANAFUSA, Hiroaki
Integrated Devices	RF/microwave/millimeter-wave CMOS circuit design. Circuit theory. Microwave and millimeter-wave measurement. Device characterization and modeling.	AMAKAWA, Shuhei
	Research on Electronic Design Automation (EDA) techniques for large-scale digital VLSI systems, with a particular focus on physical design of integrated devices in advanced semiconductor fabrication technologies. In addition, research on cell library design to achieve robust and low-voltage operation of digital VLSI systems.	NISHIZAWA, Shinichi
Integrated Systems	Research on system architecture, circuit design, layout optimization, active/passive device modeling and measurement for ultrahigh-frequency millimeter-wave and terahertz wireless communication and sensors with nanometer CMOS integrated circuits.	FUJISHIMA, Minoru
	Analysis, synthesis and design of architecture and RF circuit in CMOS technology. High-speed transceivers for wireless and wired communications between LSI chips. Development of design method combining communication, mount and circuit technique.	SASAKI, Mamoru
	Research on CMOS integrated circuit design that enables the coexistence of conflicting characteristics, such as low power and high-speed operation for wireline communication systems, and low-noise, low-voltage operation for signal detectors used in sensing and imaging. In addition, the creation of novel devices and systems through heterogeneous chip stacking.	KUBOKI, Takeshi
Integrated Circuits	Low-power and low-noise circuit techniques for analog-digital merged system LSIs. Architecture and circuit technologies for Bio-Sensor LSI, which realize sensing a neural signal.	YOSHIDA, Takeshi
Nanodevice Engineering	Silicon-Carbide (SiC) harsh-environment electronics for space exploration, decommissioning of nuclear power stations and medical, SiC power semiconductor devices and silicon thin-film devices.	KUROKI, Shin-Ichiro
	Novel device architectures and process integration for real-time edge computing under harsh environments	MURAOKA, Kosuke*
Nano-photon and quantum Engineering	Research on novel quantum physics in photon, spin and electrons as well as frontier device physics enabling low latency and low power consumption to realize next generation LSI enabling ultra-efficient information processing.	GOTOH, Hideki
	Research on photonic nano-quantum devices using various semiconductor materials for quantum information processing, quantum communication, and the realization of next-generation ultra-low-power LSIs.	JI, Sangmin*

Note: The faculty members marked with * are only in charge of Master's Course.

Specialty	Research Fields	Academic Staff
Nanoprocess Engineering	Research on devise structures, advanced process technology, and evaluation system for advanced LSI, and research on new devise structures, process technology of wide bandgap semiconductor (GaN) for power devices and high-speed communication.	TERAMOTO, Akinobu
	Research on semiconductor devices with new functions in fields such as optical devices, magnetic devices, and power devices.	AMEMIYA, Yoshiteru
	Research on low-power consumption devices and thermoelectric devices using group IV semiconductors as well as evaluation of their physical properties and processes for realization of next-generation LSI and the Internet of Things (IoT) society.	YOKOGAWA, Ryo*
Integrated Sensor Engineering	Research on integrated sensors based on CMOS integrated circuit technology, machine learning-integrated sensor systems for odor sensing, and plant-insertable ion imaging devices for smart agriculture.	NODA, Toshihiko
Intelligent Integrated Circuits Engineering	Research on wireless communication networks, wireless signal processing, wireless communication architecture & intelligent integrated circuits, and radio-wave propagation for wireless-environment cognitive IoT integrated system considering disaster resistance and medical applications.	KAMEDA, Suguru
	Architecture and circuit technologies for LSIs, which realize real-time recognition systems for flexible and intelligent information-processing based on reconfigurable logic-inmemory architecture approaches, and the systems development of medical / agricultural engineering applications.	KOIDE, Tetsushi
	Research on wireless communication networks, wireless signal processing, wireless communication architecture, and radio-wave propagation considering disaster resistance and space applications.	MIYAKE, Masataka
	Wireless sensing and biomedical imaging by using microwave and millimeter wave towards medical application, development of integrated sensing and communication (ISAC) system and the application for network management, fusion of optical and radio wave for biomedical measurement.	SONG, Hang
Biomagnetics	Research on optical and magnetic properties of biogenic crystals and living cells in tissue engineering. Electromagnetic manipulation of biological materials in bio-MEMS for biomedical science and biotechnology.	IWASAKA, Masakazu

Note: The faculty members marked with * are only in charge of Master's Course.

Transdisciplinary Science and Engineering Program (Environmental and Natural Sciences Field)

Specialty	Research Fields	Academic Staff
Environmental Earth Sciences	Hydrologic transport of earth surface materials: hydrogeomorphology and biogeochemistry	ONODERA, Shin-ichi
	Reaction and transport relevant to rock weathering	YOKOYAMA, Tadashi
	Thermodynamics of the global climate and fluid systems, dissipative structures of non-equilibrium systems	OZAWA, Hisashi
	Environment-geology-ecosystem interactions in terrestrial to coastal waters	SAITO, Mitsuyo
	Nutrient cycling and water security in watersheds	ISHIDA, Takuya
Physics of Complex Matter	Physics of Structure – Property Correlation in Polymers	KOJIO, Ken
	Crystal growth and pattern formation of softmatter	TAGUCHI, Ken
	Physics of complex systems, such as active matter and non-equilibrium ordering	TANAKA, Shinpei
	Physics Education Research, Molecular Dynamics Simulation of Liquids	MUNEJIRI, Shuji
	Physics of Disordered Materials (liquids and glasses)	KAJIHARA, Yukio
Physics of Correlated Matter	Quantum information theory concerning e.g. quantum entanglement and quantum communication	ISHIZAKA, Satoshi
	Condensed matter physics under multiple extreme conditions (very high pressure, ultra-low temperature, strong magnetic field) by laser spectroscopy method	OGITA, Norio
	Condensed Matter Theory on Superconductivity and Superfluidity	HIGASHITANI, Seiji
	Lattice dynamics in condensed matter investigated by inelastic scattering of Quantum beam and first-principles calculation	HASEGAWA, Takumi
	Experimental-nanoscale physics on superconductors and related materials with scanning probe microscopy/spectroscopy	SUGIMOTO, Akira
	Condensed matter and many-body theory of frustrated systems	AOYAMA, Kazushi
	Circuit quantum gravity theory concerning e.g. circuit analogue black holes	KATAYAMA, Haruna*
Information and Media Sciences	Computational approach to strong coupling and gravitational systems, Computer based learning materials	INAGAKI, Tomohiro
	Research on Media Communication Services	KODAMA, Mei
	Cybersecurity, Confidential Computing	WATANABE, Hidenobu
	Information Education, Theoretical Particle Physics, Large-Scale Numerical Simulations	MURAKAMI, Yuko
Materials Science for Energy Conversion and Storage	Research and development of hydrogen production, hydrogen storage, and material conversion	MIYAOKA, Hiroki

Supervisor below in charge of plural programs takes charge of the program in the following table, including Environmental and Natural Sciences Field of this program.

Graduate School / Program	Research Fields	Academic Staff
Graduate School of Advanced Science and Engineering / Mechanical Engineering Program	Research and development of energy conversion materials	ICHIKAWA, Takayuki
	Research and development of biomass utilization technology	MATSUMURA, Yukihiko
	Research and development of magnetic confinement fusion energy and plasma physics	SUZUKI, Yasuhiro
Graduate School of Integrated Sciences for Life	Studies on regulation of enzymes involved in cellular signaling	ISHIDA, Atsuhiko
	Conservation of organisms based on ecology	YAMADA, Toshihiro
	Studies on chemical interactions between plants and insects.	OMURA, Hisashi
	Thermodynamic studies on interfacial behavior of biorelated substances using model cell membranes, basic science related to drug delivery.	VILLENEUVE, Masumi
	Research of structural organic chemistry in life science.	NEHIRA, Tatsuo
	Environmental dynamics and analysis of trace compounds and reactive oxygen species in the atmosphere and hydrosphere.	TAKEDA, Kazuhiko
	Behavior and ecology of wildlife	NAKABAYASHI, Miyabi

Note: The faculty members marked with * are only in charge of Master's Course.

Transdisciplinary Science and Engineering Program (Development Science Field)

Specialty	Research Fields	Academic Staff
Urban and Data Science	Urban planning, smart mobility, travel behaviour, transport network analysis, data driven technology, mobility in built environment, spatial planning, urban environment analysis, decision making in smart energy, big data & machine learning for urban research	FENG, Tao
Environmental Health Science	Epidemiological study focusing on environmental health problems, Development of health care system based on spatial statistics	KASHIMA, Saori
Sustainable Architecture	Building and urban environmental science for achieving sustainable development in developing world	KUBOTA, Tetsu
Urban Environmental Science	Urban Climate Change Mitigation and Adaptation; Nature-based Solutions; Green Infrastructure; Urban Microclimate, Urban Resilience; Sustainable Urban Forms; Assessment Tools.	SHARIFI, Ayyoob
Risk Management Technology	Smart urban infrastructure, transportation planning, urban planning, travel behavior analysis, travel survey design, transport network analysis, resilience research, risk analysis	CHIKARAISHI, Makoto
Biomass Energy Technology, Botany Resources for the Future	Development of biomass energy technologies and application to developing countries Agricultural ecology and development of sustainable agricultural technologies	XUAN, Tran Dang
Ecosystem Conservation and Management Science	Research and education on ecology and ecosystem management	HOSAKA, Tetsuro
Energy Science and Technology	Coastal and Ocean engineering, Renewable energy evaluation and management in developing countries, Numerical models for coastal hazards・disaster prevention・mitigation, Evaluation of climate changes on natural hazards and renewable energy environment.	LEE, Han Soo
Environmental Genomics and Ecology, Environmental Microbiology	Our research focuses on understanding how microorganisms interact with each other, with their symbiotic hosts and with the environment, both experimentally and through big data analysis. Topics includes the relationship between climate change and microbes, genomic dynamics of pathogenic microbes in habitats, and pathogenic microbes and antibiotic resistance in air and water environments.	MARUYAMA, Fumito
Conservation of Biological Resources	Research and education on vegetation and landscape ecology of SATOYAMA ecosystems with a wide range of conservation issues. -Geographic distribution patterns of rural landscapes -Biodiversity conservation in SATOYAMA	WATANABE, Sonoko
Global Change and Biodiversity	To assess and mitigate climate change impacts on forest ecosystem functioning (biomass and carbon dynamics) and biodiversity by big data analysis	HISANO, Masumi
Environmental Biogeochemistry	Our research focuses on environmental pollution by microplastics and toxic elements in soil and water systems. Simultaneously, we are developing innovative toxic element removal technologies, such as advanced biochar and natural mineral-based materials, to enhance remediation efficiency and contribute to sustainable environmental management and circular resource utilization.	THINH, Nguyen Van*
Power System Science and Sustainable Development	Energy System development modelling and Energy Transition pathways planning; Renewable energy systems management and resource assessment;Mathematical optimization and Machine Learning for Power System analysis.	SOTO CALVO, Manuel*