Professor Dr. Tamio Ikehashi

Integrated Systems Field, Micro Electro Mechanical Systems Lab.
tel: 093-692-**** E-mail: t.ikehashi@waseda.jp

1. Biographical Information

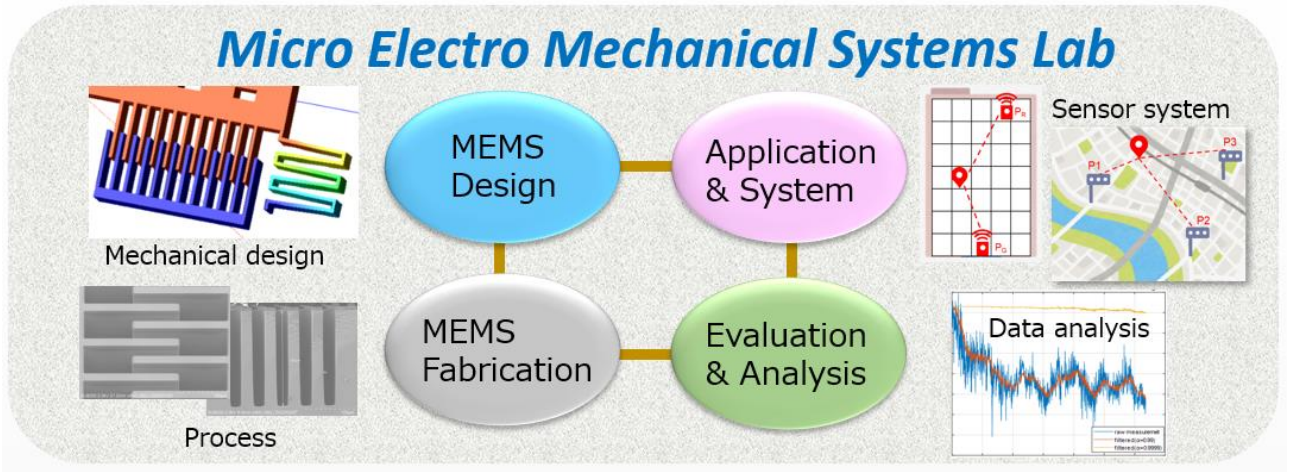
He was born in Saitama and graduated from Kumagaya high school. He got PhD at University of Tokyo, and entered Toshiba corporation on 1995. He was initially a circuit designer, but since 2004, he starts research on MEMS (Micro Electro Mechanical Systems). He developed various MEMS devices, such as RF-MEMS, pressure sensors, hydrogen sensors, accelerometers, and gyroscopes. He experienced various aspects of MEMS development, from concept design to fabrication. He became an associate professor of Waseda University on April, 2019. He is a member of IEEE, JSAP, IEICE and IEEJ.

2. Research

MEMS is a field that makes micro-sized sensors and actuators by microfabrication technologies. Familiar examples are accelerometers and gyroscopes used in smartphones. MEMS sensors are also indispensable in the field of IoT. Despite their low cost, the performance of MEMS sensors has not been sufficient to date. Higher sensitivity and accuracy are required, for example, in self-driving cars. Improving sensor performance while maintaining a low price will be a key trend for future MEMS development.

Our laboratory is conducting MEMS research with this trend in mind. One example is research on a north-finding gyroscope. This is a gyroscope that finds the direction (true north) based on the measurement of Earth's rotation. We are also developing high-sensitivity accelerometers that can be used for gravimeters, altimeters and seismometers. Mode-localization, a promising high-sensitivity technology, is also being investigated in our lab. We are also conducting research on MEMS actuators and are now developing a high voltage generating system suited for energy harvesting. Another research topic is an actuator designed to detect the Casimir force, a quantum mechanical force that is important for micro-sized devices.

Research themes will be determined based on students' interests and abilities. If you are interested in theory/design, you can do simulation-based studies. If you are interested in fabrication/measurement, you can do fabrication in a clean-room and measurements in the lab. Our lab covers all fields of MEMS development, from design, fabrication, evaluation to application system development. We are also collaborating with a company on a joint project.



3. Message

Research is like a voyage into uncharted waters. Although it is fraught with challenges, the joy of making new discoveries after trial and error is unparalleled. I look forward to sharing the excitement of such research endeavors with you!

Professor Dr. Takeshi Ikenaga

Image Information Systems Lab. Integrated Systems Field
Laboratory: N309
Tel&Fax: +81-93-692-5319, E-mail: ikenaga@waseda.jp
URL: http://ikenaga.w.waseda.jp/

1. Biographical Information

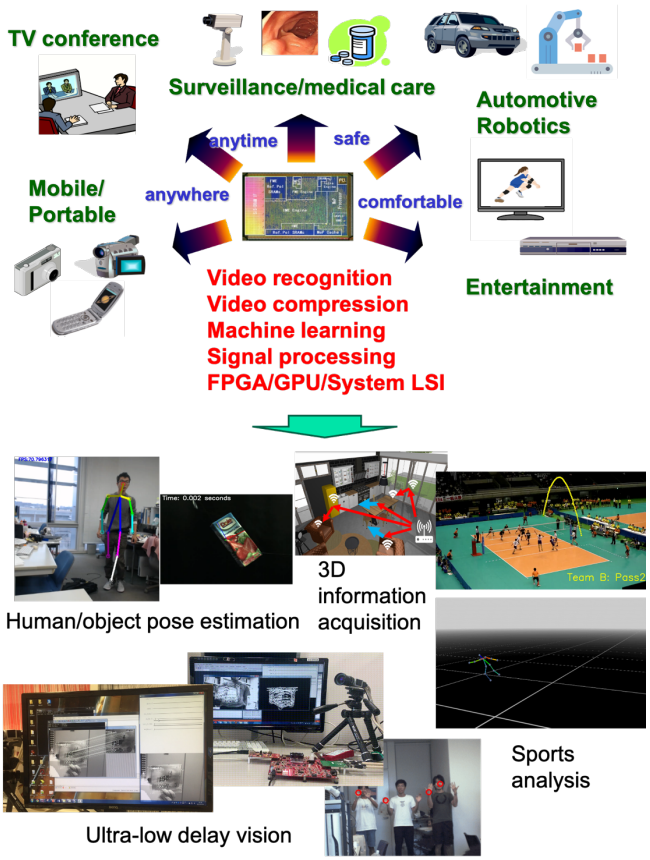
Takeshi Ikenaga received B.E. and M.E. degrees in electrical engineering from Waseda University, Tokyo, Japan, in 1988, and 1990, respectively, where he belonged to the Information Systems Laboratory directed by Professor Katsuhiko Shirai (past president of Waseda University). He also received Ph.D degree in information & computer science from Waseda University in 2001.

He joined LSI Laboratories, Nippon Telegraph and Telephone Corporation (NTT) in 1990, where he had been undertaking research on the design and test methodologies for high-performance ASICs, a real-time MPEG2 encoder chip set, and a highly parallel LSI & system design for image-understanding processing. From 1999 to 2000, he was a visiting researcher at University of Massachusetts, USA. In 2002, he returned to Kitakyushu working for FAIS as an invited researcher and in 2003 he joined IPS when it was open. He is presently a professor of Waseda University.

2. Research objective and area

Our laboratory is aiming for research on various kinds of image / video information systems and related system technologies for coming ubiquitous and ambient information society, where we can easily access any information at "anytime" and "anywhere" with "safe" and "comfortable".

The current principal targets are video recognition and video processing systems. As for the former, we are promoting research on 1ms low-delay vision system, human / object pose estimation system, 3D information acquisition system and sport analysis system. As for the latter, we mainly focus on VVC (next generation standard) video compression system and high accuracy low-level computer vision system based on deep learning. We start the research from evaluation of key algorithm and then think out hardware architecture considering various factors, such as performance, low power and hardware size. Our final goal is creating a real-time embedded system in order to verify the usefulness of proposed ideas. Actually, we developed many FPGA based real-time demonstration systems and 27 LSI chips from 2004.



We are promoting many national projects, such as Grants-in-Aid for Scientific Research, Program for Leading Graduate Schools, Global COE, Core Research for Evolutional Science and Technology (CREST). We are also promoting industry academia collaborations with many companies and joint research with universities (e.g. Tsighua, Nanjing, Fudan, Southeast, Xidian).

3. Requirement for laboratory assignment

You should have enough mathematic and programming skills at the undergraduate level related to science and engineering fields. In particular, in order to start master research, it is essential to have the skills to acquire credits of "Video signal processing," "System LSI design," and "Microprocessor." Be sure to make contact with “ikenaga@waseda.jp” in details.

Shinji Kimura, Dr. Eng., Professor

High-level Verification Technologies, Integrated Systems Field
Lab.: N325 Tel&Fax: 093-692-5374
E-mail: shinji_kimura@waseda.jp
http://www.f.waseda.jp/shinji_kimura/
http://www.waseda.jp/sem-vlsi/

1. Curriculum vitae

1982.3 Bachelor Degree of Information Science, Kyoto University
1984.3 Master Degree of Information Science, Kyoto University
1985.10 Assistant Professor at Kobe University
1989.1 Dr. of Engineering, Kyoto University
1989-1990 Visiting Scientist at Carnegie Mellon University
1993.4 Associate Professor at Nara Institute of Science and Technology
2000-2001 Visiting Scientist at Stanford University
2002.4 Professor of Waseda University

Activities in Academic Societies

Advisor of Technical Group on VLSI Design Technologies in Institute of Electronics, Information and Communication Engineers (IEICE) in Japan, Member of System LSI Design Methodology Group in Information Processing Society in Japan, Steering Committee Chair of ASP-DAC (Asia and South Pacific Design Automation Conference), etc.

2. Research Topics

Our laboratory is on high-level verification technologies for LSI design and correctness. We design and check operational modules for application specific circuits such as convolutional neural network, recognition circuit, etc. We are also working on approximate computing method for such error tolerant application circuits. Quantum algorithms are also studied to solve optimization problems.

With designing these circuits, we would like to clarify the design methodologies and algorithms of design optimization. Researches on design verification are other main themes, since the 60-70% of the design activities is spent to show the correctness of the design.

Property analysis of logic functions and logical systems are the main tools for the research.

- **LSI/FPGA Design**

  We are interested in hardware design considering the parallelism, reconfigurability and adaptability of LSI and FPGA. The hardware modules include from computation units to full application units. We are using VLSI Design Education Center (VDEC) in University of Tokyo for evaluation and fabrication of LSI. Approximate computing is also studied for error tolerable applications such as recognition and detection problems.

- **Design Automation**

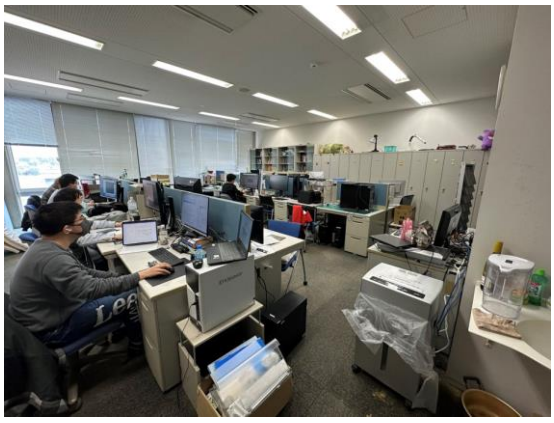
  We are working on the high-level synthesis method where C programs are analyzed and optimized for good LSI implementation. We have developed optimization technologies on CDFG (Control Data Flow Graph) converted from C programs. We are interested in the bit-length optimization of integer and float variables for area and speed optimization.

- **Design Verification**

  We have been working on the logic function manipulation, such as BDD (Binary Decision Diagram), Satisfiability (SAT) of CNF of logic formula. We have also worked on timing analysis and verification based on finite state automata theory. We are also interested in the fabrication test and dependability issues.

3. Other Information

We have several workstations, desktop PC's, notebook PC's, and FPGA boards. Please come and see our lab.



Professor Dr. Shoji Makino

Integrated Systems Field, Intelligent Acoustic Systems Research Laboratory N311, Tel: 093-692-5347, E-mail: s.makino@waseda.jp
URL: https://www.f.waseda.jp/s.makino/

1. Biographical Information

Education

1993 M.E., Tohoku University, Sendai, Japan
1993 Ph. D., Tohoku University, Sendai, Japan

Career

1981–2009 Executive Manager at NTT Communication Science Labs, Japan
2009–2021 Professor at University of Tsukuba, Japan
2021– Professor at Waseda University, Japan

Awards

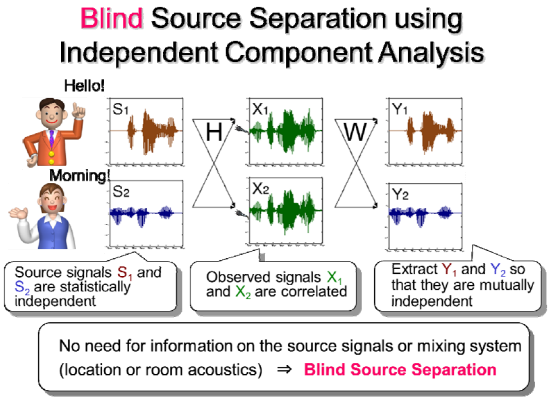
2004 IEEE Fellow
2007 IEICE Fellow
2009 IEEE Distinguished Lecturer
2022 IEEE SPS Leo L. Beranek Meritorious Award
2015 Achievement Award from Japanese Government
2006 ICA Unsupervised Learning Pioneer Award
2018 IEEE SPS Board of Governor
2018 IEICE Distinguished Contributions Award
2017, 1997 IEICE Technical Achievement Award

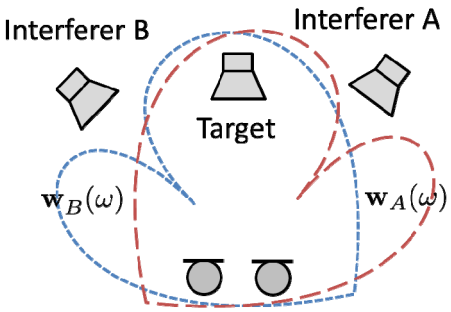
2. Research

How do humans listen to a speech, music, and environmental sounds? We listen with two ears and understand with the brain. How can we realize this mechanism by computers? Through the research on acoustic signal processing, you can learn various skills that will help you in the real life. Also, you can improve your knowledge and resourcefulness, and open up your future,

Research Themes

1) Blind Source Separation
2) Speech Enhancement
3) Speech Dereverberation
4) Microphone Array
5) Acoustic Scene Analysis
6) Acoustic Scene Classification
7) Acoustic Event Detection





Virtual Microphone (Time-Frequency Beamformer)
By switching the beamformer WA that suppresses the interfering sound A and the beamformer WB that suppresses the interfering sound B in each time-frequency point, speech enhancement is possible even in under-determined conditions (3 sources, 2 microphones).

3. Requirements

1) My three lectures
2) Mathematics, Programing
3) International conference

4. Message

Challenge to submit your results to international conferences, discuss with your friends in the world, and enjoy your research activity! My hobbies include walking, traveling, skiing, and diving.

Next-Generation In-Car Hands-Free Communication System

Professor Dr. Toru Tanzawa

Integrated Systems Field, Greening Integrated Systems Laboratory,
Room: N313, Tel: 093-692-5349, E-mail: toru.tanzawa@waseda.jp
URL: http://tanzawa-lab.w.waseda.jp/

1. Biographical Information

Toru Tanzawa is a professor in the Graduate School of Information, Production and Systems at Waseda University. He pursues the Greening of integrated circuits and systems from a circuit design perspective. He has been engaged in research and development of memory, analog, and power circuits at Toshiba and Micron for 25 years and at Shizuoka university for seven years. Dr. Tanzawa holds 280 U.S. patents and has published 60 papers in IEEE conferences and journals. Toru Tanzawa is a Fellow of IEEE. He is included in the world's top 2% of top scientists. He received the B.S. degree in physics from Saitama University, Saitama, Japan, in 1990, the M.S. degree in physics from Tohoku University, Sendai, Japan, in 1992, and the Ph.D. degree in electrical engineering from The University of Tokyo, Tokyo, Japan, in 2002.

2. Research

(Topics)

- Energy harvesting technology
- Semiconductor memory system
- Analog circuit system
- Power conversion system

The shipment volume of integrated circuits, such as IoT devices, AI-specific LSIs, and driver ICs for power semiconductors, continues to expand every year. As a result, the overall power consumption of integrated circuits is also consistently increasing. Low power consumption at both the circuit and system levels, in other words, greening, is becoming increasingly important. In our research laboratory, we are conducting research and development on technologies to green the circuit systems of digital, analog, memory, and power converter used in these LSIs. Each lab member will have the opportunity to gain experience in circuit design (creating circuit diagrams, verifying operation with a circuit simulator, and designing layouts) as well as in the measurement and evaluation of prototype circuits and paper writing, as shown in Figs. 1, 2.

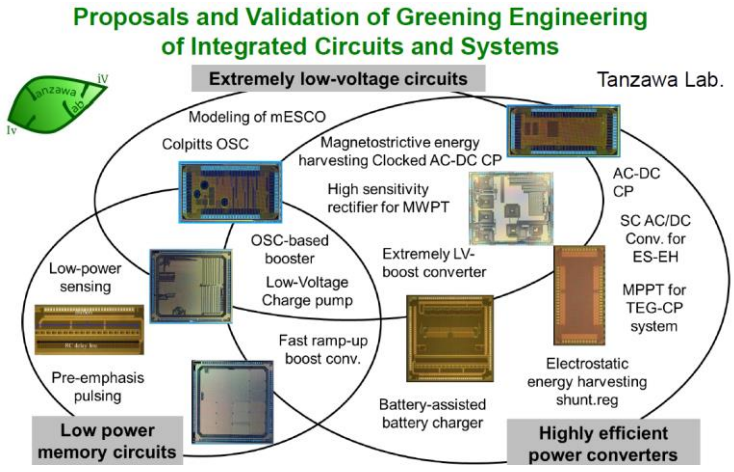


Fig. 1 Research areas and prototype integrated circuits

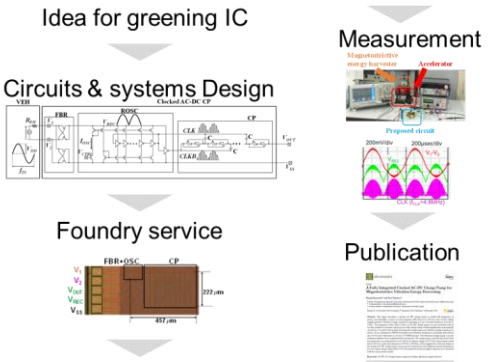


Fig. 2 Research workflow: Lab members can experience things other than foundry services on their own.

3. Message Let's enjoy imagining circuit operation in a physical sense, quantifying characteristics with mathematical sense, and contemplating the greening of the system through overall optimization. If you are confident that you can continue what you are working on, you can do well enough in this laboratory. During the provisional assignment period, you can learn the fundamentals of electronic circuits and circuit design, which will be necessary for your research after the official assignment. Recommended courses are Analog CMOS Circuits, Optimization Technology and Its Applications, VLSI Physical Design, Semiconductor Memory Technology and Engineering during the spring semester, and Integrated Circuit Engineering, Digital Circuits, Analog LSI Design, Semiconductor Device Technology and Engineering during the fall semester. If you have any questions, please contact me by email first.

Professor Dr. Shintaro Yamasaki

Integrated Systems Field,　Integrated System Optimization Lab
Room: N321　Tel: 093-692-5371　E-mail: s_yamasaki@waseda.jp

1．Biographical Information

I have worked in companies for about 10 years and in academia for over 10 years. Based on these experiences, I am engaged in *innovative manufacturing through optimal design*.

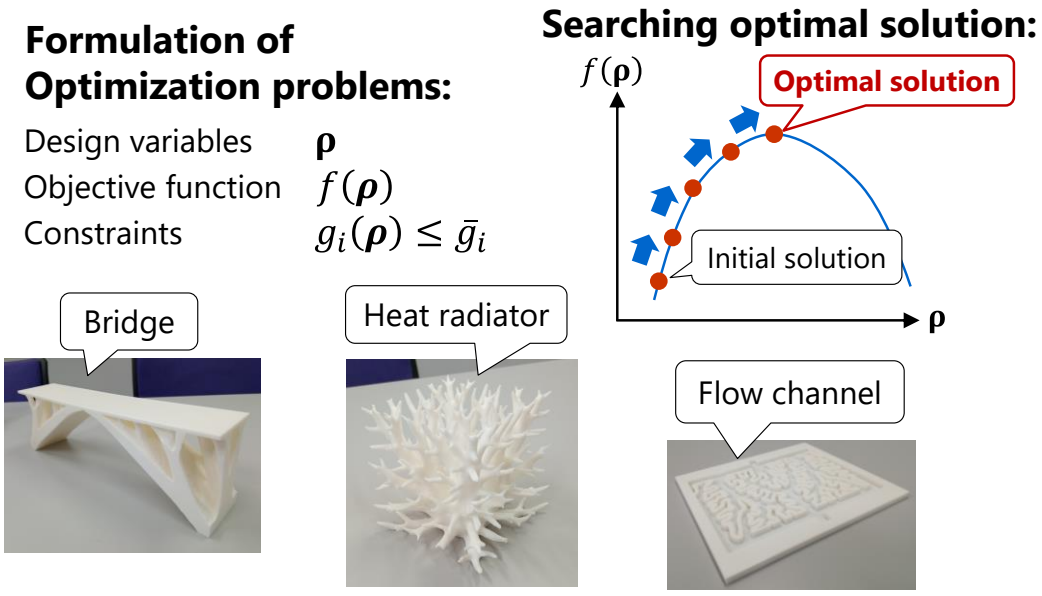
2．Research

Yamasaki Lab promotes basic and applied research on the optimal design of integrated systems in abroad sense. Optimal design consists of formulation, i.e., determining the following for a real-world design problem:

- Design variables - Factors that can be determined by the designer
- Objective function - An evaluation index of the design target that should be maximized or minimized
- Constraints - Conditions that the design target must satisfy

and deriving its optimal (or locally optimal) design solution using mathematical programming, metaheuristics, and so on. The figure illustrates the process of searching for the optimal solution using sensitivity information, which represents one of the simplest methods for optimal solution search.

For optimal design problems with a small number of design variables, that is, a small degree of design freedom, it is possible to obtain an optimal or quasi-optimal solution using human intuition and experience. However, as the degree of design freedom increases, finding the optimal solution through intuition and experience becomes extremely challenging. For example, the figure shows optimal structures of a bridge, a heat radiator, and an electrolyte flow channel. In these cases, a structural design methodology called topology optimization is used to search for solutions with hundreds of thousands of design degrees of freedom. The resulting optimal structures exhibit highly complex structures, resembling the morphology of living things. However, it would be difficult for most individuals to derive such structures based solely on intuition or experience. My research focuses on developing design methodologies that generate innovative optimal structures.



Optimal structures going beyond limits of human thinking

3．Message

Optimal design for integrated systems has the potential to derive various innovations in society. I am looking for students to collaborate on research that can make a global impact.

Prof. Toshihiko Yoshimasu

Biography

Graduate School of Information, Production and Systems,
Waseda University, Kitakyushu, Japan
2-7, Hibikino, Wakamatsu-ku, Kitakyushu, 808-0135, Japan
E-mail: yoshimasu@waseda.jp
Tel&Fax: +81-93-692-5358

Professional career

Toshihiko Yoshimasu received the B.E. degree and the Ph.D degree in Electronics Engineering from Kobe University in 1981 and 1999, respectively. He joined Central Research Laboratories of Sharp Corporation in 1981 and worked for Sharp for 22 years until 2002. He was the manager of Si RF IC and GaAs MMIC design groups. After leaving Sharp in 2003, he became a Professor at Graduate School of Information, Production and Systems at Waseda University, Kitakyushu in April, 2003.

Research career

Dr. Yoshimasu worked on design mythologies of high frequency operating transistors and monolithic microwave integrated circuits (MMIC). Regarding transistor research, he, as a key member, has developed a low noise GaAs MESFET having a noise figure of 1.3 dB at 12 GHz in 1985, and he also has developed very low noise AlGaAs/GaAs High Electron Mobility Transistor having a noise figure of 0.6 dB at 12 GHz in 1990. In a research on MMICs, GaAs MESFET MMICs integrating a two-stage low noise amplifier, an image rejection filter, a mixer and a five-stage broadband amplifier have been developed for 12 GHz Broadcast Satellite receivers in 1991. These MMICs are the first report of image rejection frequency down-converter integrating the image rejection filter.

Regarding bipolar transistors, Dr. Yoshimasu, as a senior member, has developed AlGaAs/GaAs Heterojunction Bipolar Transistors (HBTs) for high power applications. Moreover, high power amplifiers for mobile communication systems such as PHS and GSM have been developed.

Since recent Si CMOS technologies have drastically enhanced, the cut-off frequency has reached over 200 GHz. Thus, several RF ICs such as amplifiers and oscilators have been designed and evaluated for wireless communication systems. RF IC:Radio Frequency Integrated Circuits.

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Professional and advisory activities

Dr. Yoshimasu is a committee member of Asia Pacific Microwave Conference (APMC) and was a committee member of Microwave Workshop and Exhibitions (MWE). He is a senior member of the Institute of Electronics, Information and Communication Engineering (IEICE) and the IEEE..

Current Interest

Dr. Yoshimasu's current research interest includes Si and SiGe RF ICs for wireless communication systems such as WLANs and mobile phones. Especially, 1) analysis of transistor linearities, 2) highly linear power amplifier RF ICs with Si CMOS and SiGe HBTs, 3) SiGe broadband low noise amplifier and oscillators, and so on.

Associate Professor Dr. Takaaki Kakitsuka

Light Emitting Systems, Integrated Systems Field
Laboratory: N317, Tel: 093-692-5364, E-mail: t.kakitsuka@waseda.jp

1. Biographical Information

Education:

1994 B.S. in Physics, Kyushu University
1996 M.S. in Physics, Kyushu University
2012 Dr. of Engineering, Kyushu University

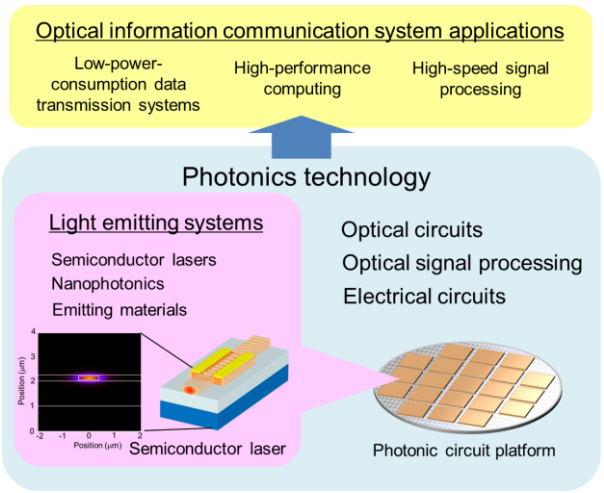
Experience:

1996–2019 Nippon Telegraph and Telephone Corporation (NTT)
2016–2019 Part-Time Lecturer, Shonan Institute of Technology
2017, 2018 Visiting Professor, Kyushu University
2019– Associate Professor, Waseda University

Research carrier: He has engaged in the study of semiconductor optical devices and their applications for optical communication systems at NTT laboratory. He has studied optical devices for transmission systems such as semiconductor lasers, optical amplifiers, and modulators. He has experienced a wide range of research fields from semiconductor material design to optical transmission systems. He has studied photonic integrated circuits and fusion of III-V compound semiconductors and silicon, aiming to reduce the power consumption of information communication equipment by introducing optical data transmission. He has achieved the world's lowest operating current (4.8 μA) of photonic crystal lasers and their optical signal transmission. He has also achieved 100-GHz directly modulated lasers for the first time by developing a laser integrated on a SiC substrate.

Academic society: IEEE, IEICE, JSAP, JPS

2. Research



Photonics technologies have sustained the progress of information society through the various information communication system applications such as optical communication, sensing, and measurements. Semiconductor lasers have attractive functions which can be applied to optical data transmission, computing, and signal processing.

Our laboratory studies novel light-emitting devices and their information communication system applications. We are currently studying (1) High-performance semiconductor lasers on silicon for optical interconnection, (2) high-speed and extended-reach optical transmitters for optical fiber transmission systems, (3) photoelectric conversion devices for terahertz-light generation, and (4) photonic integrated circuit design. We propose and design novel devices and systems by using commercial simulators and simulator development. These themes are conducted in collaboration with universities, research institutes, and companies. We are trying to expand research fields and put the technologies into practical use through the collaboration.

3. Message

Photonics technology is used everywhere around us. We welcome students having interest in challenges to make advances in communication and information processing by using optical devices and systems. Please feel free to visit our laboratory.

Recommended courses: Optical Circuit Simulation Technology, Laser Engineering, Solid State Physics, Optical Semiconductor Devices, Opto-electronic Integrated Circuits

Associate Professor Dr. Kiyoto Takahata

Integrated System Filed, Opto-electronic integrated system Laboratory
Room: N323　　tel: 093-692-5372　　e-mail: k.takahata@waseda.jp

1. Biographical Information

Education

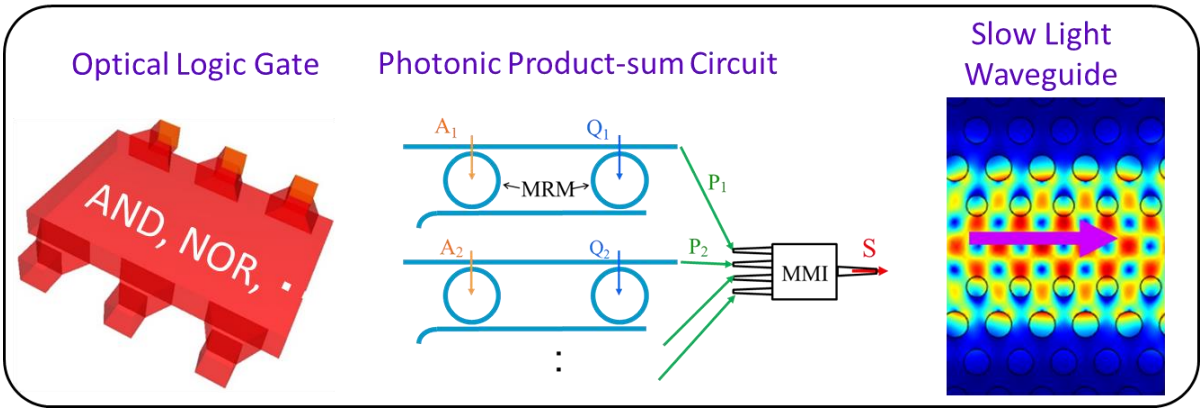
Mar. 1988　B.E., Physical Engineering, Kyoto University
Mar. 1990　M.E., Physical Engineering, Kyoto University
Mar. 2010　Ph.D., Engineering, Tokyo Institute of Technology

Experience

Apr. 1990 – Mar. 2016　NTT (Atsugi R&D center)
Dr. Takahata was engaged in research on opto-electronic integrated circuits and highly functional optical modules. He had worked on development of new business for optical devices in U. S. for one year from Nov. 2006.
Sep. 2012 – Mar. 2016　Part-time Assistant Professor, Tokyo Polytechnic University
Apr. 2016–　Associate Professor, Waseda University

2. Research

In our laboratory, we study optical devices and photonic integrated circuits based on silicon photonics technology. Aiming to create new technologies for high-performance and low-power-consumption optical devices and circuits, and optical circuits with new functions, students set their own research themes and work actively, mainly from the aspect of design. We have reported an optical logic gate device, photonic product-sum circuit, low-power optical modulator, slow-light optical waveguide, etc.
These optical devices and circuits have wide applications range, including optical communication networks, optical signal processing, and life sciences, and will play an important role in the future.



Research Themes

- Photonic integrated circuits for optical signal processing
- Photonic crystal waveguides
- Low-power-consumption optical modulators

For research in my lab., students must understand well contents in following courses.
Optical Semiconductor Devices, Opto-electronic Integrated Circuits, Electromagnetics, Optical Circuit Simulation Technology, Laser Engineering, Solid State Physics.

3. Message

I hope that all students have a fulfilling campus life and I also advance with them. So, please keep followings in your mind.

・Don't be afraid to fail. Let's research with free thinking.
・Do everything at your own initiative.

Associated Professor Dr. Kazunori Serita

Integrated Systems Field, Terahertz Integrated Systems
Laboratory :N303 tel: 093-692-5298 E-mail:

1. Biographical Information

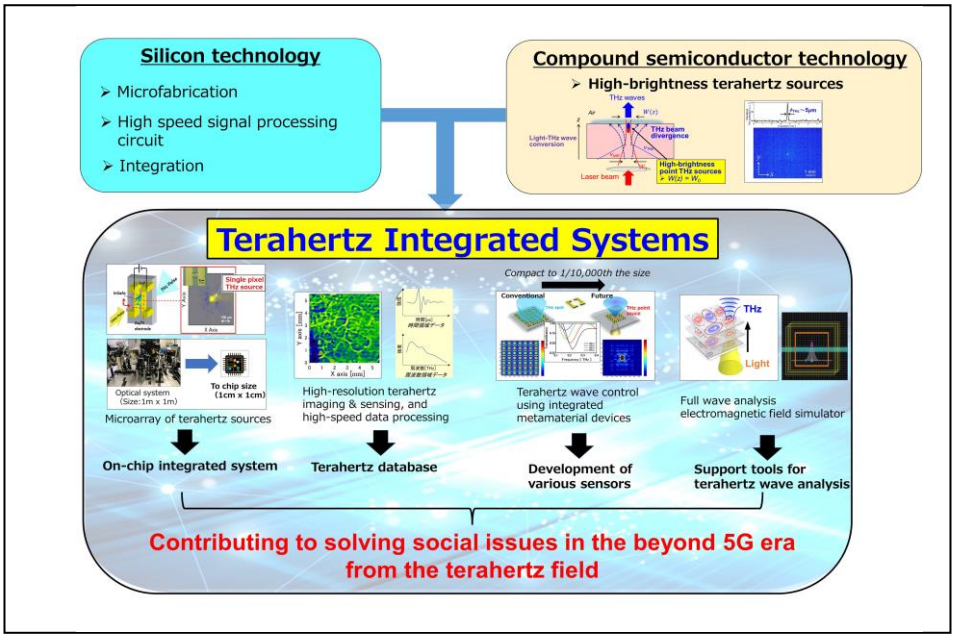
Kazunori Serita was born in Ogori City, Fukuoka Prefecture. He received the M.E. and Ph. D degrees in electrical engineering from Osaka University, Japan, in 2011 and 2014, respectively. From April 2014 to March 2015, he worked as JSPS research fellow (PD). From April 2015 to September 2022, he worked as a postdoctoral researcher and a specially appointed assistant professor at the Institute of Laser Engineering at Osaka University. Since 2021, he joined JST FOREST program as a principal investigator. From October 2022 to March 2024, he worked as an associated professor at the Office of Management and Planning, concurrently with a post at the Institute of Laser Engineering at Osaka University. In April 2024, he joined his current position at Waseda University.

His expertise lies in terahertz wave engineering, focusing on the development of sensors and light sources operating in the terahertz frequency range. Using a uniquely developed terahertz measurement system, he has conducted evaluations of various materials and explored sensing technologies.

2. Research

In the Beyond 5G era, various services using the terahertz frequency band (0.1THz to 10THz) are expected to become widespread, and the development of related systems and sensors is receiving much attention. On the other hand, due to the unique characteristics of terahertz waves, there are various problems such as propagation loss in the air, low spatial resolution, and low output power. Furthermore, the development of highly sensitive and compact terahertz systems and sensors has significantly lagged behind that of other electromagnetic waves due to the mainstream use of large and expensive solid-state lasers.

In order to solve these problems, our laboratory will develop terahertz wave sources using compound semiconductors, and by combining them with silicon technology, we will develop various terahertz integrated systems from both the software and hardware. Specifically, we explore efficient conversion conditions from light to terahertz waves through electromagnetic field analysis, aiming to develop high-brightness terahertz wave sources. Using these sources, we will conduct applied research toward highly sensitive terahertz sensing technology, efficient data processing methods, and integration. We will also focus on metamaterials, which have gained attention as terahertz wave controllers, and advance research utilizing these materials. Our goal is to promote the widespread adoption of terahertz technology, contributing to solving social issues in the new era.



3. Message

Terahertz waves are unexplored electromagnetic waves, and the possibilities for future communication and sensing technologies are expanding. We look forward to working together to pioneer this field and contribute to the advancement of future terahertz technology.