

Ttime!

Student-edited Faculty of Engineering PR Brochure



Engineering Collection

Showcase: Engineering Viewpoints from 5 Fields of Study

- ▶ Supporting Human Life
- ▶ Controlling the Movement of Objects
- ▶ Expanding IT Possibilities
- ▶ Viewing Materials at the Micro Level
- ▶ Designing Functional Materials

Learning at the Faculty of Engineering
About Ttime!

FACULTY OF ENGINEERING
THE UNIVERSITY OF TOKYO

What is the Faculty of Engineering?

Most students do not even learn about the field of engineering in high school. Thus, we prepared this brochure to help such individuals develop even a slight sense of what the Faculty of Engineering is doing and how it is interesting.

It is extremely difficult to specify just what engineering is. As you can see from the fact that there are sixteen departments in the Faculty of Engineering at the University of Tokyo, the engineering field of study encompasses quite an extensive range of subjects including architecture, urban engineering, mechanical engineering, design, mathematics, information, physical properties, nano, chemistry and biotechnology. Furthermore, architecture for example embraces a variety of approaches and in addition to the material, structure, and design of a building, how people will move in and around the building also has to be taken into consideration.

We think this variety of research being carried out shows that the Faculty of Engineering attracts people with a shared awareness that “the application of science and technology is integral to creating a foundation for tackling global issues”.

In this issue, the Faculty of Engineering is addressed under the following five general themes.

- 1 Supporting Human Life
- 2 Controlling the Movement of Objects
- 3 Expanding IT Possibilities
- 4 Viewing Materials at the Micro Level
- 5 Designing Functional Materials

We hope we have been able to convey even a hint of the great variety of independent research taking place at the Faculty of Engineering and how interesting the projects are.

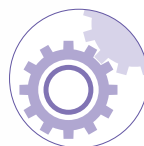




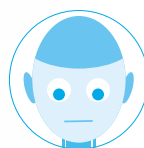
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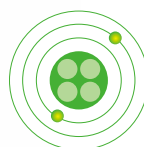
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Supporting Human Life

Architecture

Urban Engineering

Social Systems

Administration

In the ‘towns’ where we live every day, many of the technologies used in daily life seem commonplace. In this field, we interviewed Prof. Sekimoto, who carries out research on urban informatics.

What is urban informatics?

My research is on urban informatics. Many people may not have heard the term ‘urban informatics’, but to explain briefly, it is the study of “using various information about cities” just like location information is used by Google Maps, as one such common example. The reason I work in this field is to realize urban planning so people can easily enjoy life, and to reduce local government and citizen burdens by making good use of information collected from people.

When I was in elementary school, I liked place names, railways, and towns, and when I entered The University of Tokyo, I was interested in the design and planning of national lands and cities, so I entered the Department of Civil Engineering. At that time the criteria for planning were often vague in the fields of national land planning and urban planning, and I thought that if information was used in these fields, I could obtain a clear standard. Since then, I have been seeking an ideal urban form for the future utilizing car navigation system and mobile phone location information to visualize the flow of people in cities with populations from 1 to 10 million people, and predicting a future urban structure from currently publically available urban information.

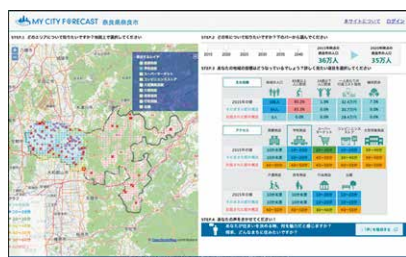


Figure: based on published data, the “MY CITY FORECAST” system visualizes regional urban structural changes caused by declining birth rates and aging populations

‘Visualizing’ the flow of people

Since the first research I conducted was to visualize the flow of large-scale people on a map, it was called the “Flow of People Project”. In this project, diverse sets of big data were collected by amassing data from recently developed measuring devices such as IC tags, smartphones, and GPS. Using this data made it possible to discuss urban design from a variety of perspectives including disaster prevention, crime prevention, marketing, and transportation. Continuing this work a step further, adding ‘invisible information’ such as factory production efficiency and office work circumstances to the ‘people’s flow’

may allow for proposing a more advanced urban model. Furthermore, the use of urban informatics with machine learning is recently being promoted. For example, a system to automatically monitor the degree and location of road damage can be obtained by simply recording with a smartphone installed in an official vehicle, and a system that identifies flying objects can be used to observe illegal drones. When I was a university student I was no good at programming, but as the need arose I had no problem learning (laughs).

Engineering ‘manufactures objects’

‘Making things’ can most likely be given as a characteristic of ‘engineering’. The image for engineering has an image of its being more difficult to obtain the Nobel Prize when compared with science. However, the theory of science alone can not maintain society well, and theory itself can not be applied to real life. In other words, there is a definitive chasm between the fields of science and engineering, and the real thrill of ‘engineering’ may be in creating technology that bridges that gap. Personally, I aspired towards engineering because I wanted to make things, but all the same, I think you are either attracted to it or you aren’t. High school students interested in engineering, please give whether you like science or engineering better some thought.

Associate Professor
Yoshihide SEKIMOTO

2002: Doctor of Engineering, Department of Civil Engineering, School of Engineering, The University of Tokyo
2013-present: Associate Professor, Institute of Industrial Science, The University of Tokyo and concurrently Department of Civil Engineering, School of Engineering, The University of Tokyo



What is the Furuichi Kōi statue?

When you walk around the Hongo campus, bronze statues can be seen everywhere. Primarily these statues depict professors who supported the development of scholarship in Japan since the University of Tokyo was established, and there are also several statues in the area and square around the Faculty of Engineering buildings. Among those, and the one we present here is the large bronze statue seen to the left as you enter the main gate and head left. It is the statue of Furuichi Kōi. Furuichi Kōi was so passionately engaged in learning that he is quoted as saying “If I rest a day, Japan will lag behind a day”. He laid the foundation for modern engineering in Japan, and for civil engineering in particular.

Sitting on a seat and watching students walk around the campus is quite dignified. Well, a little episode is associated with this statue. The name of the award at the Department of Civil Engineering for an outstanding Masters thesis is named the ‘Furuichi Award’ after him, and it is customary for students receiving the Furuichi Award to clean the bronze statue every spring.

There are various commemorative monuments and statues on campus other than the example given in this issue, and noticing them may make walking on campus more fun.



The Furuichi Kōi statue on the Hongo Campus

Fieldwork presentation!

As well as the classes held on campus the numerous Faculty of Engineering curriculums also include active fieldwork studies.

For example, reconstruction plans for disaster areas and reconstruction plans made in advance for future disasters are proposed at the Urban Redesign Studio, a seminar for members of any one of three departments at the School of Engineering at the University of Tokyo: Civil Engineering, Urban Engineering, and Architecture. In the 2019 academic year, we proposed a reconstruction plan made in advance for a Nankai Trough tsunami, targeting five municipalities in the Nanyo area (south of Ehime Prefecture). Reconstruction planned in advance refers to promoting disaster-resistant community development before a disaster strikes. This is done by studying a reconstruction process in preparation for a disaster and implementing countermeasures to cope with the situation. The seminar includes actually visiting the target area, walking around the site, and conducting a field survey over several days as local residents are interviewed. Teams formed of approximately five people from different majors cooperatively deliberate a reconstruction plan to make in advance. Each group presents its plan to the local residents, so the primary challenge in the seminar is to

create a plan that can actually be used as a local disaster countermeasure, rather than to be of no further benefit at the end of the seminar. As is evident in this example, one of the interesting things about the Faculty of Engineering is that studying is not limited to sitting behind a desk, but includes a variety of lectures and seminars.



Yawatahama, Ehime Prefecture



Controlling the Movement of Objects

Machines

Heat and Movement

Design

Vehicles

Many machines surround us. In order to operate such a machine the way we want to, correctly understanding the machine's movement, and designing and controlling it is crucial.

In this field, we present the story of Professor Nakano who carries out research on automobiles.

Machine Control

When I was a student, I primarily did research on the control of cars and trains. That research had to do with active suspension, which uses an actuator between the wheel and the vehicle body to reduce the vibration from the wheel. At that time a hydraulic cylinder was used, but in my research using an electric motor, by recovering some of the vibrational energy and using again as a power source my control was aimed to prevent reduced fuel consumption.

Human-machine Interaction

At Yamaguchi University where I previously worked, I was engaged in totally different research, but I returned to the University of Tokyo and decided to research automobiles again. While I was away from the University of Tokyo, driver support technologies began to be put to practical use. For example, one of the driver support technologies is the collision avoidance system. This technology automatically puts on the brakes and slows a car down when it is about to crash. For this technology, the timing of when to apply the brakes became crucial. If cars automatically apply the brakes just when driver are getting ready to put on the brakes, drivers may respond with a thought about how they were just going to do that. In other words, considering the timing of human reaction and, in turn, human-machine interaction is essential.

After that, I began research on steering with the steering wheel. Haptic assistance has to do with making driving somehow or another easier when the steering wheel is moved slightly in the direction the car should go. This technology is kind of like the lane keeping assist system, which can keep a car within its lane



Figure: Driving Simulator

even if the driver does not move the steering wheel and which has already being used on the road. We have examined how much assistance is appropriate by looking at human responses on driving simulators. Currently, our research theme has shifted to automatic driving, and we are studying how to put automated driving cars onto roads where people are driving.

What is engineering?

When discussing the difference between science and engineering, Einstein said, "Scientists investigate that which already is; Engineers create that which has never been." Scientists find what originally existed. Their quest is for truth. Engineers make things that have never before existed.

The truth is studied up through high school. If you want to make new things using what you have learned so far, please come to the Faculty of Engineering.

Professor Kimihiro NAKANO

2000: Doctor of Engineering, Department of Industrial Mechanical Engineering for Production, School of Engineering, The University of Tokyo
2006: Associate Professor, Institute of Industrial Science, The University of Tokyo
2018: Professor, Institute of Industrial Science, The University of Tokyo



Class schedule!

This is a class schedule for the Mechanical Engineering Department, which is one of the departments closely related to this field.

The large number of classes related to 'dynamics' and seminars that are held four times a week must stand out. The Department of Mechanical Engineering offers lectures primarily on the four fundamental disciplines of mechanics, which are mechanical dynamics, material dynamics, thermodynamics, and fluid dynamics, in the fields of design, control and nano. Seminars have extended time slots, and third year students design and produce a Stirling engine (shown in the photograph) in the S semester*, while they make products using computers, sensors, motors and the like under the theme of 'interesting things' in the A-semester*. Seminars can actually validate and deepen the comprehension of classroom learning. In addition to these sorts of class subjects at the Faculty of Engineering, are

other classes and projects offered throughout all undergraduate Faculties. One of them, the 'Creative Manufacturing Project', is presented below.

	Monday	Tuesday	Wednesday	Thursday	Friday
1 8:30~10:15	Statistical Mechanics	Thermal Engineering	Human Interface	Production System	Fluid Dynamics
2 10:25~12:10	Design Engineering	Robotics	Mathematics	System Control	Material Mechanics
3 13:00~14:45	Seminar	Seminar		Seminar	Seminar
4 14:55~16:40					
5 16:50~18:35					

(S semester* 2019 timetable for 3rd year students in the Department of Mechanical Engineering)

*During the academic school year, the first half (April to July) is called the S semester and the second half (late September to January) is called the A semester.

What is the Creative Manufacturing Project?

The Creative Manufacturing Project is a class that trains students' practical skills as they develop a finished good from scratch, from initiating product planning, designing, manufacturing, through to bringing it to society. Some of the eleven projects offered in S-Semester* are presented.

1. Historic Rally Abroad Project

This class participates in the motor sports 'Rallye Monte-Carlo Historique' set in Monaco, with their excellent 1970-model cars being entirely disassembled, repaired and restored with student skill. Vehicle assembly is not the only requirement. Students also become skilled at public relations and publicity in order to secure a sponsor, acquire web design and export procedure skills, and develop an international viewpoint and organizational management skills in order to participate in events abroad.

In this tenth year for the class, we give this challenge everything we have. "We are dedicated to pursuing this venture to achieve good results in the world's highest level historic rally, will globally share images of students steadfastly tackling hardships, will make a deep impression on society and will stimulate the resurgence of the industrial powerhouse, Japan."

Historic Rally Abroad Project: Photo at the finish line▶

2. Sports IT Project

Virtual reality has recently become a hot topic. We continue to make inroads in industries including fitness and sports. In this class, we will develop a VR app for tennis training that displays overlapping arm and ball trajectories.

3. Robot Competition Project

We aim to win at the NHK Student Robocon, Japan's largest robot contest, and the international ABU Robocon convention. In this project mechanical, electrical and control engineering knowledge is set in motion and robots are made from scratch.



*During the academic school year, the first half (April to July) is called the S semester and the second half (late September to January) is called the A semester.



Expanding IT Possibilities

Mathematical
Informatics

Information

Intelligence

Robot

IT (Information Technology) has become an indispensable part of everyday life. In this field, which has been attracting attention in recent years, we asked Professor Kuniyoshi, who is engaged in research on robots and AI (Artificial Intelligence), and Professor Aizawa, who is engaged in research on multimedia and image processing.

— What topic are you currently researching?

Professor KUNIYOSHI (hereafter, KUNIYOSHI): The Department of Mechano-Informatics catchphrase, which I personally composed, “Knowing people, creating robots, making robots, approaching humans” is the stance I take in research. In order to create robot movement, we clarify the development and movement of living things including humans. For example, we simulate the development of the fetus, and create robots that perform flashy movements as shown in Figure 1 to focus on the ‘knack’ for a movement. We are also researching technologies that actually make things, such as artificial muscles, sensors, and soft robotics *1.

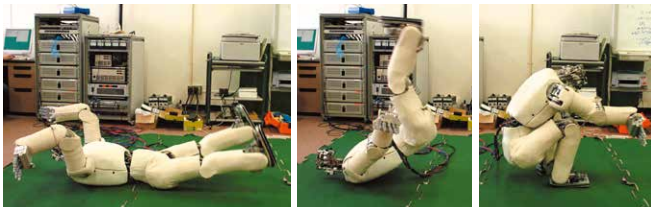


Figure 1: Jumping robot

Professor AIZAWA (hereafter, AIZAWA): I am interested in new media technology and its applications. I have been working on ‘Foodlog’ for nearly 10 years, taking food photos, understanding dishes, calculating nutritional value, and taking records. I recently developed that into an app for athletes and their dietitians (Figure 2). I am also researching a movie map that gives directions with images. By switching and connecting multiple omnidirectional videos previously taken at points such as intersections, you can

watch navigation videos. Creating such new media is interesting. I have also created tools that propose fonts that possibly fit the atmosphere of pictures and images, and a dataset *2 of manga (Japanese comic) images called Manga109.

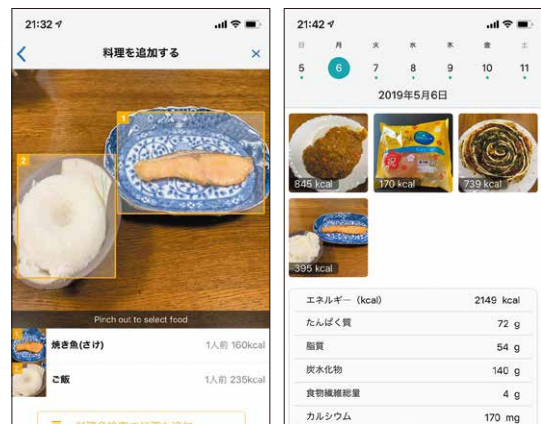


Figure 2: Foodlog app Screenshot

— What makes this field fascinating?

KUNIYOSHI: I think robots and AI alone are attractive. I feel that we adventurously pursue dreams of creating robots that are smart like humans or move like creatures and creating AI with human mind functions. Conversely, that also indicates that technology must still advance. The more you do, the more you know the magnificence of living organisms, and the more the scope for research continues to expand. That is exciting.

AIZAWA: In the end, I think my research is creation. The reason for that is because I have a simple feeling that it would be nice



to make something that surprises, delights or impresses everyone. Although I have so far been engaged in research in various fields, the lifelog *3 that I started when I was around the age of 40 had a major impact on subsequent research. I have realized that the problem setting is important for creation.

KUNIYOSHI: Setting up a problem is something you never experience in high school. In the field of research, students need to formulate good problems by themselves, not solve given problems.

— What do you think is required to appropriately establish a problem?

KUNIYOSHI: First of all, I think it is necessary to study, but regardless of what you have studied or current trends, it is better to think about questions that arise from your fundamental interest and humanity.

AIZAWA: That's absolutely correct. When you search for common ground between a research topic and something you like, you will be able to come up with new problems and work becomes smoother.

— Please tell us about the future prospects and expectations in your field.

KUNIYOSHI: In order for AI and robots to become globally widespread, it is necessary to have no-mistake credibility and autonomous behavior. To that end, I think we need to go back to how humans learn and act in the first place. And in addition to technology, I think it is necessary for people in various positions, including engineers, to think about how AI and robots can be used to change society.

AIZAWA: In the IT world an enormous amount of data is required for deep learning and AI, so many people are interested in the major issues which have accumulated a large amount of data, and I feel as if the number of people trying to tackle new issues is declining. Research issues require diversity. For example, one solution might be to look for common ground with things that you really like as I mentioned earlier.

KUNIYOSHI: People tend to just try to make things easier, and there are many issues that are important but difficult to deal with and that no one tackles. I think it is important for us to struggle and propose new things without deliberating efficiency.

*1: The research field that deals with robots made out of soft materials.

*2: A set of data processed by computer.

*3: Recording daily human life in digital data form. Foodlog is an example of a lifelog.



**Professor
Kiyoharu AIZAWA**

1988: Doctor of Engineering, Department of Electrical Engineering, The University of Tokyo
2001-present: Professor, Department of Information and Communication Engineering, School of Information Science and Technology, The University of Tokyo, and concurrently Department of Information and Communication Engineering, Faculty of Engineering, The University of Tokyo

**Professor
Yasuo KUNIYOSHI**

1991: Doctor of Engineering, Department of Information Engineering, School of Engineering, The University of Tokyo
2005-present: Professor, Department of Mechano-Informatics, School of Information Science and Technology, The University of Tokyo, and concurrently Department of Mechano-Informatics, Faculty of Engineering, The University of Tokyo

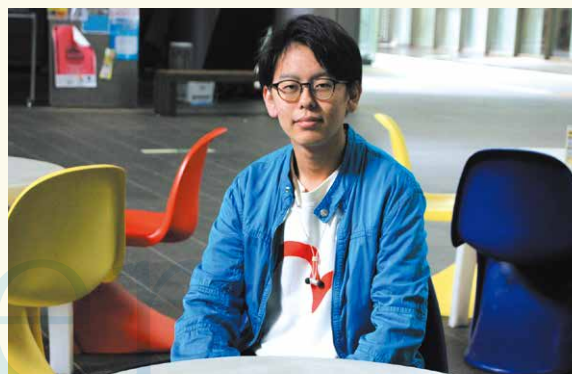


Venture Entrepreneur Interview

I began in the Natural Sciences I stream in 2015, and took a year off when in my third year, so I am currently in my fourth-year in the Department of Aeronautics and Astronautics. As a university student I decided to study design using digital tools, joined a design circle, and worked as an intern. During that time, I wanted to do more design work, and decided to take a year off from my university studies. When I was thinking about how to spend my year off, someone I knew asked me to start a business. I was also interested in entrepreneurship, so we created a company called 'Flatt'. Our first service was called 'PinQul' and it allows products to be purchased while watching live streaming. However, in the course of in depth optimization, that became a service that can be provided even if we do not do it ourselves. So now we have changed over to a cyber security BtoB* business. There is a variety of people in Tokyo, and I think there are many opportunities to be had. Moreover, I sense that among the interesting people in Tokyo, the University of Tokyo is a place where particularly interesting people gather. Once you enter a university, I think it would be advantageous to have more than one

extracurricular activity. My work began with designing a welcoming party for new circle members, subsequent work steadily became interesting, and as jobs became recurrent I started a business. If you do something interesting based on your current skills, more and more things become possible. Without limiting yourself to university classes, I think it would be nice to try areas of your own interest.

Department of Aeronautics and Astronautics, Fourth-year
Keijiro TOYODA



*Abbreviation for Business to Business.



Viewing Materials at the Micro Level

Physical Properties

Electrons

Nano & Micro

Molecule

Although small particles such as atoms and electrons are invisible, they actually play a major role in determining the properties of matter. This interview is with Professor Sugimoto who researches microscopes that look at such microscopic worlds.

Everything is made of atoms

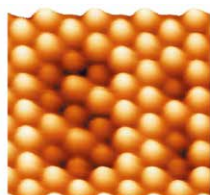
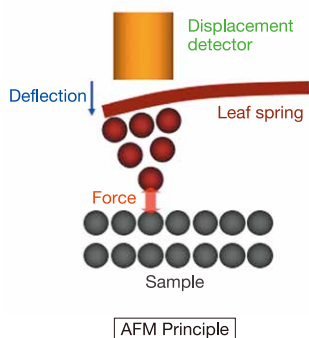
The physicist Richard Feynman wrote in his book, "If, in some cataclysm, all of scientific knowledge were to be destroyed, and only one sentence passed on to the next generations of creatures, what statement would contain the most information in the fewest words? I believe it is the atomic hypothesis" The atomic hypothesis is the idea that everything is made of atoms. As Feynman says, atoms are a core concept of modern science.

For example, the distance current flows in a transistor* shrinks to approximately ten or twenty nm, that is, the size of a few atoms. Therefore, transistor performance changes depending on the number, position, and type of atoms that make up the transistor. This is why techniques to manipulate atoms on a single level and techniques to identify types of elements are important.

See, measure and move atoms with an AFM

What we need to work with matter at the atomic level is an atomic force microscope (AFM) that I specialize in. The surface of the material is traced with a needle whose tip is as small as a single atom, and the force generated between the atom at the needle tip and the atom at the sample surface is measured at that time. This is how we are able to know the state of a sample surface at the atomic level. An AFM has diverse applications.

For example, observing the skeletal structure of a molecule can help determine the product of a chemical reaction. In addition, by measuring the chemical bond strength between the atom at the tip of the needle and the atom on the sample surface, allows the determination of which element the surface atom. Furthermore, it is also possible to move the atoms on the sample surface with a needle. As shown in the picture, the procedure is so precise that atoms can be manipulated into



In a sample surface containing a mixture of Sn (Tin) and Si (Silicon), Si atoms are moved around to write 'Si'

alphabetic letters. By applying these technologies, we assemble various nanostructures and identify and manipulate atoms comprised in nanodevices to create new functions.

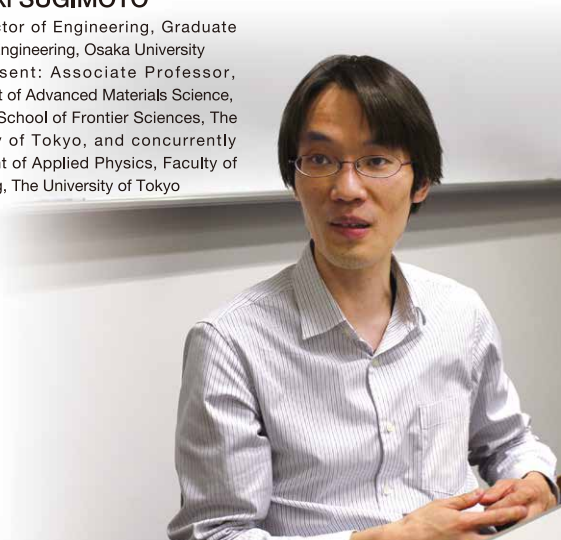
Why micro is fascinating

In general measurement, since information on a large number of atoms in a sample is averaged and evaluated, different data may be obtained depending on the quality of the sample and the influence of impurities. However, with an AFM measurement, since the information is taken from a single atom, the same result will be obtained no matter who measures it whether the measurement is ten or even one hundred years later. I think that obtaining invariant data is the fun of this field. Many people in various fields including physics, chemistry, and materials come to my lab. The attractiveness of this research lab is that people who work here can make the best use of their respective interests and strengths those in physics use electronic properties and magnetism in nanostructures, those in chemistry use organic molecules, and those in materials use nanomaterial deformation. Teamwork is very important in the lab where such a variety of people gather. I think that while students are still in high school it is important to improve communication skills by experiencing a lot of things in cooperation with others.

*A device for amplifying or switching current.

Associate Professor Yoshiaki SUGIMOTO

2006: Doctor of Engineering, Graduate School of Engineering, Osaka University
2015-present: Associate Professor, Department of Advanced Materials Science, Graduate School of Frontier Sciences, The University of Tokyo, and concurrently Department of Applied Physics, Faculty of Engineering, The University of Tokyo



The lab has this kind of equipment!

These AFM (atomic force microscope: refer to the facing page) and STM (scanning tunneling microscope) devices are capable of making simultaneous measurements. A STM can observe the surface of a sample by measuring the current that flows between the needle and the sample surface when electrical current is applied to the needle tip and sample. Therefore a STM can only observe the conductor through which the current flows. AFM, on the other hand measures the force between the needle and the sample, so insulators can be observed as well. Composite AFM and STM observations simultaneously provide a variety of information.

An ultra-high vacuum with a pressure of 10^{-9} Pa is inside the device where the sample is placed and observed (in the photo, where the round window is open). In order to create a vacuum, the interior needs to be heated to 200°C , and the device is covered with aluminum foil to uniformly heat the inside of the device.

In order to make the world's most advanced measurements, you must also make your own measuring equipment. When I was working at Osaka University, we personally built all these devices by ordering parts from town factories in Osaka. Even now, I am in the process of making a new

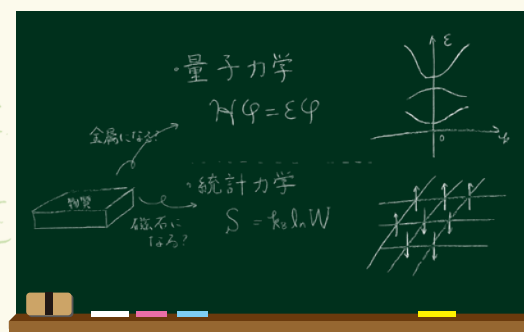
microscope. We aim to detect monoatomic spins by applying a magnetic field of 11T (Tesla) at ultra-low temperatures.



Equipment owned by the Sugimoto Lab

What physics is studied at UTokyo?

Here we will present a bit of the physics we study at UTokyo on the subject of matter. A substance is made up of a large number of atoms and electrons. Thus, when thinking about the behavior of matter and considering all the forces acting on each particle, solving a very complex simultaneous equation with a large number of unknowns is required. That is the idea of statistical mechanics comes into play. We aim to simplify the situation by focusing on the essential force acting on each particle, and successfully predict the properties of the whole substance. The fact that we want to deftly manage a large number of things is common to machine learning that we recently hear a lot about, and sometimes we use the theory of statistical mechanics. In addition, small particles like electrons exhibit strange behavior that cannot be predicted with Newtonian mechanics (\approx mechanics learned in high school). Quantum mechanics deals with such small-scale things, and helps us understand chemical bonds and material properties. Phenomena unique to quantum mechanics are fundamental when designing the abovementioned microscopes.



UTokyo Physics and Matter



Designing Functional Materials

Chemistry

Organic

Bio

Cell

Using existing substances and methods, and the power of chemistry you can create materials with entirely new functions. In this field, we spoke with Professor Uemura who conducts research on polymers.

Using voids between molecular structures as flasks

Focusing on nano-sized spaces in molecules, I am studying the synthesis of polymers that do not occur in a normal environment. When a metal ion is added to an organic substance that can be a ligand*, a crystalline complex called a metal organic framework (MOF) is formed. The function of these crystalline voids tunes the framework which can be used as a stage for polymer reactions, and there is no limit to the combination of metals and organic substances. In other words, you can prepare a flask that perfectly matches whatever polymers you want to synthesize.

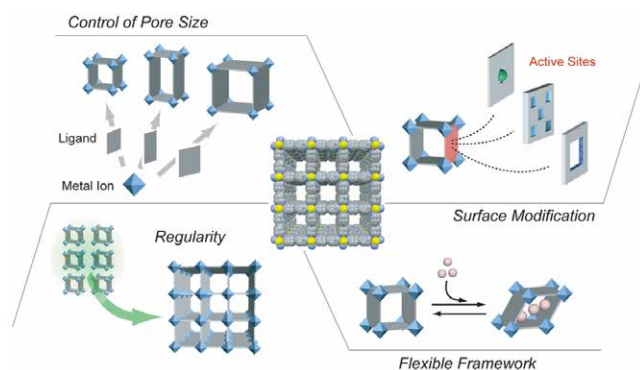


Figure: MOF Features

Overcoming the challenges of polymers

The complex three-dimensional structure of proteins perfectly replicates DNA during cell division in most organisms, but precisely controlling the length and molecular arrangement and aligning polymers is difficult when using an artificial synthesis method. Using MOF for polymer synthesis has the potential to overcome these challenges. Since MOFs have regular crystalline voids, the locations of specific reactions and the molecular length of the product can be controlled. In addition, encapsulating different polymers within a single MOF and subsequently dismantling that MOF allows for the mixture of polymers that would normally be difficult to mix at the molecular level. We can expect new individual, as well as synergistic, property effects of polymers produced this way.

MOFs can also be used as polymer containers. When naturally complexly entangled polymers are aligned and stored in MOFs, conductive polymer properties can be greatly enhanced. When combined with the fact that MOFs easily adsorb gasses, MOFs can also be used as highly sensitive gas sensors since gas adsorption changes polymer conductivity.

Research that approximates real life

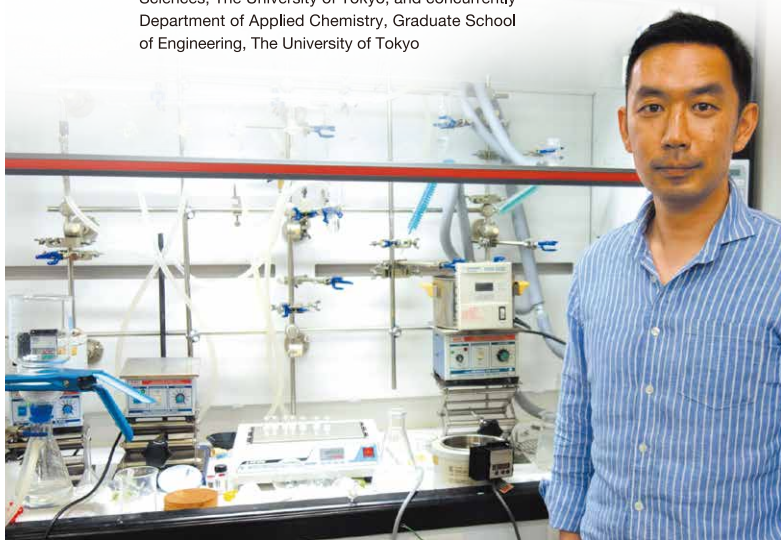
As an undergraduate student wishing to create something, I joined an organic synthesis laboratory. I subsequently moved on to a laboratory that studies polymers, which are rooted in our real life and are organic synthesis extensions. When I became an associate university professor, I decided to jump into the field of inorganic metal complexes. Although I had not been closely involved with that field, and was initially confused, that choice has now led me to researching polymers in a way that surprises many organic chemists. I think that being able to be useful not only academically but also in real life makes the field of polymers interesting to pursue new functions.

*Molecules that have unshared electron pairs and bond to a central metal atom

Professor Takashi UEMURA

2002: Doctor of Engineering, Department of Polymer Chemistry, Graduate School of Engineering, Kyoto University

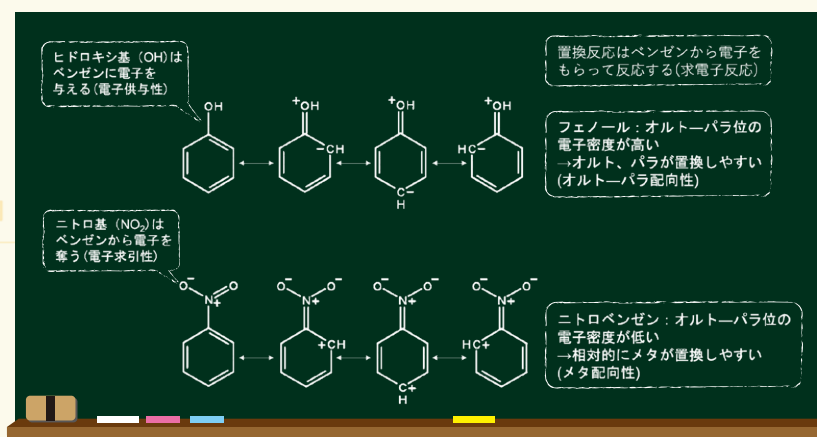
2018-present: Professor, Department of Advanced Materials Science, Graduate School of Frontier Sciences, The University of Tokyo, and concurrently Department of Applied Chemistry, Graduate School of Engineering, The University of Tokyo



What chemistry is studied at UTokyo?

Many people have the impression that chemistry is a subject to be memorized. The content learned in high school computational, inorganic and organic chemistry is broad and superficial and does not include background theory, so the result is that we are only left with what can be learned by heart. What about learning chemistry at UTokyo? Chemistry classes at the Faculty of Engineering are subdivided into chemical engineering, polymer chemistry, life chemistry, physical chemistry, analytical chemistry, inorganic chemistry, organic chemistry, and quantum chemistry. Topics one can study range from physics-oriented content such as heat transfer and quantum mechanics to life-related content such as protein and DNA. The concept of electron density is one example used for resolving chemistry questions in high school. Electron density concept shows where most electrons are located in a molecule. Once this is learned, how organic reactions take place can be

understood. Here is one problem. Phenol is an ortho/para-director, but nitrobenzene is a meta-director. Where does this difference come from? The answer is the difference between the electron attraction and donation properties of the functional benzene group. Orientation can be understood naturally when electron density distribution is considered as shown in the figure.



The outcome of using the recommended entrance examination system!

What happens after you pass the UTokyo Faculty of Engineering recommendation entrance examination?

There are two primary types of support for students recommended to the Faculty of Engineering.

First, there is an 'advisor system'. A professor assigned when you are admitted provides academic support and career advice. The second is the 'advanced course system'. First-year students are allowed to take courses normally restricted to third- and fourth-year students. Taking good advantage of this system allows you to do things like taking courses in other departments and pursuing research in a departmental lab.

How was it once you entered UTokyo?

'Can I keep up with my studies' was what I worried most about, but I decided that if I actively asked professors when I needed help I wouldn't have to worry about my grades. (laughter) If anything, since I had already selected the Faculty of Engineering when I entered UTokyo, once I began thinking about the role of each academic discipline in engineering I was able to focus on my studies with a sense of purpose.

Recently, recommended students have begun getting together, and interacting with other recommended students

from different Faculties over dinner, broadened my interest in other fields, and I picked up information on classes others recommended. I personally think that the 'recommended student network' is the biggest merit of the recommendation system!

In closing

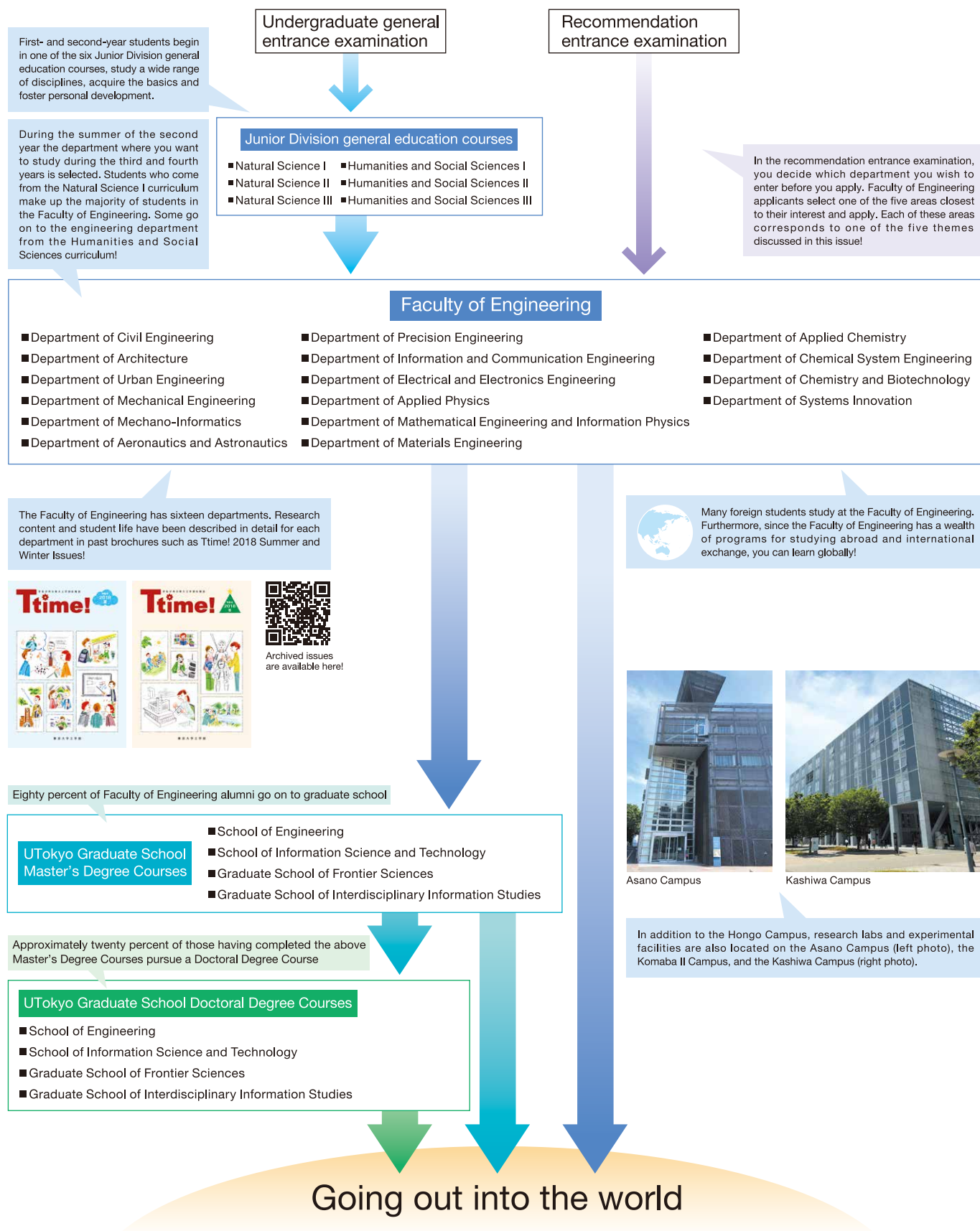
The Faculty of Engineering where I study has a system for proactively accepting high school students interested in engineering and who have the potential for further growth, so why not consider it as one of your options?



Dinner with recommended classmates

Learning at the Faculty of Engineering

Have we helped you understand what the Faculty of Engineering is like? The process of learning at the Faculty of Engineering through moving out into society is presented here.



We plan to address one's future course at the Faculty of Engineering and the connection between the UTokyo Faculty of Engineering and Society in the upcoming Ttime! 2019 Winter Issue. The Winter Issue will be published in December. Please peruse it!

These brochures . . . were written by us!



Ttime!

Faculty of Engineering
PR / Student
Assistants

We are the official Faculty of Engineering Student Teaching Assistants who provide publicity for the Faculty of Engineering. From undergraduates to doctoral students our group members come from a variety of departments. We tell spread the word through a range of activities about how great the UTokyo Faculty of Engineering is.



Workshops for elementary, junior high and high school students
Support for the Techno Science Café



Publish the Faculty of Engineering
PR brochure Ttime!



Organize a PR booth at the May Day Festival and Open Campus events

And, we post Ttime! articles on our website!

- ★ Archive of previous issues of Ttime!
- ★ English Versions of Ttime! brochures
- ★ Event reports on the May Day Festival and Open Campus
- ★ Student life introduction for each department



We will additionally publish various articles to let you know what's happening 'now' at the Faculty of Engineering. See you soon!



Editor's
Note

The Ttime! 2019 Summer Issue answered such questions as "What is engineering?" and "What is research like at UTokyo?" How did we do? From brochure planning to interviews, writing articles, proofreading, and so on, we members held many discussions as we compiled this brochure. We hope you were able to sense how fascinating the Utokyo Faculty of Engineering is. The professors who cooperated with our interviews spoke enthusiastically about their research content and the allure of their fields, and the experience was very interesting for us as well. Thank you very much.

Planning, Editing and Reporting: Faculty of Engineering PR Office Student Assistants, School of Engineering, The University of Tokyo; Miho Yonezawa (Editor); Akihiro Takeshita (Associate Editor); Chiaki Furusawa (Student Representative); Taro Kayamori; Mai Hirata; Yukino Nanba; Kazuto Ogishi; Sota Nagahara
Cooperation: Faculty of Engineering PR Office, School of Engineering, The University of Tokyo; Professor Hitoshi Tabata (Director); Professor Kiyoshi Izumi (Associate Director); Associate Professor Hideya Ochiai; Associate Professor Takasi Shimada; Tamae Kawase; Sumio Marukawa; Yayoi Miyagawa; Misuzu Kitahara; Katsuyo Nishi
Printing / Production: Anesta

At the Faculty of Engineering, students edit and publish the PR Brochure Ttime!

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Ttime! is distributed at no charge at high schools and preparatory schools throughout Japan.

Contact Us  ttime.todai@gmail.com

Faculty of Engineering Homepage

<https://www.t.u-tokyo.ac.jp/foe/index.html>



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