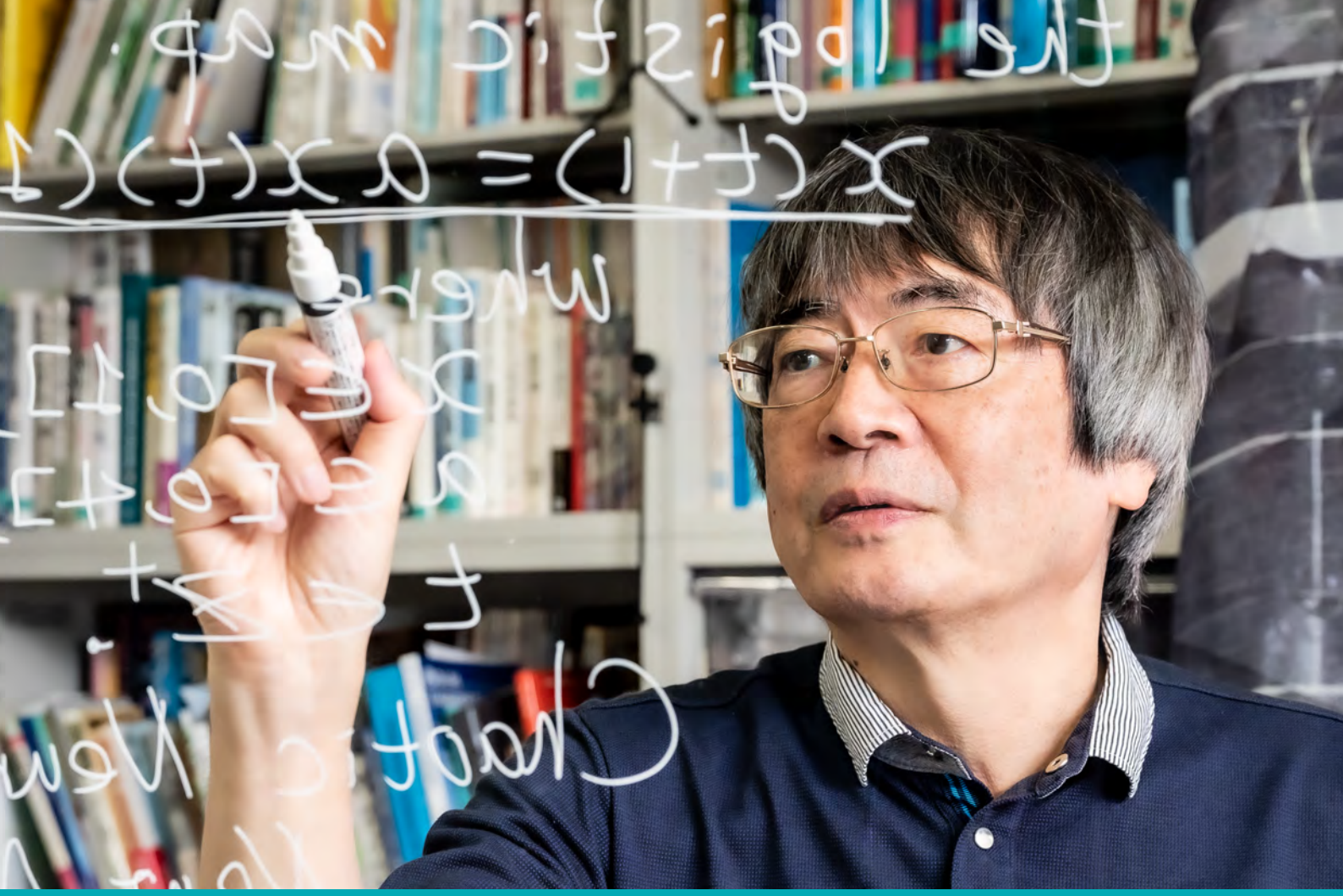

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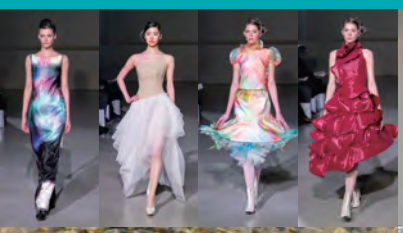
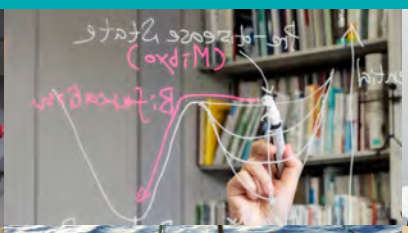







東京大学生産技術研究所
Institute of Industrial Science, The University of Tokyo

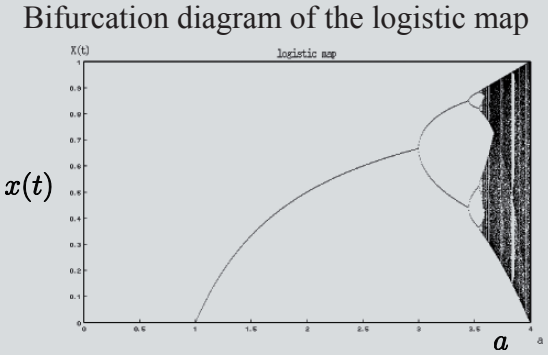
Kazuyuki Aihara, Professor

Fashionable mathematics

From fashion to personalized medicine, the applications of mathematics in society are omnipresent

Kazuyuki Aihara is a mathematical engineer at Institute of Industrial Science, The University of Tokyo (UTokyo-IIS). He has been playing leading roles in multi-million dollar national projects including the Research for Advanced Technology (ERATO AIHARA Complexity Modelling Project, Japan Science and Technology Agency, 2003 – 2009); the World-Leading Innovative R&D on Science and Technology (FIRST Program, *The Mathematical Theory for Modelling Complex Systems and its Transdisciplinary Applications in Science and Technology,* 2010–2014); and the *World Premier International Research Center Initiative* (WPI) on "Neurointelligence", a ten year project launched under the direction of Takao Hensch in 2017.

"My goal is to devise mathematically-based solutions for complicated problems covering a wide ranging spectrum of science and technology," says Aihara. "Topics include mathematical and artificial intelligence (AI) designing of fashion, formulating frequency fluctuations in power grids, and predicting the onset of human diseases for personalized medicine. A truly interdisciplinary approach."



Quadratic function $y = ax(1-x)$

Logistic map $x(t+1) = ax(t)(1-x(t))$ where $x \in [0,1]$, $a \in [0\ 4]$.

(Diagram 1)

Mathematics for fashion

Aihara's serendipitous contribution to the world of fashion was triggered by a collaboration with Eri Matsui (now Ema Rie), who is internationally known for her unique mathematically inspired designs. "Rie was inquisitive as to whether the ideas of mathematics could be used for designing dresses," says Aihara. "I decided to use the so-called 'logistic map' with a quadratic term and other nonlinear maps to design dresses. This was a very fruitful collaboration that demonstrated the power of mathematics for real-life applications in the fashion world."

Aihara's design was based on the quadratic equation known as the logistic map:

$$x(t+1)=ax(t)(1-x(t)).$$

The so-called bifurcation diagram resulting from varying the parameter, a, is shown in the diagram (Diagram 1), and the model is wearing the dress based on these calculations.

The dresses that were produced based on the bifurcation diagrams of nonlinear maps were first shown at the *2010 Eri Matsui Tokyo Collection*. "The 2010 Collection was very well received," says Aihara. "Then this year I worked with partners from RIKEN and IIS & the International Research Center for

Neurointelligence (IRCN) at UTokyo to support the *2019 Ema Rie Tokyo Collection* at the Komaba Campus towards possible collaboration between human intelligence and artificial intelligence."

The *March 2019 A/W EMarie Collection* was a collaboration between the RIKEN Center for Advanced Intelligence Project (AIP), IIS, and IRCN. "The 2019 collection attracted very much attention," explains Aihara. "Our partnership with groups working on artificial intelligence at RIKEN and neuroscience at IIS and IRCN yielded new ideas on AI-based fashion."

Fashion Designer : Ema Rie (EMarie)

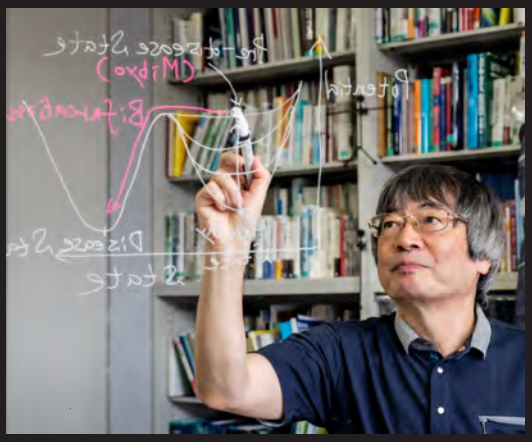
Early warning signals for deterioration of health: Bifurcation theory for personalized medicine

Preventing the onset of metabolic syndrome could in turn prevent the occurrence of many related diseases and disorders. To prevent such human ailments the major question is how to determine when an individual is on the verge of going over the tipping point after which a disease takes hold and preventive action will not be effective.

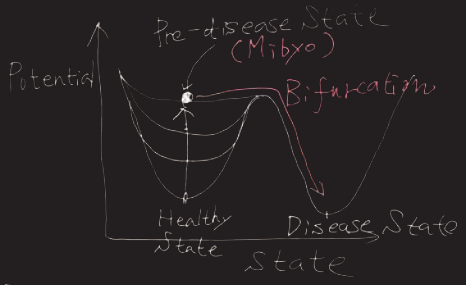
"We proposed dynamical network biomarker (DNB) theory to address this problem," explains Aihara. "We want to mathematically detect early warning signals of human diseases to predict critical transitions from healthy to disease states—a new mathematically-based biomarker for personalized medicine."

Aihara and his colleagues have defined three states: healthy, pre-disease, and disease states. These states can be envisaged like a cyclist riding towards a cliff edge; far from the edge the cyclist is in a stable healthy state; at the edge it's the tipping point or "a pre-disease state"; and riding of the cliff is unstable, and transits to a disease state.

"We recently published our findings about the effectiveness of DNB based on comparisons of gene expression data in mouse models for metabolic syndrome (Ref. 1)," explains Aihara. "We clearly observed the existence of a pre-disease state prior to the onset of metabolic syndrome that we defined it in terms of the behavior of 147 DNB genes."



Aihara and his colleagues found that the metabolic syndrome is a slow process thereby opening the door for applying DNB to both acute (abrupt changes in states such as influenza) and chronic (slow deterioration of the states of health as exemplified by metabolic syndrome and brain disorders) diseases.



"This approach to preventing diseases is referred to as '*mibyo*' in Japanese and according to the literature about Chinese medicine dating back to 221 BC (*Yellow Emperor's medicine*) as *Wei Bing* in Chinese," explains Aihara. "The words of wisdom offered by the *Yellow Emperor's medicine* are very instructive: *the best doctor treats diseases that have not occurred; the better doctor treats occurring diseases; and the inferior doctor treats diseases that have occurred!*

I hope that the DNB theory will produce many generations of "best doctors" who are able to treat people before the onset of diseases."

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Further information

Kazuyuki Aihara website
http://www.sat.t.u-tokyo.ac.jp/

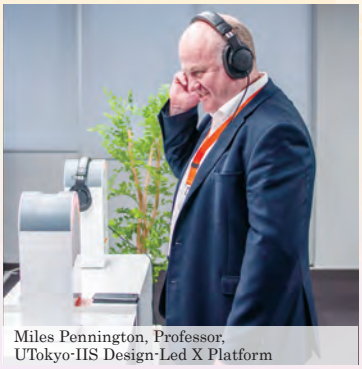
The International Research Center for Neurointelligence (IRCN)
https://ircn.jp/

Musical Biomarkers for Preventative Healthcare

Innovative procedures for 'musically visualizing blood vessels' yield deep insights into human health for disease mitigation

Yukiko Matsunaga, Associate Professor

"I have been working on vascular tissue engineering more than 10 years, and recently am strongly interested in working on preventing diseases, referred to as '*mibyo*' in Japanese," explains Yukiko Matsunaga. My project on visualizing capillaries under fingernails for healthcare is a fascinating area of research with great potential for monitoring human health and thereby reducing the burden on national resources."



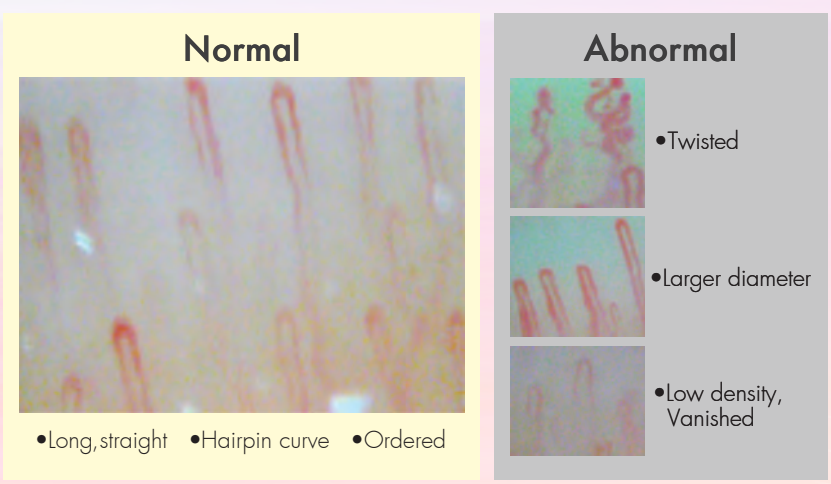
Miles Pennington, Professor, UTokyo-IIS Design-Led X Platform

Nailfold capillaries and healthcare

Optical examination of the region under the fingernails where the skin stops and nail starts, reveals so-called *nailfold capillaries* (NFCs). These capillaries form networks of loops of tiny blood vessels that are oriented parallel to the skin, with diameters so small that red blood cells can only pass through them one cell at a time. Notably, one side of the loop brings blood from the heart and the other half takes it back—a major U-turn for blood flow.

"From my previous research I knew that blood vessels can easily degenerate due to aging and unhealthy lifestyles, such as lack of exercise or excessive consumption of alcohol," explains Matsunaga. "So, after realizing that the technology to visualize nailfold capillaries is mature and readily available, I decided to look into the possibility of using images of capillaries for healthcare. In particular, as biomarkers for routinely monitoring an individual's health."

Matsunaga group analyzed images of NFCs taken of people that included 250 visitors to *UTokyo Komaba Research Campus Open House 2018*. "The results showed a direct correlation between the structure of NFCs and the state of physical condition of individuals. Specifically, healthy people had well-ordered NFCs that were long, straight, and hairpin-like. In contrast, the NFCs of people living unhealthy lifestyles were twisted, irregularly large diameter, and low density", Tadaaki Nakajima, Project Research Associate in Matusnaga group, said.



Treasure hunters and the birth of 'Attune'

The scientific observations were indeed convincing, but concrete ideas for using this information for practical healthcare biomarkers proved elusive.

"One of my roles is to scan the horizon at UTokyo-IIS in search of 'treasure projects' where my expertise in design could lead to fruitful collaborative research," says Yuri Klebanov, a research associate at the UTokyo-IIS Design-Led X Platform. "I realized that one such possibility was the research on NFCs being conducted by Associate Professor Yukiko Matsunaga. After a few meetings, we decided to collaborate to develop prototype systems for NFC based biomarkers. I had found my treasure!"

"Yuri and his colleagues at the Bezalel Academy of Arts and Design, Jerusalem, found me in their treasure hunt," explains Matsunaga. "I asked the design groups to solve some issues in my research including how to find and encourage more people to participant in the project, and how to get more data."

As a first step, in February 2019 Klebanov arranged a 'design thinking' meeting with his colleagues at Bezalel. "The three days in Jerusalem were extremely productive," says Matsunaga. "The visit led to the birth of '*Attune*'—a unique biomarker-based system that converts NFC images into customized musical melodies. I was not only impressed by the speed of the Bezalel team, but also by their way of thinking and formulating ideas. Interacting with Yuri and his designer colleagues energized this research. Now, with a view to further expand our activities, I want to connect with city planners, and healthcare workers, and am looking for collaborators. Importantly, working with my designer colleagues led to the birth of a new field of research and new ways of thinking."

The *Attune* system creates unique music that based on the pattern of an individual's NFC images. "Sound is direct, intuitive, and evocative," explains Matsunaga. "This was really an exciting development. The next task is to acquire much more information. So we need many more volunteers"

An opportunity to test the Attune system arose during the *Komaba Research Campus Open House 2019* May 31 to June 1. Matsunaga and Klebanov set up a website to spread the word about Attune and called out for volunteers to test it. "We had long queues of volunteers and tested around 350 people during the Open House," says Klebanov. "This was our capacity. We generated unique musical tunes for each of the volunteers which can be considered as being melodic-tags of their state of health at a specific time."

Notably, the potential of *Attune* was underscored by IIS Tokyo and the Bezalel Arts and Design Academy, Jerusalem signing a memorandum of understanding (MOU) to collaborate on the development of *Attune* technology. In commemoration of the new partnership, the teams held a reception at the Embassy of Israel, Tokyo, hosted by Ambassador Ben-Ari.

"The next step is to gather more data and explore the development of a musical interface as a reflection of individual health," says Matsunaga.

Yuri Klebanov, Research Associate

Launch of the Health Design Study Group

Rising health costs and the rapidly aging society in Japan will lead to a huge burden on the young and their families, so innovative approaches are required for maintaining the quality of healthcare. A high priority is tackling diseases that result from lifestyle disorders such as metabolic syndrome and stress from work environments.

With this background, in May 2019 Matsunaga and her colleague Yoshiyuki Kawazoe, an architect and associate professor at UTokyo-IIS, set up the "Health Design Study Group" with the aim of integrating different fields of healthcare science with community development.

Social implementation initiatives to-date include the "Health Design for Capillary Blood Vessels" held for two weeks in collaboration with Mitsubishi Estate and nine other companies interested in healthcare, at the Marunouchi House in the Shin Marunouchi Building, Tokyo.

"We want people from the health sector to talk with those who are responsible for town and city planning," says Matsunaga. "This study group is a platform for people from healthcare science and town development to meet regularly to devise ways of maintaining a healthy society. The reaction so far has been very positive. I am confident that we will succeed in achieving our goals."

Further information

Yukiko Matsunaga website
http://www.matlab.iis.u-tokyo.ac.jp/

RCA-IIS Tokyo Design Lab
https://www.designlab.ac/

Economic Development : An Important Factor to Realize MDG for Safe Drinking Water

The United Nations Millennium Development Goals (MDGs) attempted from 2000 to 2015 produced mixed and debatable results. But there was at least one clear MDG victory: safe drinking water.

MDG Target 7C sought to halve, by 2015, the ratio of the world's people without sustainable access to safe drinking water and basic sanitation. In this, the drinking water target was reportedly realized in 2010. No such global target on drinking water had ever before achieved.

Research led by UTokyo-IIS traced why this monumental achievement was accomplished when others failed. It also delved deeper into what defined success, and if the factors behind it could be reproduced for achieving other socioeconomic goals. The findings were published in the journal, Nature Sustainability.

"Achieving MDG Target 7C-Water was definitely a success," study senior author Taikan Oki at UTokyo-IIS says. "However, this achievement is not cut-and-dry. We found that comparatively modest goals along with rapid urbanization, especially in China, and rural development in India, were major enablers of the success."

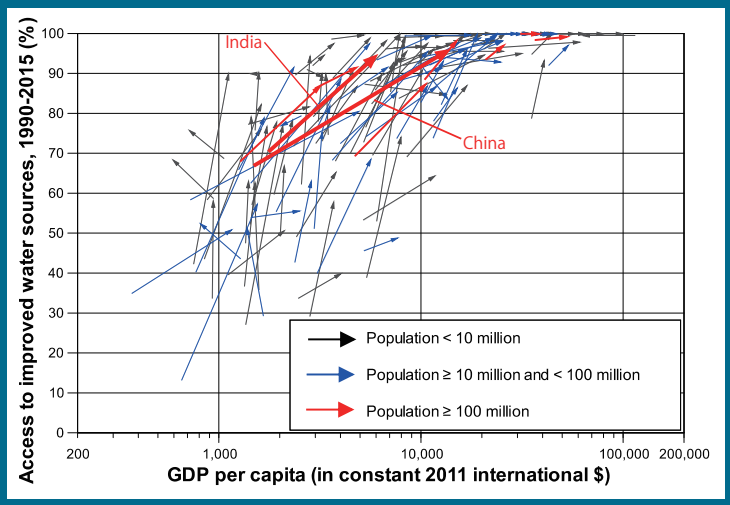
Global targets for accessible drinking water have varied widely, from 100% coverage to much lower benchmarks. The researchers looked at previous targets and reports. They found considerable variation in definitions of safe drinking water. Some emphasized lack of contamination, while others focused on factors such as the amount of available water or distance to water collection. This variance may have led to different interpretations of results.

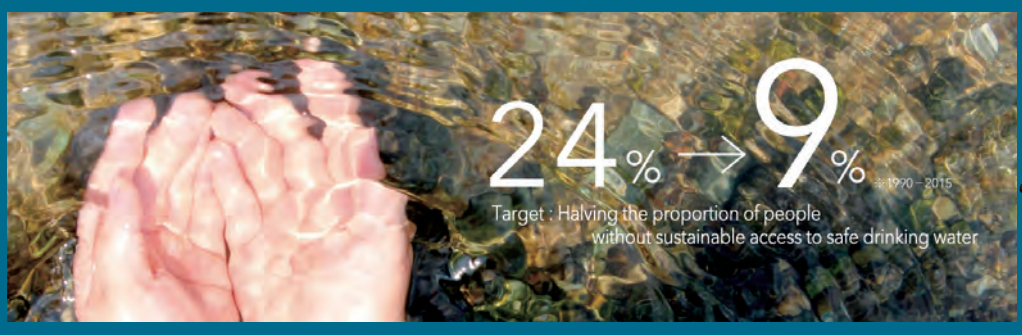
They also found that the MDG period coincided with massive rural-to-urban migration in China, along with both rural and urban development in India. These were critical in expanded drinking water coverage, as the two countries account for roughly one-third of the world's population. China's urban population more than doubled during the period.

Using a mathematical formula connecting water access with GDP, they also found economic development was imperative in the greater coverage.

The Sustainable Development Goals (SDGs) have now taken over the tasks of both expanding on the MDGs and trying to accomplish those that are still outstanding.

"The baton is now passed to SDG Target 6.1, which aims to secure safe and affordable drinking water for everyone on Earth by 2030," Oki says. "That is highly ambitious, and it's more specific and demanding than the predecessor MDG. Based on our findings, irrespective of the outcome, this high goal will stimulate motivation and investment. As economic development and poverty reduction continue, this is a good thing."





Taikan Oki,Professor

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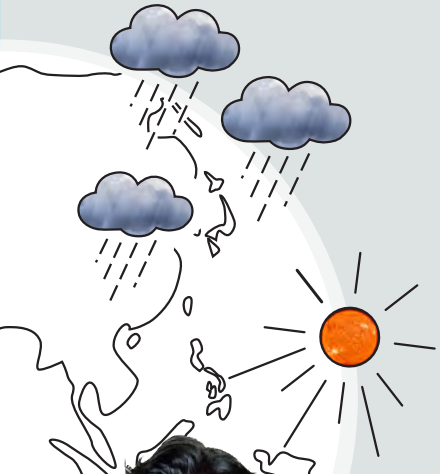

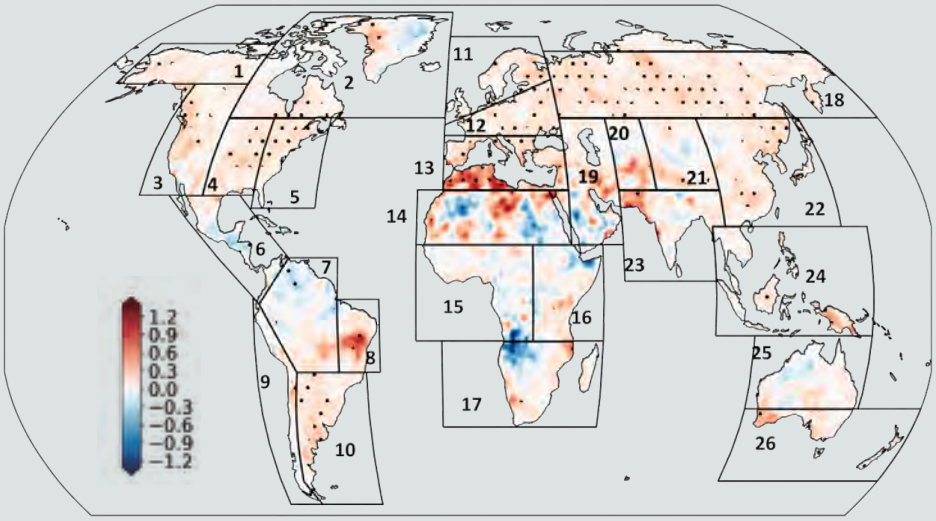

The multi-model mean change of the E2E(event-to-event hydrological intensification index) between 2 °C and 1.5 °C climates

Hyungjun Kim,
Project Associate Professor

Half a Degree Makes Dramatic Difference in Climate Change Effects on Floods and Droughts Interconnectivity

Researchers have developed a new metric to better understand the effects of 1.5°C vs. 2°C of global temperature rise on the intensification of precipitation and drought events

In 2015, to combat the urgent threats posed by climate change, most of the world's countries came together to establish the Paris Agreement: an ambitious plan to prevent the global temperature from rising 2°C above pre-industrial levels, and to work to further limit that temperature rise to 1.5°C.

These seemingly small numbers can mask the staggering impact and complexity that shifts in global temperature represent. For example, increased global temperature will also intensify the hydrologic cycle, significantly changing the frequency and intensity of rainfall. Flooding, droughts, mudslides, and food and water insecurity are just some of the many hazards of the resulting changes in rainfall patterns.

To understand what the future may hold, and to shape policies and behaviors that guide this outcome, researchers at The University of Tokyo, along with international collaborators, have developed a new metric for evaluating the intensification of wet and dry spells under the effects of global warming. They call it the "event-to-event hydrological intensification index," or E2E, as described in a new study published in *Scientific Reports*.

"The E2E combines normalized aggregated precipitation intensity and dry spell length to capture the interconnectivity of adjacent dry and wet spells and the intensification of their phase shifts," explains corresponding author Hyungjun Kim.

The research team conducted multi-model ensemble experiments to compare the E2E between scenarios with 1.5°C and 2°C of warming. Overall, warming was associated with a clear increase in the E2E, with significant additional increase from 1.5°C to 2.0°C of warming.

In addition, the study revealed geographic trends in changes in rainfall intensity under these warming scenarios. For example, more intense precipitation is predicted across much of North America and Eurasia, whereas more intense droughts are projected for the Mediterranean region. Another key finding was that the most extreme intensification would be about 10 times greater than the average intensification.

"Our results suggest that extreme dry and wet events will increasingly co-occur, such as the switch from extreme drought to severe flooding we saw in California in the recent past," says lead author Gavin D. Madakumbura. "At least in terms of disaster mitigation and water security, there would be significant benefits to limiting global warming to 1.5°C to dampen the intensification of event-to-event variability."

Reference

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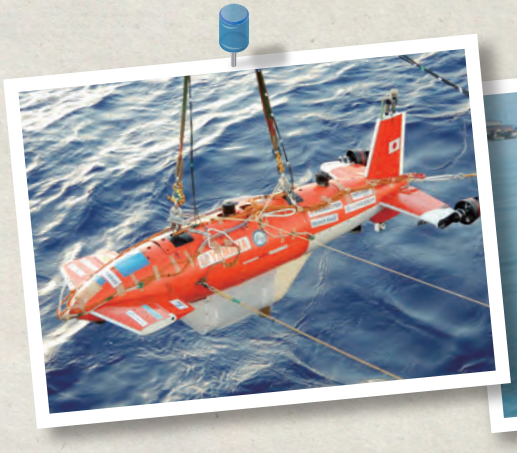
Team KUROSHIO were awarded the runner-up prize of Shell Ocean Discovery

OUR XPRIZE JOURNEY



Blair Thornton, Associate Professor, member of the Team KUROSHIO board of Directors

On 31st May 2019, during this year's UTokyo Komaba Research Campus Open House, Jyokita Virmani, Executive Director at XPRIZE, announced Japan's Team KUROSHIO as runner-up in the $7million Shell Ocean Discovery XPRIZE at the Musée Océanographique in Monte Carlo, Monaco. The official prize was a $1million cheque and a trophy. However, the real prize, is worth much, much more.

The journey started 1009 days before the prize ceremony at an advisory workshop for the Schmidt Ocean Institute held on the Island of Maui, Hawaii on 25th August 2015. I had just presented some data collected by Thornton Laboratory members in the Iheya North Field off the coast of Okinawa, when Jyokita came up to me and told me about the new concept she was developing, an XPRIZE competition for deep-sea mapping. At the time, the details were still being worked on, but what was for certain was that it would involve mapping huge areas of the seafloor using underwater robots, probably several of them.

In December 2015, the XPRIZE was announced and Team KUROSHIO was born. The challenge set was for robots to map a huge region of 500 square kilometres, the size of a large city, at a resolution high enough to identify a car, at a depth deeper than the height of mount Fuji. The real challenge was that this all had to be done in 24 hours, with no ships or people to support the robots during the entire operation.

Team KUROSHIO started out as a series of meetings where a handful of young engineers from the UTokyo-IIS, Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and the Kyushu Institute of Technology met and brainstormed. Our technology was based on the robots and sensors we had developed for deep-sea research. We exchanged hundreds of ideas, drew thousands of sketches, we challenged each other and ruthlessly eliminated concepts that weren't robust. We also realized that entering the XPRIZE required more than just good technology. It required us to be organized. We formed a board of directors, a development group, an operations groups, and management and communications teams. We grew from a handful of young engineers into a team of more than 30 young engineers, administrators and publicists from 8 organisations spanning academia, government and industry. In September 2016, we submitted a technical proposal outlining our competition strategy along with 31 other teams from around the world. In January 2018, judges from the XPRIZE travelled halfway across the world to visit our Komaba campus and cast their eye over 3 days of intense testing. In November 2018, it was the turn of more than 20 Team KUROSHIO members to travel halfway across the world to the Greek city of Kalamata to participate in the XPRIZE grand final where they secured 2nd place in the competition.

The real prize, was the journey XPRIZE took us on; the sense of achievement in seeing ideas that were first sketched on scraps of paper play out in Kalamata for the whole world to see; the thousands of supporters "following" our activities on facebook and twitter and the tens of thousands of "likes" we got on youtube; the fact that marine robotics has become a more familiar term to everyday people around the world; and most importantly, the opportunity it gave for the members of Team KUROSHIO to work closely alongside each other, because these people are the community of engineers, operators, administrators and publicists who will drive the next generation of marine robotics research in Japan.

Riding the ebbs and flows of oceanic power generation

Comprehensive approach using inexpensive and compact power stations shows potential for harnessing the power of waves and tides for generating power

Chang-Kyu Rheem is an expert at observing the physical environment of ocean-surfaces such as waves, ocean winds, tsunamis, and tidal levels using microwave pulse Doppler radar and satellites. However, the focus of his research changed dramatically following the magnitude-9 Tohoku earthquake in March 2011, which led to unprecedented damage due to tsunamis hitting the coast of northeastern Japan.

"The 2011 earthquake was a wakeup call for me," says Rheem. "It led to the shutdown of Japan's nuclear power stations and the realization of the need for alternative sources of energy, in particular renewable generation."

After the earthquake government called for proposals on generating power using renewable energy. Rheem was confident that he could contribute based on his knowledge of remote sensing of sea-surfaces and tides. "I decided to launch a project on the development of technology for power generation systems using wave and tidal power," explains Rheem. "I now work with local governments and communities throughout Japan to install wave and tidal power generation systems. I want to contribute to Japan's long term goals of reducing greenhouse gases." Indeed, Japan has set 2030 as the target to reduce greenhouse gas emissions by 26% compared with 2013 levels. Notably, Japan has a huge coastline and is the world's sixth-largest marine economic country with an exclusive economic zone, so there is huge potential for exploiting the motion of waves and tides to generate stable power all year round.

Chang-Kyu Rheem, Professor

FIELD TRIALS FOR SEA-BASED WAVE AND TIDAL POWER GENERATION SYSTEMS

Rheem oversees several projects to harness the power of the seas and is working with local authorities to build and maintain the following power stations:

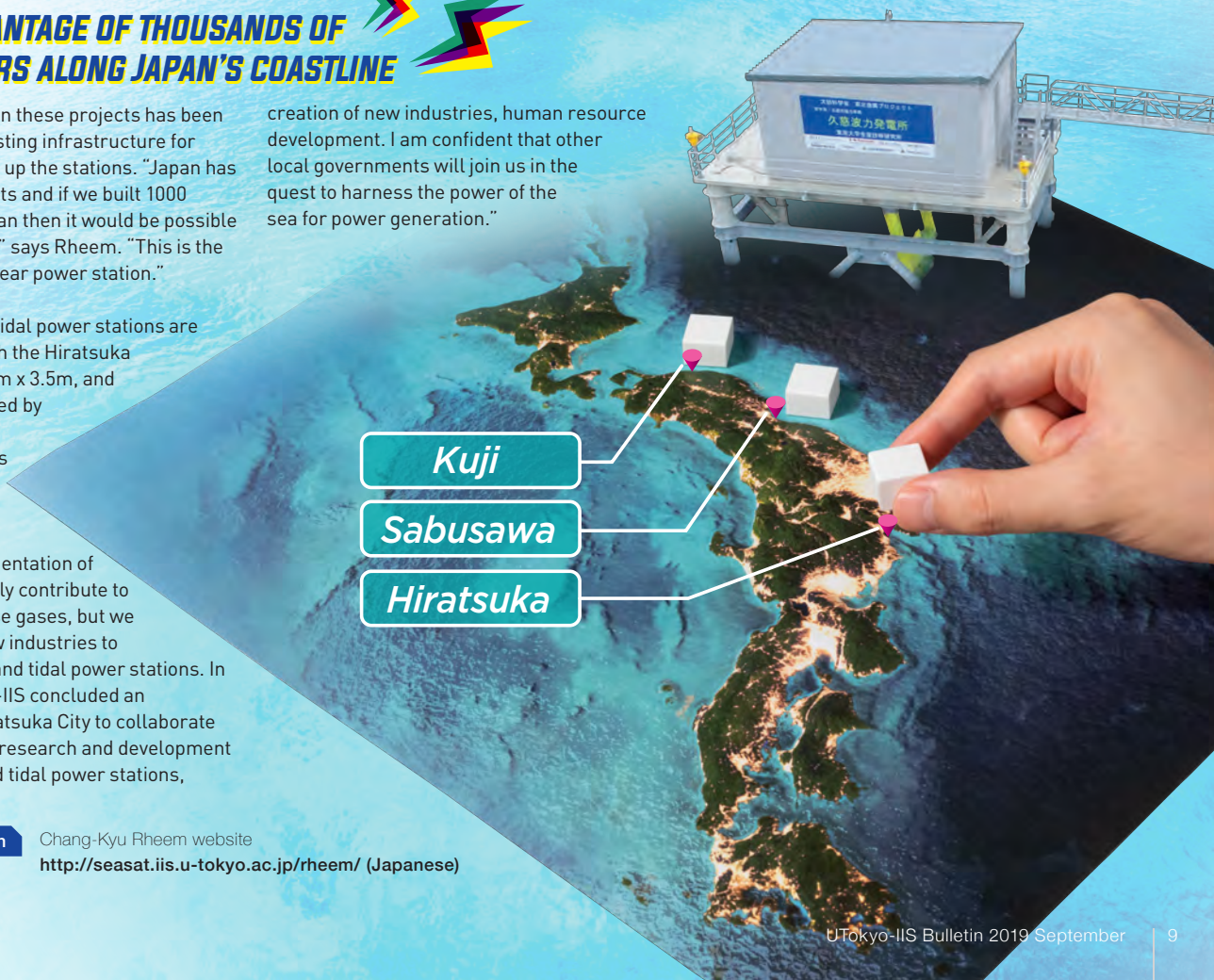
- Sabusawa Tidal Wave Power Station on the shore of Sabusawa Island, Shiogama City, Miyagi Prefecture. The facilities were completed in 2014 and power is produced by a hydraulically driven double vertical shaft floating tidal power generator with a maximum capacity of 5 kW. This is Japan's first grid-connected tidal power plant.
- The 43 kW Kuji Wave Power Station is located in the Tamanowaki breakwater at Kuji port, Kuji City, Iwate Prefecture. Built in 2016, this is Japan's first grid-connected wave power plant, where electricity is generated with a hydraulic drive pendulum wave power generator mechanism.
- The Hiratsuka Wave Power Station is scheduled to be completed in February 2020. Located at a breakwater in Hiratsuka City, Kanagawa Prefecture, this 45 kW hydraulic drive pendulum wave power generator takes advantage of reflected waves and the pendulum is made of an aluminum rubber composite wave plate rudder. Notably, power is generated with an apparatus that utilizes the steering apparatus for ships in which hydraulic cylinders are positioned vertically.

TAKING ADVANTAGE OF THOUSANDS OF BREAKWATERS ALONG JAPAN'S COASTLINE

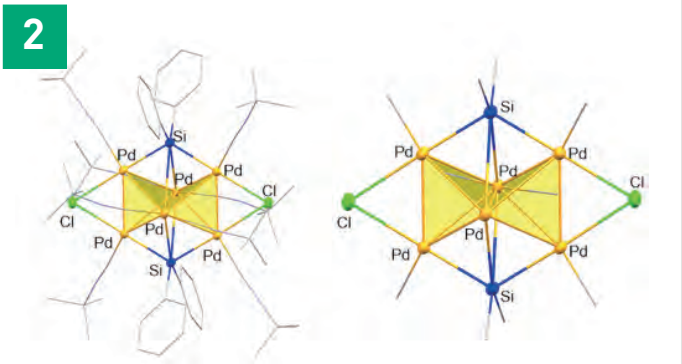
The emphasis in these projects has been to use the existing infrastructure for building and setting up the stations. "Japan has more than 4000 ports and if we built 1000 stations across Japan then it would be possible to generate 1-2 GW," says Rheem. "This is the capacity of one nuclear power station."

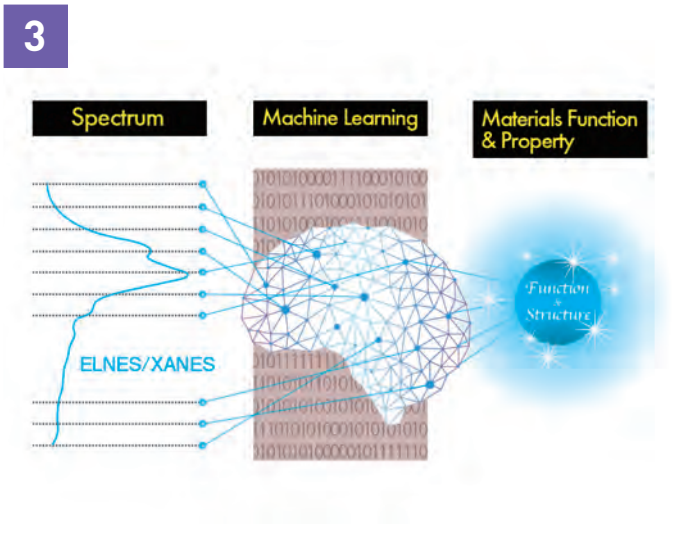
Also, the wave and tidal power stations are compact in size, with the Hiratsuka station being only 8m x 3.5m, and are being constructed by workers at local factories using parts that are readily available.

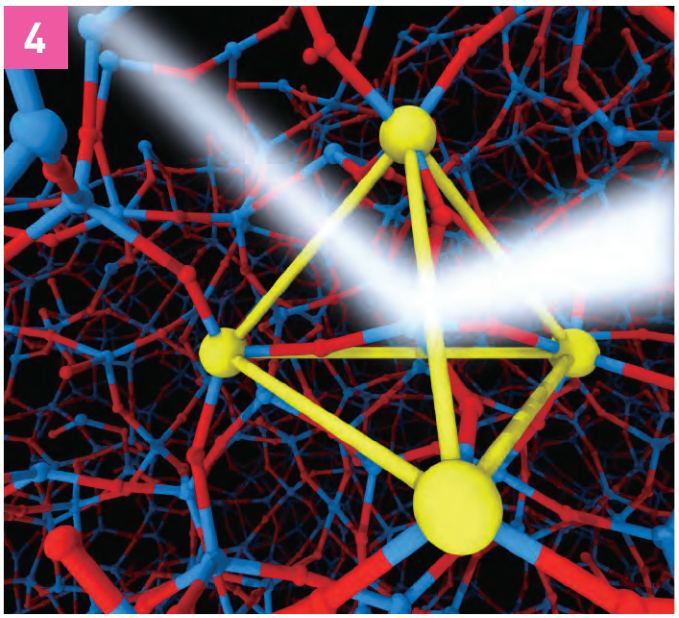
"Successful implementation of our ideas will not only contribute to reducing greenhouse gases, but we expect to create new industries to manufacture wave and tidal power stations. In March 2019 UTokyo-IIS concluded an agreement with Hiratsuka City to collaborate on the promotion of research and development of offshore wave and tidal power stations, creation of new industries, human resource development. I am confident that other local governments will join us in the quest to harness the power of the sea for power generation."



Further information Chang-Kyu Rheem website
http://seasat.iis.u-tokyo.ac.jp/rheem/ (Japanese)







Growing a Cerebral Tract in a Microscale Brain Model 1

An international research team led by UTokyo-IIS modeled the growth of cerebral tracts. Using neurons derived from stem cells, they grew cortical-like spheroids. In a microdevice, the spheroids extended bundles of axons toward each other, forming a physical and electrical connection. Fascicles grew less efficiently when one spheroid was absent, and when a gene relevant to cerebral tract formation was knocked-down. The study further illuminates brain growth and developmental disorders.

***iScience*(2019), doi: 10.1016/j.isci.2019.03.012**

Further information https://www.iis.u-tokyo.ac.jp/en/news/3095/

"Butterfly-Shaped" Palladium Subnano Cluster Built in 3-D 2

A Japanese research team at The University of Tokyo produced a 3-D cluster molecule based on palladium. First, they created a "butterfly-shaped" Pd_4 framewok, using an organosilicon compounds bearing the aromatic substitutents as both template and support for the palladium atoms. Then, using another template, they connected two "butterfly-shaped" Pd_4 skeleton, via chlorine, into a Pd_6 cluster based on edge-sharing tetrahedra. This strategy using organosilicons to design customized subnano-architectures may enable design of a range of functional materials and catalysts.

***Chemistry - A European Journal*(2019), doi: 10.1002/chem.201805678**

Further information https://www.iis.u-tokyo.ac.jp/en/news/3046/

Machine Learning Reveals Rapid Material Classification 3

Scientists introduced a novel machine learning algorithm for the rapid prediction of a materials properties and structures based on spectral scans. The program may be extremely useful for researchers when prototyping novel nanodevices.

***J. Phys:Materials*(2019), doi: 10.1088/2515-7639/ab0b68**

Further information https://www.iis.u-tokyo.ac.jp/en/news/3068/

What causes that peak? Answering a long-standing question for covalent liquids 4

Researchers at UTokyo-IIS have demonstrated a link between local structural ordering and scattering pattern features for tetrahedral liquids. It is hoped that the findings will lead to facile experimental approaches for characterizing materials for fundamental research as well as for applications such as the production of semiconductor materials.

***Science Advances*(2019), doi: 10.1126/sciadv.aav3194**

Further information https://www.iis.u-tokyo.ac.jp/en/news/3053/

UTokyo-IIS

Director General
Professor Toshiharu Kishi

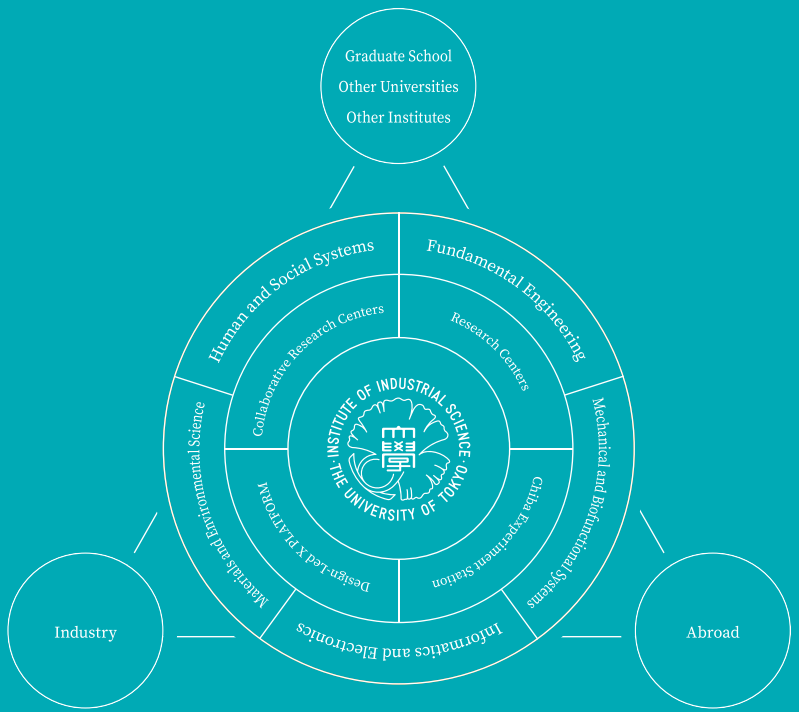
Since its establishment in 1949, the Institute of Industrial Science at the University of Tokyo(UTokyo-IIS) is one of the largest university research institutions in Japan and its history reaches 70 years.

Our multidisciplinary research covers nearly all fields of engineering, and our professors, associate professors, and lecturers each lead dedicated laboratories, about 120 in total. More than 1,000 personnel, comprising approximately 300 faculty members including staffs and 750 graduate students, participate in educational and research activities that are responsible for producing excellent research outcomes and fostering outstanding talent. All our laboratories belong to one of five core research departments and some straddle multiple departments, providing the warp and weft for nine research centers, three collaborative research centers, and two international collaborative research centers. As well as promoting original research in each specialist field, we as an institution encourage cross-disciplinary and international activities. Last year saw the functions of the Chiba Experiment Station transferred from its original home in Nishi-Chiba to our Kashiwa campus, and the launch of the new Design-Led X Platform.

Since the foundation of the Institute, we have been acutely aware that the significance of academic research into engineering lies in its real-world implementation, and together with the seeding of new academic disciplines through enhanced specialization and cross-disciplinary collaboration, we have developed and deployed new technologies that contribute to solving problems in the real world. We have also made it our mission to nurture talented people to shoulder the responsibility of technological development and dissemination, especially in the industrial world. Such a philosophy and sense of mission has been programmed into our DNA since the foundation of the Institute, and we have taken a hands-on approach to address engineering challenges as a pioneer of advocacy for collaboration between industry and academia. We also take pride in the fact that our achievements and proactive stance are widely recognized together with the name *Seiken*.

Society is facing diverse problems today, and expectations are growing for the role that engineering plays in solving these problems. At the same time, the challenge for conventional engineering is that it is unable to make widely-accepted and compelling products with an approach that focuses only on technological development. For such situations that are difficult to address with engineering alone, we are seeking to build a new *Seiken* style—one that contributes to the creation of compelling value through innovation, founded on the pursuit of academic truth as a university research institute, and adding a multidisciplinary approach integrating humanities and sciences that incorporates exit strategies for real-world implementation, to the style that it is long known for: barrier-free, cross-disciplinary, practical industry–academia collaboration, and ambitious international collaboration.

Even though it is the largest of its kind in Japan, *Seiken* is perfectly sized to maintain a strong sense of organizational unity, and through our agility and collective strength as a world-class research institute in the field of engineering, we hope to continue helping to make everyone's dreams come true.



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