FANUC NEWS

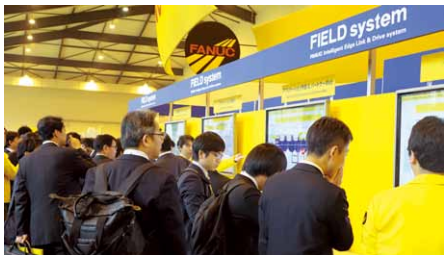
Photo taken on May 11, 2018

2018-Ⅱ

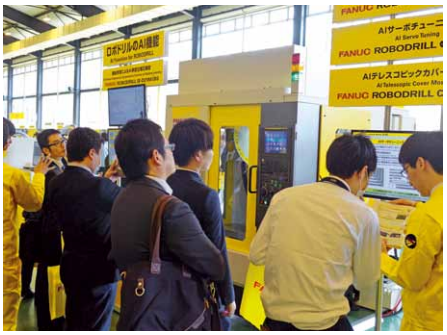
Exhibition to Present New Products

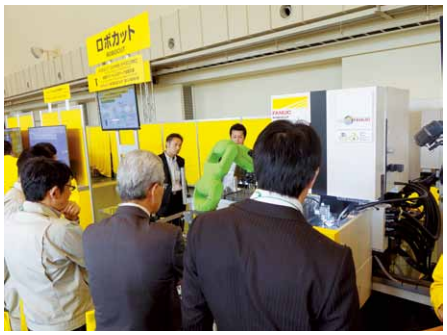
On April 17 and 18, FANUC hosted an exhibition to present new products at the Nature Hall located on the campus of our headquarters. The exhibition was blessed with fine weather this year and attracted a record high of over 8,600 guests. At the exhibition, we presented products that our company offers based on our latest technologies. For example, we exhibited FANUC's IoT function for driving machines at customers' production sites intelligently and efficiently by adding the "Drive" function to the "Connect," "Visualize," and "Think" functions. We also exhibited FANUC's AI function that has started to be used in FA, robots, and ROBOMACHINEs as well as the QSSR (Quick & Simple Startup of Robotization) function to connect a machine tool and a robot quickly and easily.

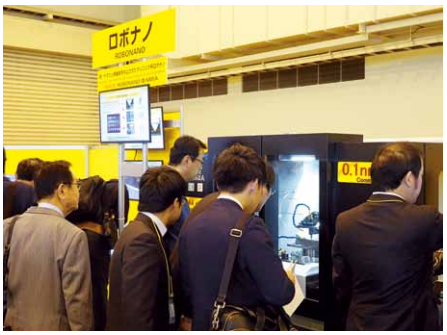
In the area of FANUC's IoT, that is, FIELD system, many customers commented that they wanted to immediately start using *i*PMA, an operation monitoring application, to visualize changing points that lead to defects and age deterioration with extensive data analysis functions as well as the further evolved *i*ZDT function, which also supports remote maintenance using collected data.
FANUC's AI function received a very high evaluation as it has been put into practice in application after application such as thermal displacement compensation, servo tuning, failure prognosis for spindle motors, robot path control, and bin picking apps.



In the FA area, we exhibited our fast cycle time technology, which consists of the culmination of our technologies for reducing cycle time, fine surface technologies providing the high-grade machining required for smartphones and mold processing, and smart machine control, which supports these technologies, and received attention from many customers.
The robot area was always crowded, demonstrating just how interested visitors are in automation and robotization. Popular exhibits included the lineup of SCARA robots, the high-speed, high-precision assembly work, the collaborative robot that has a larger application range by being mounted on an AGV, a smaller 3D vision sensor that now supports high-speed processing, and a Super Heavy Payload Robot including a demonstration of its application to the aerospace industry.
In the ROBOMACHINE area, exhibits of the AI functions including thermal displacement compensation in an actual machine, the QSSR function which supports implementation of robot systems, the LINK*i* function that monitors the operating status of machines, the *i*HMI function that controls peripheral equipment, actual machining with a ROBONANO, which specializes in nano-tech machining and supports a wide range of applications from ultra-precision machining of molds for optical parts of automobiles to ultrafine machining of watch parts, and many other exhibits, won great popularity. We received many detailed inquiries about practical application.





In addition, many customers also saw the exhibit of the extensive user support functions of the new FANUC service website and visited the area to introduce the new FANUC ACADEMY. We received many inquiries about website subscriptions and attending training sessions.

【Key exhibits】

one FANUC		
	FIELD system	"Connect, Visualize, Think, and Drive" @Production site
	FANUC's AI	AI for FA, robots, ROBOMACHINEs, and FIELD system immediately useful on site.
	QSSR	Easy connection between machine tools or robomachines and robots
FA		
	CNC and servo technologies for high-grade machining	Fine surface technologies
	CNC and servo technologies for cycle time reduction	Fast cycle time technologies
	Control optimization according to changes in the machine status	Smart machine control
	Total support for tasks in the workshop	*i*HMI and extensive applications
	Industrial PC with high performance and high reliability	PANEL *i*H Pro
	Preventive maintenance for the CNC system	Failure prognosis function for CNCs, motors, and amplifiers
	Quick visualization connecting factory facilities	MT-LINK*i*
	Accurate estimation of the machining time of each machine	FIELD machining time estimation function
	Laser system to realize a high-speed, high-precision machine tool	FIBER LASER FF*i*-A series, Series 30*i*/31*i*-LB
	Laser welding/cutting robot system	FIBER LASER FF*i*-A series + FANUC Robot
Robot		
	Small collaborative robot mounted on an AGV	CR-7*i*A/L
	Setup system with 3D vision sensor	CR-15*i*A, 3D vision sensor
	Collaborative assembly work by a collaborative robot and worker	CR-35*i*A
	Arc welding robot system	ARC Mate 100*i*D, ARC Mate 120*i*D
	3D visual tracking system	LR Mate 200*i*D, 3D vision sensor
	Advance setup system using the 3D vision sensor	M-20*i*B/25, 3D vision sensor
	Introduction and application examples of SCARA robots	SR-3*i*A, SR-6*i*A
	Automotive inner plate painting system	P-1000*i*A, P-35*i*A
	Part washing system using a washing robot	R-2000*i*C/210WE, LR Mate 200*i*D/7WP
	Maintenance, troubleshooting, and application examination functions	ZDT (zero downtime), ROBOGUIDE
ROBOMACHINE		
	Machining system with ROBODRILL + robot	ROBODRILL α-D*i*B series + FANUC Robot
	Precision molding system with ROBOSHOT + robot	ROBOSHOT α-S*i*A series + FANUC Robot
	Machining system with ROBOCUT + robot	ROBOCUT α-C*i*B series + FANUC Robot
	ROBONANO for machining with better usability and operating rate	ROBONANO α-NM*i*A

2018 Round-Table Talk

On April 20, we invited professors and researchers who provide us with continued support to look at new products at the exhibition and later hosted a round-table talk.

Attendees

Toshiro Higuchi	Professor Emeritus of the University of Tokyo
Hideki Aoyama	Professor of Keio University
Hidenori Shinno	Professor of the Tokyo Institute of Technology
Shigetaka Takagi	Professor of the Tokyo Institute of Technology
Keiichi Shirase	Professor of Kobe University
Hiroyuki Sasahara	Professor of the Tokyo University of Agriculture and Technology
Atsushi Matsubara	Professor of Kyoto University
Yoichi Hori	Professor of the University of Tokyo
Shigeki Sugano	Professor of Waseda University
Takayuki Okatani	Professor of Tohoku University
Tsunemoto Kuriyagawa	Professor of Tohoku University
Masanori Kunieda	Professor of the University of Tokyo
Eiji Shamoto	Professor of Nagoya University
Takashi Matsumura	Professor of Tokyo Denki University
Hitoshi Omori	Chief Scientist of Riken

FANUC CORPORATION

Yoshiharu Inaba	Representative Director, Chairman and CEO
Kenji Yamaguchi	Representative Director, President and COO (Moderator)
Hiroyuki Uchida	General Manager, ROBOMACHINE Business Division
Hiroshi Noda	Vice General Manager(R&D), FA Business Division
Shunsuke Matsubara	General Manager, Research & Development Administration Division
Hidehiro Miyajima	General Manager, Basic Research Laboratory, Research & Development Administration Division
Yoshiki Hashimoto	General Manager, CNC Hardware Laboratory
Mitsuyuki Taniguchi	General Manager, SERVO Laboratory
Yuji Nishikawa	General Manager, LASER Laboratory
Kenichiro Abe	General Manager, ROBOT Mechanical Development Laboratory
Seigo Kato	General Manager, ROBOT Software Development Laboratory
Tong Zheng	General Manager, ROBODRILL Laboratory
Satoshi Takatsugi	General Manager, ROBOSHOT Laboratory
Akihiko Fujimoto	General Manager, ROBOCUT Laboratory
Hon Yonpyo	General Manager, ROBONANO Research Department
Masako Sudo	Chief Engineer

(Titles are current as of April 20)

Yamaguchi

Yamaguchi: Thank you for gathering today despite your busy schedules. Prior to this round-table talk, you had a look at our new products. I look forward to having a stimulating discussion. First, we'll start with some words from Chairman Inaba.

Inaba: Thank you for gathering here today. We have been working on improving the levels of our individual products by developing new technologies that achieve high efficiency, high precision, and high speed for FA, robots, and ROBOMACHINEs to showcase them at our annual company exhibitions. However, according to recent trends, no matter how advanced the technology gets, it's futile if those functions are too hard to use. In addition, the robots and machine tools that used to function on their own have become systemized in this age, with increasing numbers of cases in which there are various combinations of use. Considering these points, we are now living in an age where usability is more important than ever. Furthermore, with recent trends surrounding Industry 4.0 and connected industries, technologies that connect, visualize, and become intelligent are especially crucial in order to develop

Inaba

successful smart factories. Bearing these developments in mind, we are currently working on the layout of the exhibition and the development of products. We are still in the stage where we are formulating ideas, and many of them have yet to produce anything concrete. In these areas, we ask for your continued guidance, and your frank comments are much appreciated. Although we only have limited time, I very much look forward to this discussion.

Yamaguchi: First, we would like to hear comments from Professor Higuchi.


Professor Higuchi

Professor Higuchi: As we've just heard from the chairman, I think the one exhibit that will play a central role this time around will be FIELD system. FIELD system has received the Grand Prix at the IT Japan Award, the Ten Great New Products Awards Masuda Award, and the Highest Award of the Nikkei Outstanding Product and Service Awards, all of which are the highest awards given. I want to congratulate you on your success. Although it has just recently entered the market, it has been highly evaluated, and further developments are anticipated. This week, FIELD system was introduced at the Techno-Frontier in Makuhari, where I watched the presentation at the booth in preparation for today. When Industry 4.0 was first introduced in Germany, I thought that utilizing the rapid development of information technology in manufacturing was a matter of course, and that there was no need to rush. With national projects, there's a tendency for system construction to start in a top-to-bottom manner, but with FIELD system, edge devices such as machine tools and robots play a crucial role, and the functions of the edge devices themselves are used. In addition, for users who want to use FIELD system, easy-to-use apps that are customized to user requirements are continually being offered. FANUC's sense of prioritizing on-site usability is very palpable.

One thing I noticed during this exhibition was the results of the joint developments with other companies. Since you are proactively pursuing cooperative development with other organizations, I thought it might be a good idea to create an exhibition booth for the results of cooperative developments.

In addition, I noticed that the fusion of the technologies of each of FANUC's divisions was showcased very effectively this time. For example, the vision sensors developed using robots was utilized in machine tools. Robots were used very effectively in the handling of the workpieces of ROBODRILL and ROBOSHOT.

From the perspective of my field of expertise, what I found the most interesting was the large servo motors. For servo motors, the ability to accelerate and decelerate rapidly is a major challenge. How much has the performance increased since before?

Taniguchi: About 10 times in torque.

Professor Higuchi: That's impressive. For large-scale manufacturing equipment, I imagine there are strong demands for equipment that can move at high speeds, achieve precise positioning, and is capable of reverse operation. FANUC has been a leader in electrification technology, which has been applied in products like injection molding machines and servo press machines. I want to see FANUC continue to excel in the field of large output servos. That's all from me.

Yamaguchi: Thank you for your comments. Continuing on, I would like to ask Professor Aoyama, Professor Shinno, Professor Takagi, Professor Shirase, and Professor Sasahara about FA.


Professor Aoyama

Professor Aoyama: I'm Aoyama from Keio University. I always get excited about the company exhibitions every year. The most surprising and interesting exhibit that stood out to me was FIELD system. It was first announced two years ago, and I believe there were connections to several other organizations at JIMTOF, but my honest impression was that this would not go beyond the conceptual level. However, as I saw today, they have shown concrete methods of system use and their results. FIELD system now looks like something that can work in practical ways in manufacturing. Another thing that was a surprise was the servers with NVIDIA installed in them. The level of completion was impressive, and I saw how it can develop into a production system that can be put to practical use. However, one thing I wondered was who is going to be responsible when this is developed into an application that is released to the world. Since it is software, I don't think there can be a 100 percent guarantee. I worry about where the responsibility will lie when accidents occur. Another thing I noticed was how it's built from the perspective of making the edge smart. I do think that the edge part of manufacturing should be smart, but when providing data collected using edge devices as feedback to production, there needs to be a system where it is stored on edge devices, in the fog, or cloud, and utilized extensively. Determining what parts of the collected data should be stored on edge devices, the fog, or cloud differs depending on the application, or how each application is built, which I think is a very difficult challenge. In a previous round-table talk, I talked about linking CAD and CAM data. Easy to say, but in practice, it is extremely difficult to do. Before we can link CAD and CAM data, we must utilize the edge, and as one smart way of utilizing the edge, I felt that processed data must be created with a strong understanding of the way NCs works.

Also, molds have started to become connected through IoT. Recent trends include embedding several sensors in the mold used in injection molding to monitor the molding state, or looking at the molding state of mold press machines by checking the pressure changes. Sensors and analysis software are emerging little by little. If these new mold systems and FIELD system can be linked at an early stage, it would improve production systems that use molding. It would be good if FIELD system applications can be used to create mechanisms that allow you to propose better molding conditions to operators based on the information gained using sensors.

On another note, although you can ask a machining professional to determine the threshold when utilizing AI systems used in FANUC products, I imagine that in the future, customers will want a system that allows non-professionals to utilize AI. Furthermore, I think that the next step to be taken is to not only use big data, but also turn it into knowledge to build systems that enable improved production.

Also, after seeing the heavy cutting of the ROBODRILL and the deep-hole machining of L/D, I was surprised at how high-spec they have become. I hope you don't mind the frankness of my comments. That's all from me.

Yamaguchi: Thank you. We appreciate your various comments on everything from FIELD system to AI, ROBODRILL, and the actual machining process. Professor Shinno, may we have a few words from you?

Professor Shinno: First of all, thank you for inviting me to the exhibition and this round-table talk today. Every year, I look forward to taking this opportunity to join in


Professor Shinno

discussions surrounding the future of manufacturing factories.
The use and application of IoT and AI are being widely talked about in recent years. Even in today's exhibition, there were announcements of new products related to connected industries and AI, and I felt the enthusiasm for following the national policy of rapidly putting new products on the market. All the products were at impressive levels of completion, and I really noticed how they had evolved a step beyond the products that were showcased last year.
First, with regard to vision, our laboratory is also pursuing research that proactively utilizes vision, so I was very interested in the robots that apply vision and status-monitoring exhibits. In all the exhibits, I saw that FANUC is engaged in groundbreaking research and development, and it served as a valuable learning experience for some of my students.
Also, with regard to big data, last year's exhibition seemed to focus on service fields. This year, I got the impression that there have been developments toward application especially for ROBODRILL. I saw that it has built-in systems that are useful for troubleshooting and operator support, so I shared some opinions about the feasibility of self-repairing functionalities based on the results of self-diagnosis as the next step.
With regard to sensors, I saw in the fiber laser exhibit how collaboration with other companies has led to the development of practical-use sensors, and how they can be embedded in robots to achieve exceptionally high positioning accuracy. We are also conducting machining research using fiber lasers, but we are still in the trial and error stage. After seeing today's exhibits, it made me eager to continue our research.
One point that I was impressed by was the significant changes to the functionalities and structure of the ROBONANO, and its impressive feat in achieving 0.1-nanometer resolution control. I was surprised to hear that they acquired hydrostatic bearing technology in such a short period, achieved high-level rigidity and high precision, and have already developed it to a level where it can be made into a product.
This exhibition emphasized the improved usability of products compared to the past. However—and this may just be my lack of expertise— I didn't find many things that struck me as exceptionally significant in that respect. I hope to see that highlighted more in next year's exhibition. Also, at the beginning of this round-table talk, Chairman Inaba mentioned smart factories that are connected and visualized, and I did see some new products related to intelligent technologies. However, I came away with an impression that was different from my notions of intelligence, including how they are different from conventional products. I'm eager to see in what ways those advancements will manifest by next year's exhibition. Thank you.
Yamaguchi: Thank you. We appreciate your input regarding usability and intelligence. We will try to improve on those points next year. Professor Takagi, a few words from you?
Professor Takagi: Thank you for inviting us and our students as well. With regard to Professor Shinno's comment about the 0.1-nanometer machining command, I was really surprised to hear that, because in integrated circuits, which is my field of expertise, it is said that four nanometers was the limit, and as recently as last year, it was one nanometer. This year, it has reached one-tenth of that.


Professor Takagi

In the Collaborative Robots section, which I was the most interested in, I saw that there was a 15-kilogram payload type that differed in specifications from conventional types, so I asked what the difference was.
I was told that this model had less temperature drift of the circuit itself. I talked about this last year as well, but after talking to various people from the noise immunity committee, I was told that noise reduction measures are about knowing the source, discovering the path of intrusion, and steadily searching for measures, and that there is no silver bullet for this problem. Another problem is that noise reduction measures tend to be forestalled, and that it is difficult to alter a device once it has been built.
Last year, I received several questions from FANUC personnel regarding parts arrangement. Apparently, it has nothing to do with circuits, but although calculations have been done with regard to parasitic capacitance, as well as whether to attach the bridge circuit resistors to the connector or the strain gauge during wiring, there are physically predetermined positions, which are difficult to change. I was also asked what kind of A/D conversion circuits are best. The questions became very detailed, and it seemed like it has gone as far as it can go. If you were to aim for one step higher, instead of working on completed machines, I think you could start completely from scratch and move in a more radical direction. I hope to be of help in that. Another thing that I worry about is malfunctions. I think it's also important to be able to predict malfunctions. If I can help in any way regarding sensing technology, I hope to have the chance to contribute. That's all from me.
Yamaguchi: Thank you for your valuable input. Professor Shirase, a few words from you?


Professor Shirase

Professor Shirase: My name is Shirase, from Kobe University. Thank you for inviting me again this year. I also came with great anticipation for FIELD system. I think that its becoming widespread hinges on usability. After that, I think it will be about how to satisfy the users of machine tools and robots, and how to create new value. In that respect, high-performance and high-quality hardware is crucial, but the key is how to offer services and convenience using a platform like FIELD system. As several FIELD system applications emerged, I continued to observe it expecting usability to improve in the future. However, as Professor Aoyama indicated, there is the issue of whether you can guarantee 100 percent reliability of the applications. Last year, I expressed that there may be a necessity for an insurance system that covers application troubles. According to the person I spoke to, since they cannot implement an inferior app, there was going to be some level of verification for functionality and reliability. However, from the standpoint of customer satisfaction, I think it's better to have the users choose. For example, you could release a sample app that was created as a test, and let users try it for free. If you get something like 10,000 likes, you can authorize it as an official app. If you can create a system that offers a place where users can assess the functionalities and reliability of apps, I think it would reduce the burden and responsibility for FANUC as well.
With regard to IoT and AI, I think it comes down to how

FIELD system will link with these technologies. In the exhibit, it was summarized that the volume, quality, and variety of data collected for AI learning is crucial. I totally agree with this. Today, all kinds of data are being collected through connected technologies and IoT, but I wonder if we can really acquire the information we need. For example, when working with machine tools, you can't acquire specific pieces of information, such as what kind of product it is making, what part it's working on, that the material is aluminum, and whether it's currently using a drill or an endmill. In our research, we are making efforts to achieve these things, but I thought it would be very interesting if these kinds of information could be acquired from machine tools.
Also, at the Fine Surface Technology and the Fast Cycle Technology sections of the FA exhibit, it was mentioned that functions that improve the quality of machining surfaces and shortens cycle times by carefully tuning the various parameters in the NC equipment will be released as 0*i*/30*i*/31*i*. However, since this only refers to the user interface that guides parameter settings, I don't know if it will be done with FIELD system or through another method, but I think the same thing can be achieved with older NC equipment. In addition, there are various appealing products emerging as AI apps, such as thermal displacement compensation systems, servo tuning systems, among others, which would all be great for users who understand AI, but for users who expect AI to be an all-powerful tool, I'm worried that they will be disappointed when they install it but doesn't work as well as they expected. I thought it would be wise to make sure to send the right message that these applications work well within the scope of the learning that the AI has achieved, but not so well outside of that range. Thank you.
Yamaguchi: Thank you for raising many interesting points. Professor Sasahara, a few words, please.
Professor Sasahara: I am Sasahara from Tokyo University of Agriculture and Technology. I spent the day enjoying the exhibition with two students and we were able to deepen our understanding on many topics. Thank you.


Professor Sasahara

The most interesting exhibit in the FA field was servo tuning and thermal displacement compensation by AI. FANUC's technology for collecting data directly linked with the machining result and machine movement and rapidly implementing optimization by skillfully using collected data has an unrivaled level of completion. I really look forward to the commercialization of this technology, which is also applicable to tuning FANUC CNCs already available on the market, and therefore, gives a big advantage to users. If you try to use AI at actual machining sites, you must collect a wide range of data. This results in a huge amount of data that contains both useful and useless data. I heard that FANUC has collected machining data from ROBODRILLs used in their factories. This means that FANUC has been conducting development using raw data. Because this is not merely a proposal of a concept, FANUC is one step ahead. I am impressed that this approach is so close to practical use.
With reference to data collection during operation of machine tools, while it goes without saying that information on the operating status, machine temperature and other factors is important, at last year's round-table talk, I expressed my hope that FANUC would work on collecting data on factors closer to the machining point, which is the information that most closely represents the product being machined. At this exhibition, I saw a vibration sensor embedded into the spindle of a ROBODRILL from which information is visually displayed. This is a step toward the realization of a system that collects data close to the machining point and feeds it back to adjust the operating conditions of the actual machine.
Another thing I want to mention is lasers. Although I was surprised by the demonstration of the synchronization between high-speed rotation and lasers last year, this year, the synchronization included another directly moving axis in addition to rotation, showing definite progress. In terms of laser application development, I have expectations for even greater developments in the combination of motion control CNC devices and lasers, which is a strength specific to FANUC. I think collaboration with a cutting-type machine tool is possible. For example, you could mount a laser on a cutting-type machine tool to perform quenching after cutting or irradiate a difficult-to-cut material with a laser to soften it before cutting. Such exhibits would widen the applications of laser processing. That's all from me. Thank you.
Yamaguchi: Thank you, professors. Now, Uchida, the CTO of FANUC, is going to comment on everyone's statements.
Uchida: Since I became CTO in the summer of 2016, I have constantly thought about how we should collaborate with one another throughout FANUC. I have not yet reached a conclusion but let me introduce some of our current efforts.


Uchida

Last year, we had an exhibit based on the concept of making QSSP (Quick & Simple Startup Package), a simple package consisting of a ROBOMACHINE and robot, easier to use and more affordable. This year, we evolved the concept of QSSP to aim for integration of the base CNC and robot controller and renamed the package QSSR (Quick & Simple Startup of Robotization). Our top priority is to examine how we can reduce investment cost and time in robotizing machine tools that incorporate FANUC CNCs.
Regarding lasers, we included CNCs and robots in the collaboration and synchronized laser oscillation with servo control. Our SERVO Laboratory is quite good at synchronous control of multiple axes and studies synchronous control of servo axes and synchronous control of servo axes and spindle axes, to name a few. I am sure that these technologies will come to be used in a wider range of fields. We also have robot control technologies and synchronized control of laser oscillators and peripheral axes and robot control at this exhibition. I believe this is something only FANUC could achieve.
Another example is high-grade machining. In the past, the CNC Software Laboratory and SERVO Laboratory addressed quality problems on the machined surface. However, the problems are caused by various factors such as the machine, tools, and machining conditions in addition to CNCs such as CAMs and servos. Because of this, software and servo engineers were sometimes unable to identify the cause. Now that the ROBODRILL Laboratory has joined the team, this so-called "cross-sectional team" investigates the cause. As a result, the team has become better able to reach conclusions through their analyses, such as the machining tool is different, the machine tool pad is not appropriate, or the vibration from the fan motor reaches the mechanical unit. FANUC is also collecting data from machine tools and robots in our factories to develop the preventive

maintenance function. This is easy to say but difficult to achieve. For example, we connected the spindle to a ROBODRILL to observe signs of failures. But we have not obtained data for preventive maintenance because the spindle rarely fails. This made us realize that a lot of knowledge, insight and experience are required to collect good data. We will further refine data collection techniques in the future.

Yamaguchi: Noda from the FA Laboratory will also make some comments.


Noda

Noda: Regarding what the CTO said about not yet being able to collect some NC information, we standardized the interface for extracting information from NCs about 15 years ago. And it was a good thing we did as it allowed us to connect past NCs to the network and collect information from them. As the IoT and AI continues to advance, the utility value of various information will continue to rise.

One direction of the evolution could be an interface that takes new technologies such as networks, the IoT, and AI into consideration.

Another point I want to emphasize about the idea mentioned here is that what seemed to be a concept was actually a concrete idea. That is a very good point. Recently, we hear about concepts such as that standalone AI will come to be used in manufacturing sites. However, we have realized that the usage of AI gradually becomes clearer as we get practical ideas by actually developing the AI. In this sense, this exhibition has moved to the practical phase.

This made me realize just how much FANUC has on its plate, including the IoT and AI.

Yamaguchi: Now, let's move on to motion control and robotics. Professor Matsubara, Professor Hori, Professor Sugano, and Professor Okatani, please share your thoughts with us.


Professor Matsubara

Professor Matsubara: I am Matsubara from Kyoto University. Last year, I said that green robots remove the fence separating machinery from the environment. Although a French instructor in our laboratory wanted to use a robot, we had to prepare many things such as a barrier and an emergency stop button. So, we should have just used a green robot. But there is more to this story. To use a robot, you must ensure safety management and the administrator must attend training. However, he is French and cannot understand Japanese training. So, I attended the training and operated the robot using the teaching pendant for a few days. I never knew how difficult it was to operate the robot until I actually tried. I had difficulty just telling the robot to move straight. If you fail, the robot hits the table. I thought to myself "we need to do something about this."

Today, I saw the robot with an acceleration sensor learn a movement. It was impressive that the robot was able to properly draw a circle, triangle, and rectangle. AI is used for this. Then, how about using the AI for measurement as well? Just making the robot move straight could change the world.

At last year's exhibit, FANUC tried to remove physical fences as the first step. This year, FANUC is apparently trying to widen the application range of robots by removing the fences between tasks. If these fences are removed, the robots, which have many degrees of freedom, can potentially be used for a variety of purposes. At today's exhibit, a robot on a dolly recognized a position by looking at a mark on the cover of the machine tool. If that is possible, you must be able to link the robot with the coordinate system in the machine, which would mean the number of possible tasks would increase even more.

Usually, we conduct measurements to understand the situation before performing the task, to solve the problem at hand. However, AI defines the task in a single step and solves the problem with the measured data. I clearly saw that that's how AI solves problems. In this sense, AI contains a problem solving methodology. We like tools. I think that's why we get the impression that AI is a little different.

Recently, machinery experts in our university are collaborating with information experts in many ways. I look forward to seeing where things go after the boundary between tasks is removed next year. Thank you.

Yamaguchi: Thank you very much. Professor Hori?


Professor Hori

Professor Hori: Today, I was impressed to see so many unique developments.

Power devices are strongly promoted in the SIP led by the Cabinet Office and I am a subprogram director in this program. In other words, power devices such as SiC, GaN, and Ga_2O_3 are entering a new era. When you break down the mechatronics field into devices, power electronics, servos, and high-end software like AI, these four categories seem to develop slightly out of phase with each other. As the trends and hot technologies constantly change, we need to seize opportunities when we see them.

I worked on power electronics and motor control in the Institute of Electrical Engineers of Japan, but now I work for the Society of Automotive Engineers of Japan and serve as the President of the World Electric Vehicle Association. We expect that future cars will evolve around motor, capacitor, and wireless technologies. These are opposite to the engine, lithium ion battery, and high-speed charging infrastructure. So, this expectation offends engine manufacturers and those attempting to create the high-speed charging infrastructure claim that that is out of the question. However, it is also critical to have such a dream for the future and at times it is equally important not to be affected by trends. Quite a few people believe that all cars will soon be electric vehicles but this is not going to happen. Gas-fueled cars will probably still be in use even 50 years from now and combustion technology is still very important. So, it is unimaginable that electric vehicles will completely replace gas-fueled cars. I am making this claim as the President of the World Electric Vehicle Association.

The world is full of interesting things. Today, FANUC has invited many young students. I always tell them to stay curious about everything. Today, FANUC showed us many different things again. I imagine that Chairman Inaba is curious about many things in the academic, business, industrial and other fields and finds a variety of things interesting. Thank you.

Yamaguchi: Thank you. Professor Sugano?

Professor Sugano: I specialize in human friendly robots and intelligent robots and I am very happy to see how the green robot evolves every year. I found it a very interesting new development that FANUC exhibited an on-site application example of a combination of a collaborative robot and AGV this year. Although AGVs

may not be FANUC's specialty, future collaborative robots will certainly need better harmony between movement and manipulation. I strongly hope that you proceed with development in this direction. Although it is said that human friendly robots will be used in households and for medical and welfare purposes, they will probably become common in the industrial workplace first. By using human friendly robots to their full potential in this area, we will be able to see what technologies and conditions are required for collaboration. Then, we will be ready to introduce human friendly robots into many other facilities including welfare and medical institutions for the first time. I hope FANUC will be a leader in this direction. Although it is true that Germany has the lead in standardization and certification, Japan should take the lead in the standardization and certification of collaborative robots as complete systems. However, it is difficult for universities to achieve this goal. That's why I hope that private companies will make efforts to show leadership in this area. In this sense, I hope that FANUC will make a significant impact on the world by playing a leading role and guiding us in the right direction.

Professor Sugano

I would also like to see you turn the SCARA robot into a green robot. The SCARA robot is good at assembly work and is very suitable for helping people around them. If the mobile, SCARA, and standard robots evolve like a cell that works as a part of a human being, the human friendly robot system will make much progress. I strongly hope that you will consider this sort of systemization. Today, the professors attending this talk have mentioned AI. Collaborative robots definitely need AI. Since human beings are ambiguous, the robots and systems that collaborate with human beings need a prediction function. AI is good at doing what human beings can do using their senses but is difficult to formulate. You could probably create a new production field by skillfully introducing AI into the part that corresponds to the prediction function of human beings. I hope that FANUC will develop these comprehensive frameworks. I'm counting on you.

Yamaguchi: Thank you. As we have recently come to see combinations of AGVs and collaborative robots more often at exhibitions, we will carefully watch future trends. Professor Okatani?

Professor Okatani: I specialize in vision, machine learning centered around vision, and deep learning. It is certain that, of these, deep learning has advanced the most dramatically in recent years. Voice recognition reached the commercialization level in the form of AI speakers. It was also reported last month that machine translation reached the human level in translating news articles between Chinese and English though there are still some problems. I remember saying "Everyone in the world thinks that the robot is the next trend." However, when I look back on the past year, research development in related fields was disappointing. Although Google DeepMind, which created AlphaGo, is most actively applying reinforcement learning to robots, they have had a hard time too. It seems that we must wait a long time until a true innovation occurs in the world of robots. The highest hurdle is the generalization capability in deep learning. In fact, the same problem exists even in the fields where deep learning is already effectively used. In any case, robots do not function as expected without data. Although there is the saying, "A word is enough to the wise," the current robot barely understands 20% of the big picture when given one word. We manage to handle pattern recognition problems such as image and voice with a realistic amount of data. However, when it comes to moving a robot, the space that the robot faces has too high a degree of freedom and it may be impossible to prepare corresponding data. A word is far from enough for the current level of deep learning and this is a large bottleneck. What we can do now is to find problems other than these and consider how to apply deep learning to problems for which a lot of data with clear input and output can be collected as learning data. Deep learning can be applied to many other FANUC products. The collaborative robot Professor Sugano mentioned is a typical example. Thank you.

Professor Okatani

Yamaguchi: Thank you for your valued opinion about the application of deep learning to robots. We must also think about this carefully.

Uchida: AI is a large subject in robotics. As the professors have just explained, FANUC will clearly recognize differences from the world of Google, that is, differences between the analog fields of mechanics and electricity and the world of text data and continue development. Text data is, by definition, already digitized and can be directly used for deep learning. However, the fields of robots and machine tools are occupied by analog data. So, it is important to consider how to digitize and apply it to AI. We must not underestimate the difficulty of this task. When I was invited by RIKEN last year, I saw a presentation of their project that involved videotaping the work processes of machining and casting engineers and convert the precision, time, temperature and other factors into data, that is, digitize them, from the video. That was an eye-opening undertaking. The analog level of robots seems to be a little bit lower than that of machine tools. However, the situation is the same in the spot, arc, laser and other welding process, after all. How to address this situation is a future challenge.

Yamaguchi: Abe from the Robot Laboratory, do you have a comment?

Abe: Users in existing markets are familiar with the use of robots. However, we are also aware that usability will be an issue when people who have never used robots start doing so in the future. This is a very difficult challenge. We will have to think about how much we can simplify operations and how people who have never used robots can move a robot or have it quickly learn or imitate an operation by using the imaging and AI systems. As Professor Matsubara said, collaborative robots provide a very good perspective on removing the fence separating machines from the environment to improve usability. However, we now face the next obstacle, the fence between tasks. We continue to struggle with such endless challenges every day. Professor Sugano also mentioned the SCARA green robot. In addition, now that the collaborative robot has been created, the AGV is also used in more scenarios. FANUC will continue to work on a variety of challenges one by one. We look forward to your guidance.

Abe

Yamaguchi: We will hear about the ROBOMACHINE from Professor Kuriyagawa, Professor Kunieda, Professor Shamoto, Professor Matsumura, and Professor Omori.

Professor Kuriyagawa: At this exhibition, I was most impressed by the ROBODRILL being able to machine Inconel in dry mode using a ceramic chip to the point


Professor Kuriyagawa

that the area around the tool becomes bright red. I was also surprised to see that the relative positions of the ROBODRILL and robot on the dolly in front of the ROBODRILL are automatically calibrated even if the robot is placed without thinking.
I heard that the ROBONANO has a resolution of 0.1 nanometers. I actually saw and was impressed with the truly smooth machined surface. The keyword of future machining technologies in Japan is high added value. Regarding high added value machining, I have recently been focusing on the purpose rather than the method. Two technologies are critical for functional sophistication. These are the creation of functions and ultra-precision machining. For the creation of function, we should first examine materials and then the design methodology to embody the function. For ultra-precision machining, we need to think about what the machine tool uses and in what way. The most important aspect is high precision NC. ROBONANO is the embodiment of these technologies.
I have also recently come to the realization that hardware such as the spindle and feed system is also important to configuring machine tools in addition to NCs. In other words, we must go back to and further study the basics of machines. For example, the static spindle looks perfect at a glance. However, we can probably improve the performance by examining the basics. In addition, we do not fully understand the phenomenon that occurs on the interface between the tool and chips or material during cutting. We can also study what happens when cutting fluid enters into the interface as well as the turning tool, grinder and other tools for ideal machining. We also study cutting fluid and there are still other interesting subjects such as oil for the static spindle or texturing of the spindle surface. We are also interested in the actual machining mechanism. One of our projects targets polishing GaN wafers. We also study what happens to atoms and molecules during machining. It is important to develop advanced systems and fundamental machining principles using FANUC machines while reviewing the basics.
In addition, we recently received an increasing number of requests for consultations from industrial manufacturers that want to enter into the medical field. Technologies for medical purposes will increasingly be needed in the future. Examples include medical devices for technologies for the aging society and technology to sense a person's health status before they become sick as the study of presymptomatic disorders. More and more researchers are conducting research and development on medical devices or medical systems in my laboratory as well. FANUC's ROBONANO and ROBODRILL have a very wide application range as exemplified by today's tooth implant exhibit. I expect that they will be used more often, especially in the medical field where small parts are often used.
We will continue to use FANUC machine tools for our studies. Thank you.
Yamaguchi: Thank you very much for saying so. Although we are a CNC manufacturer, we cannot create good CNCs without understanding machining. That's exactly what we are working on. Professor Kunieda, please share your thoughts
Professor Kunieda: In the Faculty of Engineering, we started internally creating commemorative medals to give to retired professors using a ROBODRILL this fiscal year. We succeed in creating great medals thanks to instructions from FANUC. We thank you for that. I saw the exhibition with five students today and they were surprised to see that such milling processing is possible.


Professor Kunieda

Although there has not been much progress in discharge machining technology in general, I saw eight new technologies today, and realized that FANUC is fully engaged in basic research as well. The combination with the collaborative robot, thermal displacement compensation, the use of AI, control to maintain the gap for override during machining, and underwater wire connections are impressive. Japan has led the discharge machining field. At an international conference on electrical machining three years ago, Japan gave 40 presentations and China gave 43, accounting for about 25% of all presentations. Although the same scientific meeting will take place in Spain next week, China will be the top presenter with 55 presentations followed by Germany, which will give 23 presentations.
The number of presentations given by Japan will be 20, accounting for 13% of the total. This clearly suggests that Japan is lagging behind.
We must somehow make a breakthrough. For this purpose, we must seriously work on basic research. Discharge machining conditions have always been adaptively controlled while monitoring discharge current and voltage waveforms. However, we still do not know how changes in current and voltage waveforms correspond to phenomena. We must understand these interrelationships.
As I said two years ago, only several percent of the crater volume dissolved in one discharge is removed and the remaining volume solidifies again. If all of the dissolved material can be removed, the current machining speed will increase by dozens of times. Basic research in this area has the potential to make a breakthrough.
In addition, simulation of discharge machining has not yet been put to practical use. This is due to the computation speed and the need for a huge database. However, this simulation is likely to be put to practical use soon in Europe. I think incorporating sensors is one way to put the simulation to practical use. I hope that FANUC work on this point to bring about a breakthrough. Thank you.
Yamaguchi: Thank you. Professor Shamoto?
Professor Shamoto: Thank you for introducing a lot of new technologies again this year. My specialty is machine tools and machining processes. So, I am most interested in the performance improvement of machining and I watched the exhibits with this point in mind. In a nutshell, it is great that ROBODRILL has reached a very high level in terms of comprehensive performance. There are many aspects of performance. The first aspect is high precision. ROBODRILL serves as a stage on which to practice technologies that will widely spread as a typical example of a machine tool. The whole system from hardware to software has reached a very high technological level as exemplified by ROBODRILL achieving surfaces close to a mirror surface in the past several years. The followability of NCs has been significantly improved thanks to HRV+. Software processing has also picked up speed. FANUC decreased tolerance by using a 0.1 micron command as NC input


Professor Shamoto

and realized a mirror-like finish as a result. It is practically significant that FANUC has realized this in very low-cost machine tools. The second aspect is high speed. This aspect of performance has been improved little by little by thoroughly cutting waste, exercising ingenuity in making the most use of the motor torque, among other efforts. The third aspect is high output. Because machining is so efficient and not just fast, even iron materials can be deep cut and machined. However, because we are using the small machine with spindle taper size of No. 30, problems with chattering or forced vibration are expected if we try many different kinds of machining, though it can be used without problems when the rigidity and attenuation are large. Although this is one of my fields of research, I feel that there are still many challenges to overcome. The last aspect is intelligence and smart machining. I saw a demonstration of monitoring with an acceleration sensor attached to the spindle of a ROBODRILL today. FANUC has developed technologies to monitor the machining process. This is a good direction to go in. In the process-related area, we must develop deeper technologies. There are still many challenges to overcome. In other words, this field has the potential for dramatic technological innovation.
I hope that FANUC will continue to develop technologies to improve each aspect of basic performance. Thank you.

Yamaguchi: Thank you very much for talking about the ROBODRILL. Professor Matsumura?


Professor Matsumura

Professor Matsumura: I had the chance to see several exhibits today, and I was impressed at how far the efforts toward AI application have advanced. I was especially interested to see how AI is applied in thermal displacement compensation. I believe that these kinds of AI control must be developed through learning by example with a strong understanding of the phenomena that actually occur. If incorrect data is learned, it will not function effectively. Filters and controls for interference are especially important. Take the impact of scraps and cutting fluid on status recognition, for example, there are still many challenges to achieving robust control. Also, from another perspective, I'm also interested to know how the AI functions when the machines malfunction, or undergo some unforeseen incident. I think the technology required to monitor machine status or machining processes by attaching acceleration sensors would be even more difficult than thermal displacement compensation. If you go further and consider vibration and strength during cutting, sufficient recognition cannot be achieved without fully grasping the conditions during machining. I saw in this exhibit that a sensor was attached on the spindle side to monitor the machining status, but I also heard that there were plans to also attach a sensor on the table side, which I think would help achieve even higher recognition precision. Furthermore, one important factor in machine learning is the necessity of considering the unique qualities of each machine, even if they are the same model. In the process of machine learning, the past data of many machines are used, but if you could separate generic past data from the data that are unique to each machine, the learning process could become more efficient.
With regard to FIELD system, the development of apps that takes FIELD system into consideration when developing ROBOMACHINEs seems to be underway, and I'm finally starting to see the overall picture. If you properly prepare an integrated development environment for those who are developing various applications, it would support future developments, and moreover, it would encourage researchers at universities like ours to take up the challenge.
There was an exhibit this year that linked ROBODRILLs with robots. I think this is great news for small to medium enterprises. This achieves the combined use of CNC and robots, which I think is a strength that is unique to your company. Furthermore, new machining methods that use Punch Tap required special movement control, but I felt that FANUC is uniquely capable of controlling complex combinations of operations.
The other exhibits also showcased some very impressive technologies. I look forward to seeing future developments.

Yamaguchi: Thank you for providing us with many useful hints for future developments. Professor Omori, a few words, please.


Professor Omori

Professor Omori: Thank you for the opportunity today to observe some of your new technologies and products. There seems to have been many developments since last year. I saw the ROBONANO exhibit first, and was very impressed by the demonstration of the free-curve surface cutting.
My research focuses on areas such as ultra-precision machining and nano-machining, but I also research the visualization of technical capabilities. About a decade ago, the massive rate of compulsory retirement of the baby boomer generation led to a severe shortage of expert machining technicians. We started a project that aimed to create a system that visualized the technical capabilities of technicians. Veteran technicians can look at a parts chart and know the steps required for machining, so there was no need to write flow charts. However, this is too difficult for younger technicians, so some form of visualization is needed. The way it works is that when you click on a certain process or step, the vital points are displayed, allowing the younger technicians to learn. If they prepare this way before learning the practical skills on site, they learn much faster. This verified its effectiveness as a method of visualization for technical capabilities and as a way of handing down information.
However, there has been a gradual drop in the number of people who can teach these skills and the number of people learning them. The issue of how to accumulate information and who should teach that information has become a difficult problem to solve.
With the ROBONANO, the architect of the process first acts as the operator to create the ultra-precision parts. The process itself is a collection of know-how. Since FANUC is involved in data collection and AI interaction, I thought it would be good if ROBONANO could learn the process of ultra-precision machining. If you can do that, then the more ROBONANO is used by experienced technicians, the more intelligent it gets. If a young successor uses ROBONANO, it could realize that this person is not as experienced, and offer suggestions accordingly. Especially with the problems that are anticipated as we approach the year 2050, seeing ROBONANO made me think that in the future, it will be the machining tools that will be providing suggestions. I was also very surprised today to see the improvement in the accuracy of robots with AI. In the past, you had to attach a diamond bit to a robot and make it handle the lathe turning process to acquire the function of a lens, but with today's robots, you can let them handle the tools to make more objects. I think this development will lead to a significant change in manufacturing methods of the

future. I'm also conducting research in bioprinting. Bioprinters are a type of 3D printer that can layer cells three-dimensionally to create functioning artificial internal organs. The cells are measured in units of 10 or so microns, so precision and resolution don't need to be at the nano level. If a bioprinter that can stack like a robot is created, it has the potential of becoming a groundbreaking product. I also saw the fiber laser exhibit. I sometimes perform implant machining, but when I cut valuable titanium alloys, they mostly end up as scraps. Combining machine cutting and laser cutting, such as by using lasers to make blank materials without waste, and then do the minimum necessary cutting, seems like the more modern method.
As the products we manufacture change with the times, I hope to see FANUC continue to showcase various usage situations and demonstrations. I think that would invite input from different perspectives from many users. I look forward to future developments.
Yamaguchi: Thank you. We appreciate your very interesting take on matters such as the visualization of technical capability and bioprinting. Now, a few words from Uchida, the CTO.
Uchida: Thank you for all of your valuable input. It has been a very insightful discussion with regard to our development efforts as a whole. There were some comments that were painfully true in some respects, but I hope to work on those points so that you'll see improvements next year. Regarding the trend toward IoT and AI starting with FIELD system, after becoming involved in AI development and considering the process from defining the challenges to methods of use, it has become clear that there is very little understanding of the physical phenomena on the factory floors of machining and molding. It made me really consider the importance of solidifying the fundamental basics.
On a final note, I think it's important not only to go back to the basics for research and development, but also for sales. It is crucial to hear the opinions of those working in our factories, and study the current conditions. The one conclusion I arrived at after hearing your many opinions is the need to carefully study everything from the highest levels to the factory floor, as well as the physical phenomena. Thank you all very much.
Yamaguchi: Thank you. Next, a few words from Fujimoto from the ROBOMACHINE Laboratory.
Fujimoto: I want to revisit the point raised by Professor Kunieda earlier about the sludge that melts upon the electrical discharge of the ROBOCUT and then resolidifies, and how if this was resolved, it would lead to improved speeds. I would like to work on that and hope to tie that to improved product performance. We appreciate your guidance.


Fujimoto

Yamaguchi: Professor Shinno, may we have some final comments before we conclude?
Professor Shinno: I would like to summarize all of the future expectations of FANUC based on the comments.
First and foremost, please make sure that FANUC's unique strengths are reflected in your products.
FANUC's strength lies in the fusion of software and hardware. There are not many companies in Japan that can really accomplish this. We would like you to focus on and pursue your strengths and improve on them, and create products that highlight those strengths.
Second, please present new concepts. In today's exhibition, we saw concepts clearly presented in more than half of the new products. Please present these new concepts as a way to inspire and motivate customers and your employees.
Third, please don't become satisfied with existing products but make sure they continue to improve and evolve. ROBONANO has achieved remarkable advancements in the past few years. Today, as I jokingly commented to a development lead, saying, "it looks like you've achieved all you can achieve," they responded by saying, "we still have a lot of the basics we have to work on." The challenges that we face are mostly unrefined, basic technologies, but that's something that involves all the professors who are here with us today. I hope to see these professors get more involved to engage in efforts to create more advanced products.
As the fourth point, please focus your strengths on basic research. In both industry and academia, our country is being criticized for neglecting basic research. In order to attain core competence, basic research is absolutely crucial. Luckily, we have in this round-table talk today some of the best brains in Japan. I hope to see all the knowledge and wisdom collected here today applied to the creation of open innovation based on meaningful industry-academic collaboration.
Finally, please create as many success stories as you can. I hope to see this industry-academic collaboration continue beyond mere information exchanges, and lead to concrete results and successful product development.
In recent years, in the manufacturing industry, the excessive focus on core technologies due to the concept of "selection and concentration" is being criticized for contributing to the decline in the research and development capabilities of companies. As a result, we have not been able to achieve what is sometimes called the "skills refined through combinations." Skills refined through combinations yield more significant effects the more elements there are. As we move into the future, companies and people that do not possess a surplus of skills and flexibility are on a certain path to failure, so I hope to see this company acquire various core technologies to strengthen and maintain their competitive edge. I've been invited to participate in this round-table talk for many years, and I've found it to be a very valuable fixed-point observation opportunity to discuss the future of manufacturing factories. It has also been a valuable opportunity for the professors who have joined us today to think about the future of manufacturing environments, so I hope to see this event continue to be held.
When formulating corporate and research strategies, PEST analysis is being used as an effective tool. When developing new products, companies internally discuss political factors (P), economic factors (E), social factors (S), and technological factors (T) and identify them, allowing them to see what kind of products should be created in the future. I hope that as a result, after presenting clear concepts, everyone involved shares their information with each other to create new products. Thank you.
Yamaguchi: We have always thought of ourselves as being focused on certain fields and forging a narrow path, but every time we have these round-table talks, I'm surprised by the breadth and depth of the knowledge of the professors. We hope to benefit from your guidance in various areas going forward, and look forward to your continued cooperation. Thank you very much.

FANUC Global Conference

This year's FANUC Global Conference was held for three days from March 12 to 14. Representatives of employees from FANUC Group companies worldwide assembled in one place to discuss future product developments and sales strategies. As globalization rapidly advances in the machine tool industry and industries that lead in metal machining technologies, such as the automobile and aerospace industries, this conference has become increasingly important, with a far higher number of overseas members participating than last year.

Similar to last year, discussions on many topics were held with the keywords "Transparency and Strict Preciseness," "one FANUC," "Reliable, Predictable, and Easy to Repair," and "Service First." The discussions were so active that three days seemed to not be nearly enough time.
The business divisions of FA, ROBOT, and ROBOMACHINE took turns introducing their latest products and features, and lively discussions were held on future development plans that meet market needs. Furthermore, the latest topics and information surrounding the "one FANUC" initiative, such as FIELD system, the new function development using AI, QSSR (Quick & Simple Startup of Robotization), fiber laser applications, and more were shared globally, and the steady progress toward an innovative reformation of manufacturing all over the world was palpable. On the final day, we introduced the newly completed FANUC ACADEMY to the overseas participants, and shared with them FANUC's approach in steadily supporting customers in the latest training environment that has an abundance of actual machines.

After all the sessions ended, Chairman Inaba hosted a party where all the participants further deepened their mutual friendships.

Completion of FANUC ACADEMY

The training facility known as FANUC ACADEMY was opened as a place where customers can better familiarize themselves with FANUC's products. FANUC ACADEMY is equipped with an abundance of machinery for hands-on learning and state-of-the-art training equipment. We've also built a Guest House where trainees can stay overnight. Our goal was to build a facility where all visitors will leave as fans of FANUC.



From the left: Training being offered on FA products, robot products, and ROBOMACHINE products

- Training rooms where trainees can learn and immediately apply their newly acquired knowledge on actual equipment. Each trainee is assigned their own CNC, robot, or ROBODRILL so they can get the most out of their training.
- Training that enables trainees to use equipment immediately upon returning to their companies Based on this motto, we offer easy-to-understand training.

We've designed FANUC ACADEMY in a way that allows anyone to participate in training programs whenever they wish by increasing the number of courses held. We will also continue to offer short courses that align with your needs.




The lodging rooms are designed to provide a comfortable stay during the training period, and iPads are used throughout the course so that trainees can freely prepare for lessons and review them afterward. There is also a hot spring spa adjacent to the Scandinavian-themed dining hall, where trainees can unwind and relax after a day of training.

Awards

● Received the GM Supplier of the Year Award

FANUC was selected as the 2017 Supplier of the Year for the 14th time and for the 13th consecutive year by the US-based company GM. Dr. K. Inaba, General Manager of the ROBOT Business Division, and President Cicco of FANUC America attended the award ceremony held in Orlando, USA on April 20.

● Received the VW Group Award

FANUC received the 2018 Group Award from the German automaker Volkswagen. President Yamaguchi and Dr. K. Inaba, General Manager of the ROBOT Business Division, attended the award ceremony held in Berlin on May 23.

● Received the Bene Meritus Award

FANUC Europe received an award for economic contribution from the city of Echternach, where it is located. President Tanzawa of FANUC Europe attended the award ceremony on April 24.

Certified as a Daimler CNC Supplier

FANUC Europe developed Daimler dedicated software and user interface and was chosen the official CNC supplier.

Ceremony to Welcome New Employees

The ceremony to welcome new employees was held on April 2 in the head office hall. On this day, 252 new employees joined the FANUC workforce. Hearing Chairman Inaba's encouraging and welcoming words, the new employees reaffirmed their determination.

Four Seasons of FANUC

Grey wagtail

Japanese hornbeam

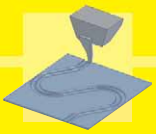
Long tail spangle

Summer is the liveliest season in the forest of FANUC.
The high-pitched and intricate chirping sounds of the grey wagtail can be heard, and the large and distinctively shaped spikes of the Japanese hornbeam can be seen hanging.

ROBONANO α-NM*i*A

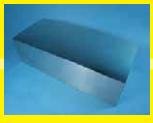
Ultra Precision Machine with Enhanced Ease of Use and Sustainability

Milling
(curved surface)

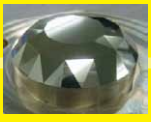


Cutting

Milling
(groove)



HUD mold machining



Watch part

Hologram

FANUC News 2018-Ⅱ

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