

The 15th International Machine Tool Engineers' Conference

The 15th IMEC

~ New core technologies accelerating innovation in machine tools ~

Oral Session

November 2nd (Fri.) ▶ 3rd (Sat.), 2012

Venue Reception Hall A, Tokyo Big Sight

Poster Session

November 1st (Thu.) ▶ 6th (Tue.), 2012

Venue East Hall 3, Tokyo Big Sight



This conference is subsidized by JKA through its Promotion funds from KEIRIN RACE.

Organizers: Japan Machine Tool Builders' Association, Tokyo Big Sight Inc.

For holding the 15th International Machine tool Engineers' Conference

Japan Machine Tool Builders' Association (JMTBA) has been holding the International Machine tool Engineers' Conference (IMEC) since 1984 during JIMTOF aiming contribution to improvement of world machine tool technology.

IMEC is the international conference where researchers, engineers and users of machine tools from the world gather and exchange technologies, and persons from the industry take the initiative different from other academic conferences held by academia aiming for academic results of research. This is the 15th holding of IMEC.

The severe accident of Fukushima No.1 nuclear power plant caused by Eastern Japan Great Earthquake happened in March 2011 forced Japan to review its energy policy, and also has greatly affected international energy policy of Japan. Other than that, globalizing of Japanese "MONOZUKURI" is accelerated by huge rising market in newly developing countries in addition to strong yen and more production ratio in newly developing countries.

In the developed countries, innovative progress is required for "MONOZUKURI" in aeronautical, automotive, energy and medical industries.

Under these conditions, the roll of the machine tools to directly carry out manufacturing of the basic producers' goods is getting highly important. To highly implement the role, innovative progress of machine tool technology is expected and international cooperation is indispensable to achieve the object.

Under these conditions, this time, we will hold IMEC under the comprehensive theme of "New core technologies accelerating innovation in machine tools" to focus on basic technologies of machine tool and discuss new basic technologies for the future reviewing the present basic technologies.

In oral session, key note session will be held under the theme "Machine tool in next stage", and for technical sessions, three themes are prepared for discussion, such as "Accuracy evaluation and error compensation of machine tools", "Chatter free technologies", and "High efficiency oriented technologies in machine tools and new material machining".

Also, in poster session, wide range of research results will be presented from the machine tools and their element technologies to machining, measurement and evaluation and tooling technology related with comprehensive theme and each session theme mentioned above.

Japan is facing many problems like reconstruction of Tohoku area after Eastern Japan Great Earthquake and actions for strong yen and for Euro crisis, etc. However, in the worldwide market, demand for machine tools is expected to grow in newly developing countries and also in developed countries.

We think it is a role of IMEC to serve the occasion to positively exchange technologies among the machine tool engineers of the world, not to limit to domestic, and to accelerate innovative progress of machine tool technologies to contribute to realize even higher level of the industry as a whole and to flexibly respond to such demand.

We hope the conference will become even more fruitful with participation of engineers, researchers and users of the machine tools from all over the world as many as possible.

Finally, we are much obliged to many speakers of domestic and overseas presenting papers in oral and poster sessions, many overseas special advisors, overseas special committee members and related organizations of domestic and overseas supporting IMEC for their great contribution.



Shinji SHIMIZU, Prof. Dr.

Chairman of Organizing Committee of 15th IMEC, JMTBA
Faculty of Science and Technology
Sophia University

<http://www.jmtba.or.jp/>

Outline

Name:	The 15th International Machine Tool Engineers' Conference (IMEC)
Aim:	IMEC is the international conference led by the industrialists. This conference aims for promotion of level up of worldwide machine tool engineering by technical exchange with participation of worldwide researchers, engineers, users and dealers related with machine tool.
Structure:	It is composed of two parts: The first one is oral session for real example and the trend of engineering development in the industry, using technique by the users and the topics having special attention; The second one is poster session widely announcing the results of advanced research and development on machine tool by poster format.
Organizers:	Japan Machine Tool Builders' Association, Tokyo Big Sight Inc.
Supporting Organizations:	<p><Overseas> KSMTE (Korean Society of Manufacturing Technology Engineers)</p> <p><Domestic> The Japan Society of Mechanical Engineers, The Japan Society for Precision Engineering, The Japan Society for Abrasive Technology, The Robotics Society of Japan, The Institute of Electrical Engineers of Japan, The Institute of Electronics Information and Communication Engineers, Japan Welding Society, The Society of Instrument and Control engineers, The Institute of Systems Control and Information Engineers, SME Tokyo Chapter, Machine Tool Engineering Foundation, Japan Society for the Promotion of Machine Industry, Advanced Machining Technology & Development Association, Machine Tool & Related Products Committee, Japan Forming Machinery Association, The Japan Machinery Federation, Japan Machine Tools Importers' Association, Japan Die & Mold Industry Association., Japanese Society of Die & Mold Technology, Japan Foundry Society, Inc., The Society of Japanese Aerospace Companies, Japan Automobile Manufacturers Association, Inc., Japan Auto Parts Industries Association, Society of Automotive Engineers of Japan, Inc., Mechanical Engineering Association, Japan Management Association, The Japan Electrical Manufactures' Association, The Japan Society of Industrial Machinery Manufacturers, The Japan Bearing Industrial Association, Japan Robot Association, The Japan Welding Engineering Society</p>

Organizing Committee:	Chairman	Prof. Dr. Shinji Shimizu, Sophia University
	Co-Chairman	Prof. Dr. Yoshimi Takeuchi, Chubu University
	Co-Organizer	Mr. Tetsuro Shibukawa, Mitsui Seiki Kogyo Co., Ltd. Prof. Dr. Hidenori Shinno, Tokyo Institute of Technology
	Members	Dr. Atsushi Ieki, Okuma Corp. Prof. Dr. Masaomi Tsutsumi, Tokyo University of Agriculture & Technology Prof. Dr. Tojiro Aoyama, Keio University Prof. Dr. Mamoru Mitsuishi, The University of Tokyo Prof. Dr. Noboru Morita, Chiba University Prof. Dr. Keiichi Shirase, Kobe University Prof. Dr. Atsushi Matsubara, Kyoto University Dr. Hitoshi Ohmori, RIKEN Ms. Masako Sudo, FANUC Ltd. Mr. Shigeo Ohishi, JTEKT Corp. Mr. Shingo Suzuki, Makino Milling Machine Co., Ltd. Mr. Koichi Amaya, Matsuura Machinery Corp. Mr. Tetuya Miyake, Mitsubishi Heavy Industries, Ltd. Dr. Makoto Fujishima, Mori Seiki Co., Ltd. Mr. Takashi Sawazaki, Sodick Co., Ltd. Mr. Atsushi Tada, Toshiba Machine Co., Ltd. Mr. Hidekatsu Asai, Yamazaki Mazak Corp.
	Permanent Advisor	Prof. Dr. Toshimichi Moriwaki, Setsunan University
	Honorary Advisors	Emeritus Prof. Hisayoshi Sato, The University of Tokyo Emeritus Prof. Yoshimi Ito, Tokyo Institute of Technology
	Advisors	Prof. Dr. Yuji Furukawa, Polytechnic University Prof. Dr. Ichiro Inasaki, Chubu University

Overseas Advisors	Overseas Committee Members
<p>Prof. Christian Brecher, WZL RWTH Aachen (Germany)</p> <p>Prof. Ekkard Brinksmeier, University of Bremen (Germany)</p> <p>Prof. Erhan Budak, Sabanci University (Turkey)</p> <p>Prof. Berend Denkena, Leibniz University of Hannover (Germany)</p> <p>Prof. David Dornfeld, University of California-Berkeley (U.S.A.)</p> <p>Prof. Robert J. Hocken, University of North Carolina-Charlotte (U.S.A.)</p> <p>Prof. Fritz Klocke, WZL RWTH Aachen (Germany)</p> <p>Dr. Wolfgang Knapp, Engineering Office Dr. W. Knapp (Switzerland)</p> <p>Prof. Bert Lauwers, K. U. Leuven (Belgium)</p> <p>Prof. Jun NI, University of Michigan-Ann Arbor (U.S.A.)</p> <p>Prof. Mustafizur Rahman, National University of Singapore (Singapore)</p> <p>Prof. Alexander Verl, University of Stuttgart (Germany)</p> <p>Dr. Tung-Chuan Wu, Industrial Technology Research Institute (Taiwan)</p> <p>Prof. Kazuo Yamazaki, University of California-Berkeley (U.S.A.)</p>	<p>Mr. Timothy B. Dining, Co-Chairman, AMT (U.S.A.)</p> <p>Mr. Shane Infanti, Chief Executive Officer, AMTIL (Australia)</p> <p>Mr. Martin Kapp, President, CECIMO (Europe)</p> <p>Mr. Wu Bailin, President, CMTBA (China)</p> <p>Mr. Vikram Sirur, President, IMTMA (India)</p> <p>Mr. Jong-Hyeon Shon, Chairman, KOMMA (Korea)</p> <p>Mr. Michael Hauser, President, SWISS MEM (Switzerland)</p> <p>Mr. John Hsu, Chairman, TAMI (Taiwan)</p> <p>Mr. Luigi Galdabini, President, UCIMU (Italy)</p> <p>Mr. Martin Kapp, Chairman, VDW (Germany)</p>

ORAL SESSION



Oral session conducts productive discussions among participants, also mainly consists of the speech for the results of advanced research and development on machine tools in the world to aim at innovative advancement of the machine tool in the future.

This time, Oral session is held under the theme "New core technologies accelerating innovation in machine tools" to re-review the basic focus based on current states of the machine tool technologies.

*Official languages: English and Japanese (with simultaneous interpretation service)



Date:	November 2nd (Fri.) - 3rd (Sat.), 2012
Venue:	Reception Hall A (Ground floor), Tokyo Big Sight
Maximum Number of Participants:	250 (on a first come, first served basis.)
Main Theme:	New core technologies accelerating innovation in machine tools
Keynote Theme:	Machine Tools in Next Stage
Technical Theme ①:	Accuracy evaluation and error compensation of machine tools
Technical Theme ②:	Chatter free technologies
Technical Theme ③:	High efficiency oriented technologies in machine tools and new material machining

Registration Fee: 10,000 Yen for One day, 20,000 Yen for Two days, per person (including tax)
"Proceedings" Fee is separately, 10,000 yen (including tax)

Deadline for Application: October 19th (Fri.), 2012

Method for Registration:

- 1: Please fill out the attached application form and send to Secretariat of IMEC by Telefax or E-mail.
- 2: Payment (through a bank transfer) is due upon receipt of invoice.
- 3: To notify of the completion of registration, you will receive a "Registration Card" about 2 weeks after confirmation of payment.
- 4: Please submit the "Registration Card" to the registration desk on the day of IMEC.

Conference Secretariat:

Secretariat of IMEC, Technical Department,
Japan Machine Tool Builders' Association (JMTBA)
 3-5-8, Shibakoen, Minato-ku, Tokyo 105-0011, Japan
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 E-Mail: IMEC15@jmtba.or.jp URL: <http://www.jmtba.or.jp/english/>

Cancellations:

If you want to cancel your registration, please inform the Secretariat of IMEC immediately in writing for refund of the registration fee. The cancellation will be processed based on the date when your cancellation notice is received after Oct. 19.

All refunds will be made after the conference.

(date received)	(rate of refund)
on and before Oct. 26.....	50%
after Oct. 27.....	0%

Opening Address

09:10~09:20

Mr. Motohiko Yokoyama, Chairman of Japan Machine Tool Builders' Association
Prof. Dr. Shinji Shimizu, Chairman of Organizing Committee

Keynote Session

Machine Tools in Next Stage

Chairperson: Prof. Dr. Shinji Shimizu (Sophia University)
Co-Chairperson: Mr. Tetsuro Shibukawa (Mitsui Seiki Kogyo Co., Ltd.)

- 09:20~09:30 Chairperson's Address
- 09:30~10:20 **Keynote Speech**
"Desirable Deployment of Japanese Machine Tool Industry in Not Distant Future"
Emeritus Prof. Yoshimi Ito, Tokyo Institute of Technology (Japan)
- 10:20~10:40 Coffee Break
- 10:40~11:30 **Keynote Speech**
"Trends and future possibilities of ISO standards for machine tools – accuracy tests, capability tests and environmental assessment"
Dr. Wolfgang Knapp, Engineering Office Dr. W. Knapp (Switzerland)
- 11:30~12:20 **Keynote Speech**
"Expansion of manufacturing technologies into the medical field"
Prof. Dr. Mamoru Mitsuishi, The University of Tokyo (Japan)
- 12:20~12:30 Q & A for Keynote session
- 12:30~13:30 Lunch Break

Technical Session 1

Accuracy evaluation and error compensation of machine tools

Chairman: Prof. Dr. Atsushi Matsubara (Kyoto University)
Co-Chairman: Dr. Makoto Fujishima (Mori Seiki Co., Ltd.)

- 13:30~13:40 Chairperson's Address
- 13:40~14:30 **Keynote Speech**
"The latest trends and future possibilities of volumetric error compensation for machine tools"
Dr. Heinrich Schwenke, CEO, ETALON AG (Germany)
- 14:30~15:15 **Speech**
"Error calibration for five-axis machining centers and new proposal to ISO standards"
Assoc. Prof. Dr. Soichi Ibaraki, Kyoto University (Japan)
- 15:15~15:35 Coffee Break
- 15:35~16:20 **Speech**
"Machining adjustment and evaluation method with 3D in-machine measurement system"
Mr. Kenichiro Ueno, Manager, C Development Project Office,
Technology Elements Development Section, Mori Seiki Co., Ltd. (Japan)
- 16:20~17:05 **Speech**
"Compensation technology for Volumetric error in Machine Tool"
Mr. Yusaku Yamada, General Manager, CNC Software Laboratory, Laboratory Division,
Fanuc Corporation (Japan)
- 17:05~17:15 Q & A for Technical Session 1

Program for Oral Session *Program is subject to change without notice.

Technical Session 2

Chatter free technologies

Chairperson: Prof. Dr. Tojiro Aoyama (Keio University)

Co-Chairperson: Dr. Atsushi Ieki (Okuma Corp.)

- 09:00~09:10 Chairperson's Address
- 09:10~10:00 **Keynote Speech**
"Phenomena regarding chatter and its core characteristics"
Emeritus Prof. Hisayoshi Sato, The University of Tokyo (Japan)
- 10:00~10:45 **Speech**
"Suppression of chatter vibrations in multi-tasking machine tools"
Prof. Dr. Erhan Budak, Sabanci University (Turkey)
- 10:45~11:05 Coffee Break
- 11:05~11:50 **Speech**
"Analysis and Suppression Technology of Tool Deformation Error"
Mr. Yoshihiko Yamada, Manager, Research & Development Center,
Advanced Fundamental Research Dept., JTEKT Corporation (Japan)
- 11:50~12:35 **Speech**
"Machining condition search function and its application example"
Dr. Harumitsu Senda, General Manager, R&D Dept., Okuma Corporation (Japan)
- 12:35~12:45 Q & A for Technical Session 2
- 12:45~13:00 Awards ceremony for The 15th IMEC Poster Session
- 13:00~14:00 Lunch Break

Technical Session 3

High efficiency oriented technologies in machine tools and new material machining

Chairperson: Prof. Dr. Hidenori Shinno (Tokyo Institute of Technology)

Co-Chairperson: Mr. Shingo Suzuki (Makino Milling Machine Co., Ltd.)

- 14:00~14:10 Chairperson's Address
- 14:10~15:00 **Keynote Speech**
"Energy-Efficient Machine Tools and Technologies"
Prof. Dr. Berend Denkena, Leibniz University of Hannover (Germany)
- 15:00~15:45 **Speech**
"The trend and manufacturing engineering challenges toward aircraft components"
Mr. Ryota Shibata, Manager, No.1 Manufacturing Engineering Section, Production Department,
Guidance & Propulsion Division, Aerospace Systems, Mitsubishi Heavy Industries, Ltd. (Japan)
- 15:45~16:05 Coffee Break
- 16:05~16:50 **Speech**
"Innovative high-efficiency machining technology of CFRP"
Mr. Hiroto Kojima, Manager, Manufacturing Technology R&D Team,
Manufacturing Engineering Dept. & Production Dept.,
Aerospace Company, Fuji Heavy Industries Ltd. (Japan)
- 16:50~17:35 **Speech**
"Advanced Machining Technology for Difficult-to-Cut Materials While Providing
Both Increased Productivity and Tool Life"
Mr. Hiroshi Ueno, Manager, Customer Application Group, Makino Milling Machine Co., Ltd. (Japan)
- 17:35~17:45 Q & A for Technical Session 3

Keynote Session

Machine Tools in Next Stage

Keynote Speech “Desirable Deployment of Japanese Machine Tool Industry in Not Distant Future”

Emeritus Prof. Yoshimi Ito, Tokyo Institute of Technology (Japan)



With the advance of the localized globalization, we must consider very complicated engineering environments surrounding the machine tool industry, and also various market needs across the whole world. This keynote address first shows an overall view for the desirable leading-edge technology-based (strategic) and bottom-up technology-based (tactic) products and discusses the necessary remedies to develop them in consideration of the present state of the Japanese machine tool industry. Following it, at issue in the discussion is the future perspective of the conventional MC and TC of Japan-make with special respect to the enhancement of the marketability in BRICs. In addition, the keynote address suggests the fundamental technological subjects. In retrospect, we have been aware of the crucial importance of such technologies, but not conducted actively the due research in academia so far.

Keynote Speech “Trends and future possibilities of ISO standards for machine tools – accuracy tests, capability tests and environmental assessment”

Dr. Wolfgang Knapp, Engineering Office Dr. W. Knapp (Switzerland)



The paper focuses on accuracy tests, capability tests and environmental assessment for NC machine tools. For accuracy tests the range of ISO standards is presented in a short overview. Main developments of the last years are presented, as well as gaps that are being closed by actual research activities. Advantages of accuracy standards are discussed, as well as future developments. A capability test for machine tools is defined in an ISO project; the standard under development is just about to be finished. Differences in the approach of the ISO committee on statistics and the ISO committee for machine tools are presented and discussed. Environmental assessment of machine tools is a new topic that caused the launch of new projects within the ISO committee for machine tools. The statuses of the projects are explained and future developments are discussed. Goals and benefits of this group of standards are given and discussed.

Keynote Speech “Expansion of manufacturing technologies into the medical field”

Prof. Dr. Mamoru Mitsuishi, The University of Tokyo (Japan)



The role of engineering, and in particular manufacturing technology, is increasing rapidly in the medical and welfare sectors. The biofabrication area is introduced first in my lecture with a discussion of the kinds of materials and the manufacturing methods used for an artificial joint and a stent. The micro and nano structure on the artificial joint surface allows for a rapid increase in the adhesive force between the bone and the artificial joint after implantation. Next, the biomechatronics area is introduced with a discussion of technologies to improve bone cutting accuracy and to reduce damage to the bone during joint replacement, including medical CAM and a high accuracy registration system. Furthermore, guidelines for designing such systems and devices are presented and future directions in therapy are discussed from an engineering perspective. Considerations for starting an enterprise are also mentioned briefly in the talk.

Keynote Speech “The latest trends and future possibilities of volumetric error compensation for machine tools”

Dr. Heinrich Schwenke, CEO, ETALON AG (Germany)



Some three years ago volumetric compensation machine tools has been introduced to industry. Today all mayor controller manufacturers have integrated the necessary algorithms in their NC kernels and the market step by step discovers the possibilities of numerical compensation in industrial practice. At the same time, the metrology has matured and instruments and software have been developed to cover the entire range of three to six-axes machines in industry.

After a short introduction to the basics of numerical compensation the talk will focus on practical experience and recent developments. It will present examples of large and very large machine tools as well as of small high end five axis machines. It will give an overview on the potentials as well as the limits of volumetric compensation. Special emphasis will be given to thermal issues and best practice to deal with them on the shop floor.

It will finish with a market analysis and an outlook of the role of numerical compensation in the future.

Speech “Error calibration for five-axis machining centers and new proposal to ISO standards”

Assoc. Prof. Dr. Soichi Ibaraki, Kyoto University (Japan)



For five-axis machining centers with rotary axes, the tool center point (TCP) displacement relative to the work table is influenced by not only the positioning accuracy of rotary axes, but also many factors such as alignment errors or gravity-induced mechanical deformation. It is important to observe how error motions of rotary axes change with their rotation, which is directly connected to the concept of the volumetric accuracy or the error map. Its numerical compensation is possible in many latest CNC systems. This talk will overview new technologies to calibrate volumetric errors of five-axis machines in an accurate, high-efficient, and automated manner using the R-test, the double ball bar, a touch-triggered probe, and machining tests. The revision of ISO standards related to error calibration and compensation of five-axis machine tools will be also presented.

Speech “Machining adjustment and evaluation method with 3D in-machine measurement system”

Mr. Kenichiro Ueno, Manager, C Development Project Office, Technology Elements Development Section, Mori Seiki Co., Ltd. (Japan)



Recently, various technology elements such as optics technology, data transfer technology, and information analysis technology reach to be available for the measurement using the laser sensor, and these basic technologies have reached to realize in-machine measurement on machine tool. In other hand, the accuracy requirement of the machine tool from user becomes higher, and the precision and automatic in-machine measurement system must be needed.

In this session, I show the current situation of the contactless measurement technology using the laser.

And also I introduce our measurement system built in machine tools with the laser triangulation sensor, and explain the difference with the usual contact measurement method and the current technical issue.

And furthermore, I explain several cases. of application using this measurement system applied to machining . adjustment, the measurement method for the accuracy improvement, the machining adjustment method, and the method how to evaluate the accuracy of machine tool.

Speech “Compensation technology for Volumetric error in Machine Tool”

Mr. Yusaku Yamada, General Manager, CNC Software Laboratory, Laboratory Division, Fanuc Corporation (Japan)



In this lecture, the compensation technology for the volumetric error in a machine tool is explained. In the movable volume of a machine tool, for assembly errors(straightness error or parallel error of guide, etc.) or movement errors(pitch error, thermal error, etc.), there are translational errors(positional errors) and rotary errors around each axis, as volumetric error. And, in a 5-axis machine tool, there are displacement center errors and tilted center errors of rotary axes, too. In order to realize high precision machining, those errors must be compensated.

In this lecture, Fanuc's up-to-date compensation technologies for the volumetric errors are also explained, including the compensation method and the compensation data configuration of the 3-dimensional error compensation and the 3-dimensional rotary error compensation. A few cases are explained, which show the effects of the compensation in a 3-axis machine and a 5-axis machine. The contents of the compensation data which a measurement machine makes is explained, and the way for the measurement machine to transmit the compensation data to CNC is explained.

Keynote Speech “Phenomena regarding chatter and its core characteristics”

Emeritus Prof. Hisayoshi Sato, The University of Tokyo (Japan)



The vibration problems of machine tool was recognized by a paper published in Proc. IME soon after the World War II, in which the papers in Trans. JSME on self-excited vibration, that is, chatter described in Japanese by Doi were referred. The basic phenomena of the vibration measured using the fine device developed in the investigation were clarified, however, the characteristics were not considered the chatter, but the forced vibration. The recognition as the chatter was after the war during his association with researchers in the vibration problems in Japan. In the 1950s the investigations on determining the limit for the region of the stable cutting conditions avoiding the generation of the chatter was actively carried out. The problems on the forced vibration started from identifying the characteristics of the structural vibration, which had to be developed to correlate with the machining accuracy regarding the surface roughness. The development was carried out using the various unique measurement devices for the surface profile. In the procedure of the development, the nonlinear stiffness at the junctions of the component structures, and the nonlinear phenomena in the chatter behavior after the onset were analyzed. The results contribute to improving how to design the structural performance for the machining, and how to manage the production planning efficiently.

Speech “Suppression of chatter vibrations in multi-tasking machine tools”

Prof. Dr. Erhan Budak, Sabanci University (Turkey)



The use of multi-tasking machine tools is increasing in industry due to their various advantages. These machines offer higher productivity and quality in many applications since the part can be completed in one set-up. In addition, some of these operations can be performed simultaneously which is another benefit offered by multi-tasking machine tools. For instance, parallel turning or milling provides increased productivity due to multiple cutting tools in operation. However, as in standard cutting operations, chatter vibrations may cause reduced productivity and part quality in parallel machining. If the cutting conditions are selected properly, on the other hand, chatter can be suppressed and stable high material removal rates can be achieved. In this talk, dynamics and stability of parallel turning and milling will be discussed. Effects of cutting conditions on parallel process stability will be presented through modelling and experimental results. Methods for suppression of chatter with increased productivity will also be shown. One of the interesting results is that the stability could be increased due to dynamic interaction between the tools creating an absorber effect on each other. Application of the developed methods will be demonstrated by several example cases.

Speech “Analysis and Suppression Technology of Tool Deformation Error”

Mr. Yoshihiko Yamada, Manager, Research & Development Center, Advanced Fundamental Research Dept., JTEKT Corporation (Japan)



In recent years, due to intensified global competitiveness in mechanical processing field, further reduction of lead time, reduction of costs and increase of accuracy are in demand. To solve these issues, it is important to predict and suppress tool deformation error due to machining phenomenon, not to mention increase of speed and accuracy of the machine tool itself.

For example, with deep machining of die mold, tool deformation error tends to become large due to high hardness of workpiece and long protraction length of the tool. Due to this, the machining condition is dropped and/or touch-up time is increased in order to keep the necessary accuracy, resulting low productivity.

In this lecture, technologies to measure, analyze and suppress tool deformation error, including chatter, will be introduced.

Speech “Machining condition search function and its application example”

Dr. Harumitsu Senda, General Manager, R&D Dept., Okuma Corporation (Japan)



In order to achieve faster delivery in the current manufacturing environment encouraging large-variety low-volume manufacturing, the optimum cutting conditions should be found in a short period. Searching the optimum machining conditions has been a key issue for its direct link to the productivity of machines as new materials have been developed for the functional advancement of products. At the same time, how to pass down the machining know-how of a lot of skilled workers, who are reaching retirement age, to the next generation of workers has become another major issue. For these reasons, the manufacturing means to obtain workpieces “with stable quality, high speed and high accuracy” is constantly required by the market.

It is a key to productivity growth to find the optimum machining conditions without difficulty. Therefore we visualized the type of chatter based on data on chatter and developed a system that automatically changes the spindle speed, which is one of the machining conditions. In this lecture, I am going to introduce an example of productivity growth actually achieved with this system at a manufacturing site after giving a brief explanation of the system.

Keynote Speech “Energy-Efficient Machine Tools and Technologies”

Prof. Dr. Berend Denkena, Leibniz University of Hannover (Germany)



Recently, production industries have to deal with the challenge to reduce its energy consumption more than ever. Machine tool manufactures are forced to improve the energy-efficiency due to more energy-conscious end-users and governments. Energy-efficiency also plays an important role in marketing, as this is a good opportunity for companies to improve their “green” image and stay competitive.

Therefore, measurements to identify optimization potentials have been performed. Although the energy consumption differs widely between machine tools, it can be seen that auxiliary components consume approximately two thirds of the total power machine tools. Hence, intelligent and process-oriented control techniques for cooling circuits, cutting fluid supply – especially high-pressure pumps – and in some cases hydraulics offer major improvements. Above this, new machine tool controls are able to supervise these units and switch between different operating states and sleep-modes to save energy in breaks.

In addition, engineering strategies such as lightweight structures or the efficiency increase of drives have to be developed even further. Because a faster processing shortens the power intake time, these improvements can go along with current research work on the optimization of machine tools and machining technologies.

Speech “The trend and manufacturing engineering challenges toward aircraft components”

Mr. Ryota Shibata, Manager, No.1 Manufacturing Engineering Section, Production Department, Guidance & Propulsion Division, Aerospace Systems, Mitsubishi Heavy Industries, Ltd. (Japan)



This lecture will describe the manufacturing engineering challenges toward aircraft components, especially for increasing importance for more efficient manufacturing, based on the current aircraft component market trend.

In this lecture the component features such as material, figure, and manufacturing method, of the latest airframe and engine will be described together with the position of aircraft industry in Japan and current civil aircraft trend. Then, using MHI, Mitsubishi Heavy Industries, typical aircraft components as samples, key points of technology will be introduced for more efficient manufacturing.

Speech “Innovative high-efficiency machining technology of CFRP”

Mr. Hiroto Kojima, Manager, Manufacturing Technology R&D Team, Manufacturing Engineering Dept. & Production Dept., Aerospace Company, Fuji Heavy Industries Ltd. (Japan)



CFRP is lightweight and high-strength material compared with conventional metals for aircraft structures. Recent aircrafts have been reducing their weight by converting their component materials to CFRP, as a result improvement of fuel efficiency and CO₂ emission reduction are expected.

However, trimming, drilling, etc to formed CFRP components are necessary to make CFRP components perform as aircraft structures. Because of wearing out of cutting tools and difficulties of ensuring machining quality by CFRP machining difficulties, CFRP machining process takes lots of energy, as a result, CO₂ emission increase can be a concern. And excessive machining speed increase can be cause of excessive cutting temperature rising and excessive cutting force, as a result material deterioration and quality loss can be a concern.

In this lecture, in the field of machining of CFRP for material of aircraft structure, the practical consideration based on its nature of material and machining quality requirement, several actual applications to achieve high-quality and high-efficiency machining, in addition, trails of new machining technology and prospects for future are introduced.

Speech “Advanced Machining Technology for Difficult-to-Cut Materials While Providing Both Increased Productivity and Tool Life”

Mr. Hiroshi Ueno, Manager, Customer Application Group, Makino Milling Machine Co., Ltd. (Japan)



Global demand for aircraft is increasing rapidly with some manufacturers planning to more than double production of some models in the next few years. These increases are driven both by the expected passenger growth of 5% per year, and also to replace aging fleets with modern, fuel efficient, environmentally friendly aircraft.

In order for aircraft parts manufacturers to remain competitive while machining difficult-to-cut materials their methods must incorporate the most advanced cutting process technologies. Two of the more significant process cost elements are production lead times and consumable tooling costs.

Makino has developed new “Four by Four” technologies that provide fourfold improvement in both metal cutting productivity and cutting tool life as compared to conventional processing of titanium components. Makino’s advanced research efforts support customers in the application of these modern technologies.

The core process elements are:

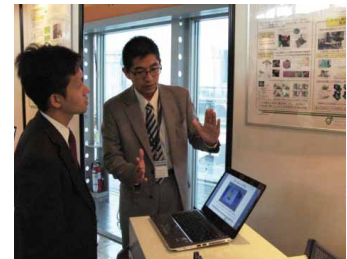
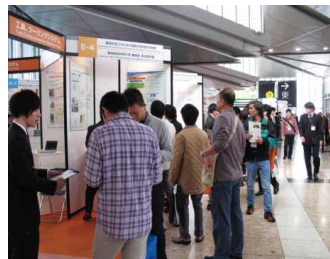
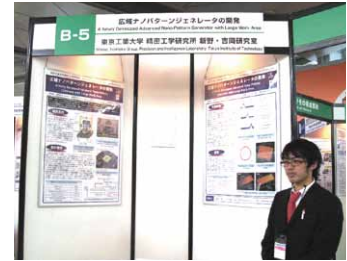
- ① Machine / spindle construction which provides a robust structure along with high damping characteristics
- ② New, advanced, cutting tool geometries and advanced cutting techniques to deliver shortened cycle times
- ③ Unique coolant delivery methods which provide extended cutting tool life
- ④ Sophisticated machine control technology which minimizes or eliminates opportunities for mistakes which effect production by preventing such problems as tool interference with the parts / fixtures and spindle overload conditions.

This presentation will explain Makino’s solutions which allow aerospace manufacturers to realize significant cost reductions in the production of titanium aircraft parts.

II POSTER SESSION

Poster session conducts discussions and technical exchange among researchers and engineers of machine tools by widely announcing the results of advanced research and development on machine tool from universities, technical colleges, public laboratories and member companies of JMTBA by poster format. In this session, all visitors of JIMTOF have an opportunity to discuss directly with presenter of poster session.

Briefing Assistants of each exhibitor shall provide explanations about research contents on 1 to 4 pm, November 3 and 4, 2012.



Period	Six days from November 1st (Thu.) through November 6th (Tue.), 2012,	Venue	East Hall 3, Tokyo Big Sight
Participants	The participants shall be limited to the teaching staff members and researchers of universities, technical college, public laboratories, etc. and the member companies of JMTBA.		
Briefing Assistants	<p>Briefing Assistants of each exhibitor shall provide explanations about research contents on 1 to 4 pm, November 3rd and 4th, 2012.</p> <p><u>Conference Secretariat:</u> Secretariat of IMEC, Technical Department, Japan Machine Tool Builders' Association (JMTBA) 3-5-8, Shibakoen, Minato-ku, Tokyo 105-0011, Japan Tel: +81-3-3434-3961 Fax: +81-3-3434-3763 E-Mail: IMEC15@jmtba.or.jp URL: http://www.jmtba.or.jp/english/</p>		

List of Participants and Research Theme (random)

A Machine tool and elements

Moronuki Lab., Tokyo Metropolitan University

"Patterned self-assembly of fine particles and application to polishing tool"
 "Design of friction with structured surfaces"

Saito&Tanaka Laboratory, Department of Mechanical and Control Engineering, Tokyo Institute of Technology

"Research on the Error Compensation and Machining Accuracy about the 6-DOF Parallel Mechanism Work Table"
 "Research on the Structural Color Appearance of Titanium by Laser Irradiation"

Graduate school of Engineering, Kyoto University

"Estimation of friction force arising at rolling guideway by locomotive multi-bristle model"

Otsuka-Toake Lab., Shizuoka Institute of Science and Technology

"Accuracy enhancement of precision positioning device by feedback cooling based on Peltier module"

Morimoto laboratory, Dept. of Mechanical Engineering, College of Eng., Kanazawa Institute of Technology

"Development of Pipe Frame Machine Tool"
 "Realization of 3D Surface by Lathe Turning"

CIMS Lab., Graduate School of Engineering, Kobe University

"Measurement and Evaluation of Power Consumption of Feed Drive System in 5-axis Machining Center"
 "Influence of Motion Error of Feed Drive Systems on Machined Surface"

Precision and Intelligence Laboratory, Tokyo Institute of Technology

"High Speed/Multi-DOF Lens Drive Actuator and its Application to Laser Beam Cutting"

Nakao Laboratory, Mechanical Engineering, Kanagawa University

"Improvement of bearing stiffness by optimum restrictor design of water hydrostatic bearings"

Kato laboratory, Department of Intelligent Mechanical Engineering, Faculty of Engineering, Fukuoka Institute of Technology

"Rotation control of air turbine spindle using high precision quick response pneumatic pressure regulator"

B Machining technologies and machining phenomena

ITOH laboratory, Collage of Engineering, Ibaraki University

"ELID Mirror Grinding Technique Using Component-Regulated Grinding Solution"

Enomoto Lab., Department of Mechanical Engineering, Osaka University

"Development of highly functional cutting tools with textured surface"

Ninomiya Lab., Department of Mechanical Engineering, Nippon institute of technology

"A method of environmental coolant supply in the grinding process on the 5 axes machine tool"

Technical Research Institute, Japan society for the Promotion of Machine Industry

"Wear of diamond cutting tools used for glass machining"

Production Engineering Laboratory, School of Engineering, The University of Shiga Prefecture

"Micro-End-Milling of Hardened Die Steel"

Moriwaki Lab., Setsunan University

"Machining of Carbides for Dies and Molds"

Precision Engineering Laboratory, Graduate School of Science and Engineering for Research, University of Toyama

"The effect of tool geometry on surface integrity in drilling of CFRP composite material"

Ultraprecision Engineering Research Group, Department of Mechanical Science and Engineering, Nagoya University

"Design of a novel boring tool with infinite dynamic stiffness for chatter avoidance"

Chiba University

"High-Aspect-Ratio Microdrilling with Laser Ablation"

Lee Yamada Lab., Department of Mechanical Engineering, College of Science and Technology, Nihon University

"Development of an electric discharge machine for micro holes"

National Institute of Advanced Industrial Science and Technology, Advanced Manufacturing Research Institute

"Machining conditions of CFRP using diamond abrasive"

Dr. Jun Shinozuka Laboratory, Department of Mechanical Engineering, Yokohama National University

"Cutting phenomena appearing in high-speed and ultra high-speed cutting states"

Matsuura Machinery Corporation

"Development of medical implants manufacturing technology by Laser sintering & high speed milling hybrid process"

Institute of Industrial Science, University of Tokyo

"Development of fixed abrasive tool with no supportive"

Ishida and Mizobuchi Laboratory, Institute of Technology and Science, The University of Tokushima

"Crack-Free Through-Hole Drilling of Glass Plate Using Electroplated Diamond Tool"

OONO Lab., Dep. Mechanical Engineering, Kyusyu Sangyo University

"A study on micro machining of brittle materials"

Manufacturing Laboratory, Faculty of Engineering, Nigata University

"Study on Evaluation of Cutting Performance with Ball End Milling for Inclined Surface using 3D-CAD"

Manufacturing System and Processing Laboratory, Tokyo Denki University

"Micro Milling of Brittle Materials"
"Analytical Simulation of Cutting Processes in Turning, Milling and Drilling"

Nontraditional Machining Laboratory, Graduate School of Natural Science and Technology, Okayama University

"Study on Improvement in Surface Characteristics for Metal Mold by Large-area Electron Beam Irradiation"

Manufacturing Engineering Lab., Graduate School of Natural Science and Technology, Okayama University

"Grinding System Considering Thermal Deformation of Workpiece"
"Micro patterning on cylindrical surface using blasting"

Precision Engineering Laboratory, Sophia University

"Determination method of machining conditions for extreme-small diameter end-mill considering tool wear"

Mitsubishi Sugita Laboratory, Department of Mechanical Engineering, School of Engineering, The University of Tokyo

"Layer-selective ultra-precision machining of biocompatible titanium alloys with micro surface reforming layer"

Kuriyagawa Lab., Graduate School of Engineering, Tohoku University

"Innovation of dental treatment by using powder jet deposition"

Sasahara lab., Tokyo University of Agriculture and Technology

"Development a novel machining technology for CFRP Flexible circular saw"
"Profile Grinding of Difficult-to-Cut Materials Using Coolant Supplying System from Inner Side of Grinding Wheels Hyper Grinding"

Suzuki Labo., Chubu University

"Ultraprecision Machining of Ceramics by Micro Milling Tool Made of Single Crystalline Diamond"
"Development of Uniform Polishing Machine of Large Aspheric Glass Lens"

Material Processing Laboratory, Dpt. Mechanical Engineering, Nagaoka University of Technology

"Large Area Machining of the Insulating Ceramics by EDM"

Nagasaki University

"High performance cutting technology for Sapphire"

Nakamoto Laboratory, Tokyo University of Agriculture and Technology

"Ultraprecision Machining of Hard Material by Suppressing Diamond Tool Wear"

Precision Engineering Laboratory, Department of Mechanical Engineering, Chubu University

"Novel Automated Finishing Processes of Electroless Nickel Plated Dies for Hard X-Ray Mirror Replication"

Tanabe Lab., Mechanical Engineering, Nagaoka University of Technology

"Cutting Technology in Strong Alkaline Water for Materials with Low Thermal Conductivity"

Precise Machining and Mechanism Lab., Nagaoka University of Technology

"Ultrasonic vibration assisted machining techniques for difficult-to-cut materials"

C Measuring and evaluation technology

Precision and Intelligence Laboratory, Tokyo Institute of Technology

"Surface texture assessment of ultra-precision machined parts using a laser speckle method"

Precision Engineering Laboratory, Sophia University

"Development of on-machine measurement system for the axis motion of rotational tools"

Precision and Intelligence Laboratory, Tokyo Institute of Technology Shinno Group

"An ultra-precision machining system equipped with an on-machine noncontact profile measuring function"

Sasebo National College of Technology

"Three-dimensional measurement of wheel surface topography with image processing"

Precision Engineering Lab., Osaka Institute of Technology

"Verification of draft test standard of five-axis machining center"

D System and control technology

Morishige Lab., Dept. of Mechanical Engineering and Intelligent Systems, The University of Electro-Communications

"Development of CAM Software for 5-Axis Controlled Machining"
"Development of Operation Interface for Machine Tool Using Haptic Device"

Department of Mechanical Engineering, Doshisha University

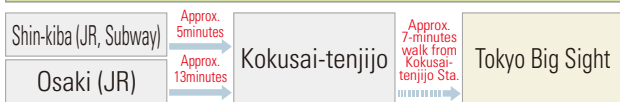
"End-milling Condition Decision Support System Using Catalog mining for Difficult-to-cut materials"
"Estimation and Improvement of High Precision of Dual Arm Cooperative Motion by Operating Rotary Motion of Working Plate with Dual Arm Robot"

Manufacturing Process Laboratory, Division of Mechanical engineering, Graduate School of Science and Engineering, Saitama University

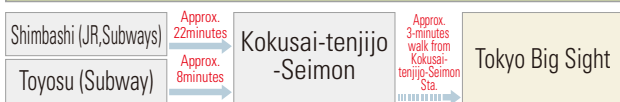
"Fast simulation method of instantaneous cutting force for continuous 5-axis machining"
"Ultra-parallel processing method for machining simulation based on Voxel representation"



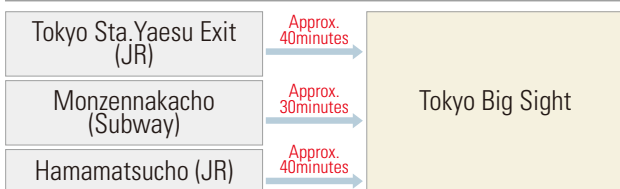
Rinkai Line



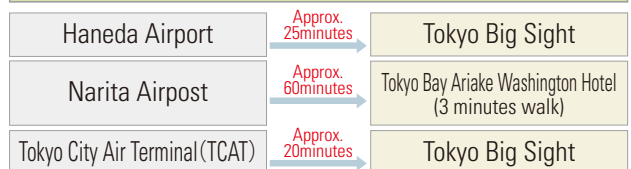
Yurikamome



Toei Bus



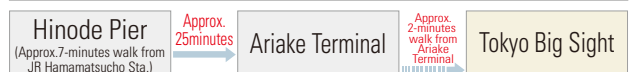
Airport Bus (Limousine Bus, Keihin Kyuko Bus)



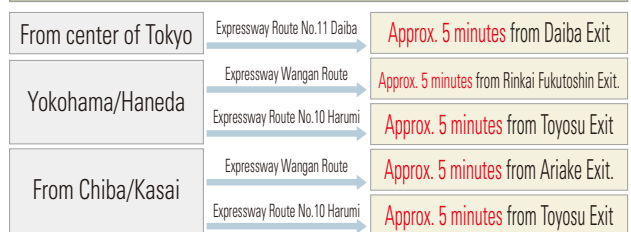
Express Bus (Keihin Kyuko Bus)



Water Bus



Car



Contact

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