The 17th International Machine Tool Engineers' Conference (The 17th IMEC)
Final Report

JMTBA and Tokyo Big Sight, Inc. held the 17th International Machine Tool Engineers' Conference at the occasion of JIMTOF (28th Japan International Machine Tool Fair) at Tokyo Big Sight.

The oral session was held during two days of November 20 and November 21, 2016 at the Reception Hall of Tokyo Big Sight, together with the poster session held since November 17 till November 22, 2016 at the East Hall 8 of Tokyo Big Sight. Both sessions were held with great success.

I. Oral Session

In the oral session of the 17th IMEC, 15 papers were presented during two days by the researchers and engineers actively working in the present society in and out under the overall theme of set as "Exploring Emerging Technologies of Manufacturing Innovation". There were 359 participants (433 participants in the previous conference) from foreign countries and domestic who enjoyed meaningful technical exchange through the presentation. The outline of the session is as follows.

1. Date: November 20th (Sun.) – November 21st (Mon.), 2016

2. Venue: Tokyo Big Sight Reception hall

3. Aims: IMEC is the international conference led by the industrialists. This conference aims at promoting level up of worldwide machine tool engineering by information exchange with participation of worldwide researchers, engineers, users and dealers related to machine tool.

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

5. Supporting Organizations:

・Overseas

euspen (European Society for Precision Engineering and Nanotechnology)
KSMTE (Korean Society of Manufacturing Technology Engineers)

・Domestics

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, 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 Tool Importers' Association, Japan

Die&Mold Industry Association, The Japan Society for Die and Mould Technology, Japan Foundry Society, Inc., The Society of Japanese Aerospace Companies, Japan Auto Parts Industries Association, Society of Automotive Engineers of Japan, Inc., Japan Management Association, The Japan Electrical Manufacturers' Association, The Japan Society Of Industrial Machinery Manufacturers, The Japan Bearing Industry Association, Japan Robot Association, The Japan Welding Engineering Society

*Machine Tool & Related Products Committee
Japan Machine Accessory Association, Japan Precision Machine Association, Japan Gear Manufacturers Association, Japan Fluid Power Association, Japan Grinding Wheel Association, Japan Cutting & Wear-resistant Tool Association, Industrial Diamond Association of Japan, Japan Precision Measuring Instruments Manufacturers Association, Japan Optical Measuring Instruments Manufacturers' Association, Japan Testing Machinery Association

6. Theme: "Exploring Emerging Technologies of Manufacturing Innovation"
Keynote Session : World-leading New Technology for the Future
Technical Session 1 : Key Technology for Smart Factory
Technical Session 2 : Development and Applications of Advanced Composite Materials
Technical Session 3 : New Machining Technologies for Manufacturing Process Innovation

7. Official Languages: English and Japanese (with simultaneous interpretation service)

8. Organizing Committee of IMEC:

Chairperson: Prof. Dr. Hidenori SHINNO, Tokyo Institute of Technology
Co-Chairperson: Prof. Dr. Tojiro AOYAMA, Keio University
Mr. Tetsuro SHIBUKAWA, Chubu University
Co-Organizer: Prof. Dr. Mamoru MITSUISHI, The University of Tokyo
Dr. Atsushi IEKI, Okuma Corp.
Members: Prof. Dr. Masanori KUNIEDA, The University of Tokyo
Prof. Dr. Tsunemoto KURIYAGAWA, Tohoku University
Prof. Dr. Keiichi SHIRASE, Kobe University
Prof. Dr. Atsushi MATSUBARA, Kyoto University
Prof. Dr. Takashi MATSUMURA, Tokyo Denki University
Prof. Dr. Hiroyuki SASAHARA, Tokyo University of Agriculture & Technology
Ms. Masako SUDO, FANUC Ltd.
Mr. Yoshio WAKAZONO, JTEKT Corp.
Mr. Norio MORI, Makino Milling Machine Co., Ltd.
Mr. Koichi AMAYA, Matsuura Machinery Corp.
Mr. Akihiro SAGO, Mitsubishi Heavy Industries, Ltd.
Dr. Makoto FUJISHIMA, DMG MORI SEIKI Co., Ltd.
Mr. Takashi SAWAZAKI, Sodick Co., Ltd.
Mr. Atsuhi TADA, Toshiba Machine Co., Ltd.
Mr. Yasuhiko SUZUKI, Yamazaki Mazak Corp.
Advisors: Emeritus Prof. Hisayoshi SATO, The University of Tokyo
Emeritus Prof. Yoshimi ITO, Tokyo Institute of Technology
Prof. Dr. Toshimichi MORIWAKI, Setsunan University
Emeritus Prof. Dr. Shinji SHIMIZU, Sophia University
Secretariat: Mr. Fumiyoshi OHTSUKI, Japan Machine Tool builders' Association
Mr. Teppei SASAGAWA, Japan Machine Tool builders' Association
Mr. Jun OKUBO, Japan Machine Tool Builders' Association

Overseas Advisors:
Prof. Christian Brecher, WZL RWTH Aachen (Germany)
Prof. Ekkard Brinksmeier, University of Bremen (Germany)
Prof. Erhan Budak, Sabanci University (Turkey)
Prof. Berend Denkena, Leibniz University of Hannover (Germany)

Prof. Fritz Klocke, WZL RWTH Aachen (Germany)
Dr. Wolfgang Knapp, Engineering Office Dr. W. Knapp (Switzerland)
Prof. Bert Lauwers, K. U. Leuven (Belgium)
Prof. Jun NI, University of Michigan-Ann Arbor (U.S.A.)
Prof. Mustafizur Rahman, National University of Singapore (Singapore)
Prof. Alexander Verl, University of Stuttgart (Germany)
Dr. Jwu-Sheng Hu, Industrial Technology Research Institute (Taiwan)
Prof. Kazuo Yamazaki, University of California-Berkeley (U.S.A.)

Overseas Committee Members:
Mr. Richard L. Simons, Chairman, AMT (U.S.A.)
Mr. Shane Infanti, Chief Executive Officer, AMTIL (Australia)
Mr. Luigi Galdabini, President, CECIMO (Europe)
Mr. Chen Huiren, President & CEO, CMTBA (China)
Mr. Parakramsinh G. Jadeja, President, IMTMA (India)
Mr. Jong-Hyeon Shon, Chairman, KOMMA (Korea)
Mr. Michael Hauser, President, SWISS MEM (Switzerland)
Mr. Alex Ko, Chairman, TAMI (Taiwan)
Mr. Massimo Carboniero, President, UCIMU (Italy)
Dr. Heinz-Jürgen Prokop, Chairman, VDW (Germany)

9. Number of Participants: Total 359
194, at November 20(Sun.), 2016 (including 12 from foreign countries)
165, at November 21(Sat.), 2016 (including 9 from foreign countries)

10. Program of the 17th IMEC Oral Session:

Theme: "Exploring Emerging Technologies of Manufacturing Innovation"
November 20th, 2016

09:10～09:20	Opening Address Mr. Yoshimaro Hanaki, Chairperson of Japan Machine Tool Builders' Association Prof. Dr. Hidenori Shinno, Chairperson of IMEC Organizing Committee
	Keynote Session：World-leading New Technology for the Future Chairperson：Prof. Dr. Hidenori Shinno, Tokyo Institute of Technology Co-Chairperson：Mr. Tetsuro Shibukawa, Chubu University
09:20～09:30	Chairperson's Address
09:30～10:20	Keynote Speech "Forefront of Internal-combustion engine development" Mr. Mitsuo Hitomi, Managing Executive Officer, Mazda Motor Corporation (Japan)
10:20～10:40	Coffee Break
10:40～11:30	Keynote Speech "Innovative Technologies in Tokaido Shinkansen during 50 years(safety and evolution)" Dr. Masaki Seki, President, Futaba Railways Industries co.,Ltd. (Japan)
11:30～12:20	Keynote Speech "Solar System enabled through Round Voyage Technology" Dr. Junichiro Kawaguchi, Professor, Senior Fellow, Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA) (Japan)
12:20～12:30	Q & A for Keynote session
12:30～12:45	Award ceremony for the Poster Session
12:30～13:30	Lunch Break

	Technical Session 1：Key Technology for Smart Factory Chairperson：Prof. Dr. Tojiro Aoyama, Keio University Co-Chairperson：Ms. Masako Sudo, FANUC Ltd.
13:30～13:40	Chairperson's Address

13:40～14:30	Keynote Speech “Networked Production – Challenges and Potentials for Manufacturing” Prof. Fritz Klocke, Fraunhofer IPT and WZL RWTH Aachen (Germany)
14:30～15:15	Speech “Platform for smart factory with IoT technology and activities with CNC and Robots” Mr. Hiroshi Noda, FA Business Division Vice General Manager, Fanuc Corporation (Japan)
15:15～15:35	Coffee Break
15:35～16:20	Speech “Machine Tool 4.0” Dr. Makoto Fujishima, Senior Executive Officer, Manufacturing/Development /Quality HQ, In charge of Electrical Circuit/Control, DMG MORI SEIKI Co.,Ltd. (Japan)
16:20～17:05	Speech “Trends and Directions in the Internet of Things and Industrial Internet” Mr. Sky Matthews, Watson IoT Division, IBM (U.S.A.)
17:05～17:15	Q & A for Technical Session 1

November 21st, 2016

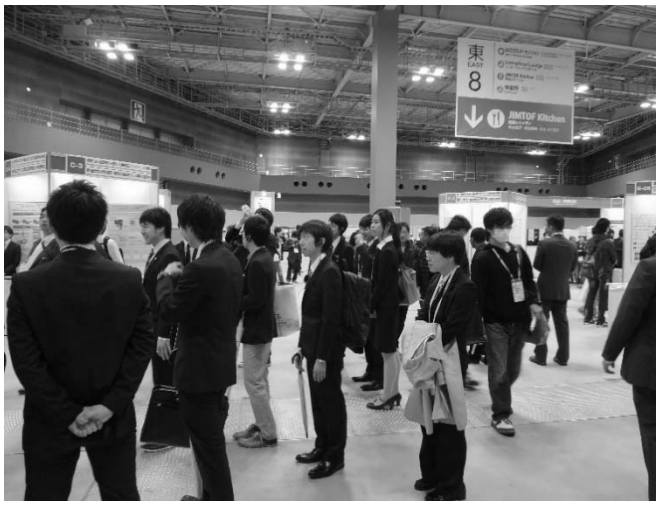
Technical Session 2：Development and Applications of Advanced Composite Materials Chairperson：Prof. Dr. Mamoru Mitsuishi, The University of Tokyo Co-Chairperson：Mr. Yasuhiko Suzuki, Yamazaki Mazaku Corp.	
09:00～09:10	Chairperson’s Address
09:10～10:00	Keynote Speech “Innovation of Carbon Fiber Production Process and Application to Industrial Products” Prof. Kazuro Kageyama, Department of Technology Management for Innovation, School of Engineering, University of Tokyo (Japan)
10:00～10:45	Speech “The latest developments of the CFRP technology” Prof. Yuji Kageyama, Graduate School of Engineering, Kanazawa Institute of Technology (Japan)
10:45～11:05	Coffee Break
11:05～11:50	Speech “The feature of the CFRTP「CABKOMA」and the application fields” Mr. Teruhiro Okuya, Director of R&D Dept., KOMATSU SEIREN Co.,Ltd. (Japan)
11:50～12:35	Speech “The automation technology of trimming and drilling processes for aircraft CFRP parts” Mr. Haruhiko Kakimoto Manager, Metallic Section, Production Engineering Department, ShinMaywa Industries, Ltd. Aircraft Division (Japan)
12:35～12:45	Q & A for Technical Session 2
12:45～13:45	Lunch Break

Technical Session 3：New Machining Technologies for Manufacturing Process Innovation Chairperson：Prof. Dr. Takashi Matsumura, Tokyo Denki University Co-Chairperson：Mr. Yoshio Wakazono, JTEKT Corp.	
13:45～13:55	Chairperson’s Address
13:55～14:45	Keynote Speech “The Application of a Technological Milling Simulation to the Manufacturing of Titanium Aircraft Structural Parts” Dr. Tobias Surmann, NC-Programming Division, Premium AEROTEC (Germany)
14:45～15:30	Speech “Blue Arc™ Technology and the Machine Tool Characteristics for Successful Implementation” Mr. Michael Petracci, Ventures Licensing Division, GE (U. S. A.)
15:30～15:50	Coffee Break

15:50～16:35	Speech “Additive Manufacturing in Aerospace” Mr. Paolo Gennaro, Strategy and Product Leadership Division, GE Avio S.r.l (Italy)
16:35～17:20	Speech “Gear cutting technology by universal machine tools that gear skiving function is added” Mr. Hisashi Otani, Machining & Process Engineering Office, Machine Tools &Mechatronics Engineering Dept., JTEKT Corporation (Japan)
17:20～17:30	Q & A for Technical Session 3

II. Poster Session

In the poster session of the 17th IMEC, 55 parties including universities and research institutes of in and out and the member of JMTBA were joined. The results of advanced research and development relating with machine tool of each parties were presented in posters. In total, 69 interesting themes were presented and which induced active technical exchange with the participants.



The organizing committee of 17th IMEC audited the themes with such references as (1) newness and originality of the research content, (2) possibility of contribution to the level up of machine tool technology, (3) expression and solicitation of the poster panel.

One prize for “The Best Poster Award” and five prizes for “Excellent Poster Award” and one prize for “Special Poster Award” were selected among the theses applied to the poster session. These awards were announced at the venue of JIMTOF opening reception on November 20, 2016. Each recipient was presented the award of a certificate by Prof.Dr.Hidenori Shinno, Chairperson of IMEC. Awarded parties and themes are shown as follows.

◆Best Poster Award

“Reduction of sputtering and thermal deformation in selective laser melting”

・Manufacturing Systems Laboratory, Faculty of Mechanical Engineering, Institute of Science and Engineering, Kanazawa University

◆Excellent Poster Award

“Development of an intelligent cutting process identification technique utilizing model-based simulations”

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

“Tool servo system driven by giant magnetostrictive element for milling process”

・Shinno-Yoshioka Group, FIRST, Tokyo Institute of Technology

“Fabrication of infrared microlens array by ultraprecision diamond turning of single-crystal silicon”

・Laboratory for Precision Machining and Nano Processing (PMNP Lab)

“Development of CBN cutting tool with textured flank face for high-speed machining of Inconel 718”

・Enomoto Lab., Department of Mechanical Engineering, Osaka University
"Development of Curved Hole Drilling Method by EDM with Suspended Ball Electrode"
・Nontraditional Machining Laboratory, Graduate School of Natural Science and Technology, Okayama University

◆Special Poster Award

・Institute of Machine Tools and Manufacturing, Swiss federal Institute of technology Zurich

In addition, the short presentation of IMEC poster session was held at East Hall 8 on November 19 and 20. Each researcher has presented the research contents for JIMTOF visitors.

The 17th International Machine Tool Engineers' Conference Poster Session
Researchers and Themes

No.	Researchers	Theme
A. Machine tool and elements		
A-1	Mitsuishi Sugita Laboratory, Department of Mechanical Engineering,School of Engineering, The University of Tokyo	Design of the CFRP-elastomer composite of high stiffness and damping capability
A-2	Moronuki Lab., Tokyo Metropolitan University	Surface Functionalization through Micro-structuring and Material Deposition
A-3	Suwa Research Group, Setsunan University	Estimating Power Consumption in Machine Tools Based on Specific Energy Consumption
A-4	Mosan's laboratory, Kanazawa Institute of Technology, Graduate School of Engineering, Graduate Program in Mechanical Engineering.	Development and performance evaluation of desktop machine tool with CFRP pipe frame
A-5	Precision Measurement and Manufacturing Laboratory, Dept. of Micro Engineering, Kyoto University	Evaluation of Position and Direction Dependencies of Machine Tool Stiffness
A-6	Precision Machining, Mechanical Systems Engineering, National Defense Academy	Study on wheel cover safety for grinding machines
A-7	Murayama Lab. , Department of Mechanical Engineering ,Tokai University	A study of a small NC machine for the construction of "Tabletop Size of the Factory"
A-8	Shinno-Yoshioka Group, FIRST, Tokyo Institute of Technology	Tool servo system driven by giant magnetostrictive element for milling process
A-9	Ultra-Precision Machine System Laboratory, Department of Mechanical Engineering, Kanagawa University.	Study on thermal stability of water hydrostatic spindle
B. Machining technologies and machining phenomena		
B-1	Sasahara lab., Tokyo University of Agriculture and Technology	A newly developed woven metal wire tool with electrodeposited diamond grains and its application in CFRP core drilling
B-2	Sasahara lab., Tokyo University of Agriculture and Technology	Wire and arc-based additive manufacturing -Fabricating high specific strength component and cooperative system for additive manufacturing with machining-
B-3	Kunieda Laboratory., Department of Precision Engineering, The University of Tokyo	The Simulation of Electrochemical Machining Process
B-4	Kunieda Laboratory., Department of Precision Engineering, The University of Tokyo	Micro Electrochemical Machining

B-5	Natsu Lab, Graduate School of Engineering, Tokyo University of Agriculture and Technology	Electrochemical Machining with Application of Electrolyte Suction Tool
B-6	Natsu Lab, Graduate School of Engineering, Tokyo University of Agriculture and Technology	Influence of Machining Conditions on ECM Equivalent Circuit's Parameters
B-7	Tsuchiya lab. Institute of Industrial Science, University of Tokyo	Mirror polishing of pearskin surface using double-layer fixed abrasive tool
B-8	Adachi Lab., Dept. Mechanical Engineering, Chubu University	Deep hole internal grinding technology using novel internal grinding spindle with a large length-to-diameter ratio
B-9	Precision Engineering Lab., Osaka Institute of Technology	Research on the Surface Properties by Turn-milling Process
B-10	Kuriyagawa, Shimada & Xu Lab./ Mizutani Lab, Department of Mechanical Systems Engineering, Graduate School of Engineering, Tohoku University	Fabrication of micropatterns by ultra-precision cutting
B-11	Manufacturing Process Laboratory, Tokyo Denki University	Micro machinings of thin wires
B-12	Manufacturing Process Laboratory, Tokyo Denki University	Cutting simulation in drilling of CFRP/Ti alloy stacks
B-13	Takeuchi Laboratory, Chubu University Department of Mechanical Engineering	5-Axis Control Finishing Suppressing Tool Wear
B-14	Takeuchi Laboratory, Chubu University Department of Mechanical Engineering	Dexterous Machining of Unstable Thin Plate
B-15	Enomoto Lab., Department of Mechanical Engineering,, Osaka University,	Development of CBN cutting tool with textured flank face for high-speed machining of Inconel 718
B-16	TANABE Labo., Nagaoka University of Technology	Forced Cooling Using Strong Alkaline Water
B-17	Precision Machining and Mechanism Lab., Nagaoka University of Technology	Precise machining technique aided by ultrasonic oscillation for difficult-to-cut materials
B-18	Nano precision manufacturing laboratory, Department of mechanical engineering, School of engineering, Tokyo Denki University	Nano precision technology for ultrahigh precision optics manufacturing
B-19	Innovation Center for Production Engineering, Chubu University	Texturing of Ti Surface for Dental Implant
B-20	Innovation Center for Production Engineering, Chubu University	Surface topography and dielectric properties of polished PMN-PT single crystals
B-21	Manufacturing process and functionality assessment lab., Sophia University.	Development of a novel shell shaping method with CFRTP
B-22	Precision Engineering Laboratory, Sophia University	Simulation method of ground surface roughness based on working surface profile of grinding wheel

B-23	Nontraditional Machining Laboratory, Graduate School of Natural Science and Technology, Okayama University	Development of Curved Hole Drilling Method by EDM with Suspended Ball Electrode
B-24	Laboratory for Precision Machining and Nano Processing (PMNP Lab), Faculty of Science and Technology, Keio University	Fabrication of infrared microlens array by ultraprecision diamond turning of single-crystal silicon
B-25	Laboratory for Precision Machining and Nano Processing (PMNP Lab), Faculty of Science and Technology, Keio University	Three-dimensional micro-structure fabrication of PCD by micro-EDM utilizing interfacial carbon diffusion
B-26	Manufacturing Systems Laboratory, Faculty of Mechanical Engineering, Institute of Science and Engineering, Kanazawa University	Reduction of sputtering and thermal deformation in selective laser melting
B-27	Sakai- Shizuka laboratory, Department of Engineering, Shizuoka University	Development of High productivity Cutting Technique by using Nitrogen Atmosphere
B-28	Cats laboratory, Graduate school of Engineering, Chiba University	Estimation of fracture surface pattern of glass sheet during wheel cleaving using high-speed polarization measurement
B-29	Manufacturing Engineering Lab., Graduate School of Natural Science and Technology, Okayama University	High Quality and High Efficiency Dry Grinding of CFRP Using Dry Ice Particle Blasting
B-30	Manufacturing Engineering Lab., Graduate School of Natural Science and Technology, Okayama University	Development of an intelligent grinding system considering thermal deformation of the workpiece during grinding process
B-31	Kakinuma Lab., Dept. of System Design Engineering, Keio University	Ultra-precision machining of optical materials
B-32	Yoshioka Group, School of Engineering, Tokyo Institute of Technology	Titanium Coloring Machining by Laser Irradiation
B-33	Ishida & Mizobuchi Laboratory, Tokushima University	Through-Hole Drilling of Quartz Glass Plate by Cavitation Aided Ultrasonic Vibration using Electroplated Diamond Tool with Straight Face Port
B-34	Goto Lab., Faculty of Science and Technology, Department of Mechanical Engineering, Shizuoka Institute of Science and Technology	Electrochemical Machining of Sintered Carbide
B-35	Itoh Lab., College of engineering, Ibaraki University	Fabrication of Hybrid Structure Grinding Wheel Using PELID and 3D Printer
B-36	Dr. Jun Shinozuka Laboratory, Department of Mechanical Engineering, Yokohama National University	Influence of the friction property at the tool-chip interface on a high-speed cutting mechanism
B-37	Ogawa Laboratory, Faculty of Science and Technology, Ryukoku University	Shape formation after laser hardening for high precision micro-cutting edge

B-38	Ninomiya Laboratory, Department of MECHANICAL Engineering, Nippon Institute of Technology	Machining of cemented carbide by combined use of EDM and grinding with a rotary PCD segment tool
B-39	OONO Laboratory, School of Science and Engineering, Teikyo University	A fracture free cutting for the freeform machining by the edge serrated tools
B-40	Photonics for Material Processing Lab., The Graduate School for the Creation of New Photonics Industries	Development of PCD micro end mills formed by ultrashort pulse laser
C. System and control technology		
C-1	Shinno-Yoshioka Group, FIRST, Tokyo Institute of Technology	Surface texture assessment based on analysis of laser speckle
C-2	Ultra-Precision Machine System Laboratory, Department of Mechanical Engineering, Kanagawa University.	Evaluation of power consumption for NC machine tool motion and cutting
C-3	Morishige Lab., Dept. of Mechanical Engineering and Intelligent Systems, The University of Electro-Communications	Development of Machining Interference that Aims for Rapid Prototyping by Cutting
C-4	Nakamoto Laboratory, Tokyo University of Agriculture and Technology	Proposal of Cutting Procedure Based on Topology Optimized Workpiece Shapes
C-5	Man machine Lab., Faculty of Mechanical Engineering, Institute of Science and Engineering, Kanazawa University	The Present and Future of Open CAM Kernel “Kodatuno”
C-6	Manufacturing Lab., Graduate School of Science and Engineering, Saitama University	Process planning system for multi axis controlled machining based on geometric calculation with ultra-parallel computing technology
C-7	Computer Integrated Manufacturing Systems Lab., Department of Mechanical Engineering, Graduate School of Engineering, Kobe University	Development of Innovative Intelligent Machine Tool based on CAM-CNC Integration Concept
C-8	Computer Integrated Manufacturing Systems Lab., Department of Mechanical Engineering, Graduate School of Engineering, Kobe University	Finished Surface Evaluation Method based on Human Visual Characteristics
C-9	Ultraprecision Engineering Research Group, Department of Mechanical Science and Engineering, Nagoya University	Development of an intelligent cutting process identification technique utilizing model-based simulations

C-10	Hibino Laboratory, Department of Industrial Administration, Faculty of Science and Technology, Tokyo University of Science	Production Management Method Using Simulation to Evaluate Productivity and Energy Consumption in Production Line Consisting of Machining Systems
C-11	Hibino Laboratory, Department of Industrial Administration, Faculty of Science and Technology, Tokyo University of Science	Cooperation Simulation to Simultaneously Evaluate to Production Line Operation including Machining and Feed of Computer
D. Measuring and evaluation technology		
D-1	National Institute of Technology, Sasebo College	High Speed Measuring of a Grinding Tool Surface Topography by a Voronoi Diagram
D-2	Kakinuma Lab., Dept. of System Design Engineering, Keio University	Sensorless cutting force estimation technique and its application
D-3	Yoshioka Group, School of Engineering, Tokyo Institute of Technology	Influence of angular error in multi-axis machine tool on estimation of machining force by disturbance observer
D-4	Lee & Yamada Lab. Department of Mechanical Engineering, College of Science & Technology, Nihon University	Proposal of on-machine measuring methods of cutting edge distributions
D-5	On-demand Manufacturing System Group, Advanced Manufacturing Research Institute, National Institute of Advanced Industrial Science and Technology (AIST)	Smart manufacturing by using advanced technology and monitoring
D-6	Micro and Nano Engineering Laboratory (HASE Laboratory), Department of Mechanical Engineering, Faculty of Engineering, Saitama Institute of Technology	Studies on AE Sensing for Making Smart Factory and IoT System in Machine Tools
D-7	Precision Machining Laboratory, Department of Mechanical Engineering, Meiji University	Study on the optical probe with the high lateral resolution by the collecting laser irradiation
D-8	Saito Laboratory, Department of mechanical engineering, College of engineering, Nihon University.	3-dimensional measurement of positioning accuracy of machine tools by using image matching
S. Special Exhibits		
S-1	Institute of Machine Tools and Manufacturing (IWF), ETH Zurich, Switzerland	Virtual methods: Simulation based tryout