

ICMDT 2015

PROCEEDINGS

The 6th International Conference on
Manufacturing, Machine Design and Tribology

Okinawa, Japan | April 22-25, 2015

No.15-204



The Japan Society of Mechanical Engineers



The Korean Society of Mechanical Engineers

ICMDT2015

Program at a Glance

Wednesday, April 22

	Plenary Room	Room A	Room B	Room C	Room D	Room E
15:00-17:00	Korea-Japan Friendship Seminar					
18:00-20:00	Welcome Party					

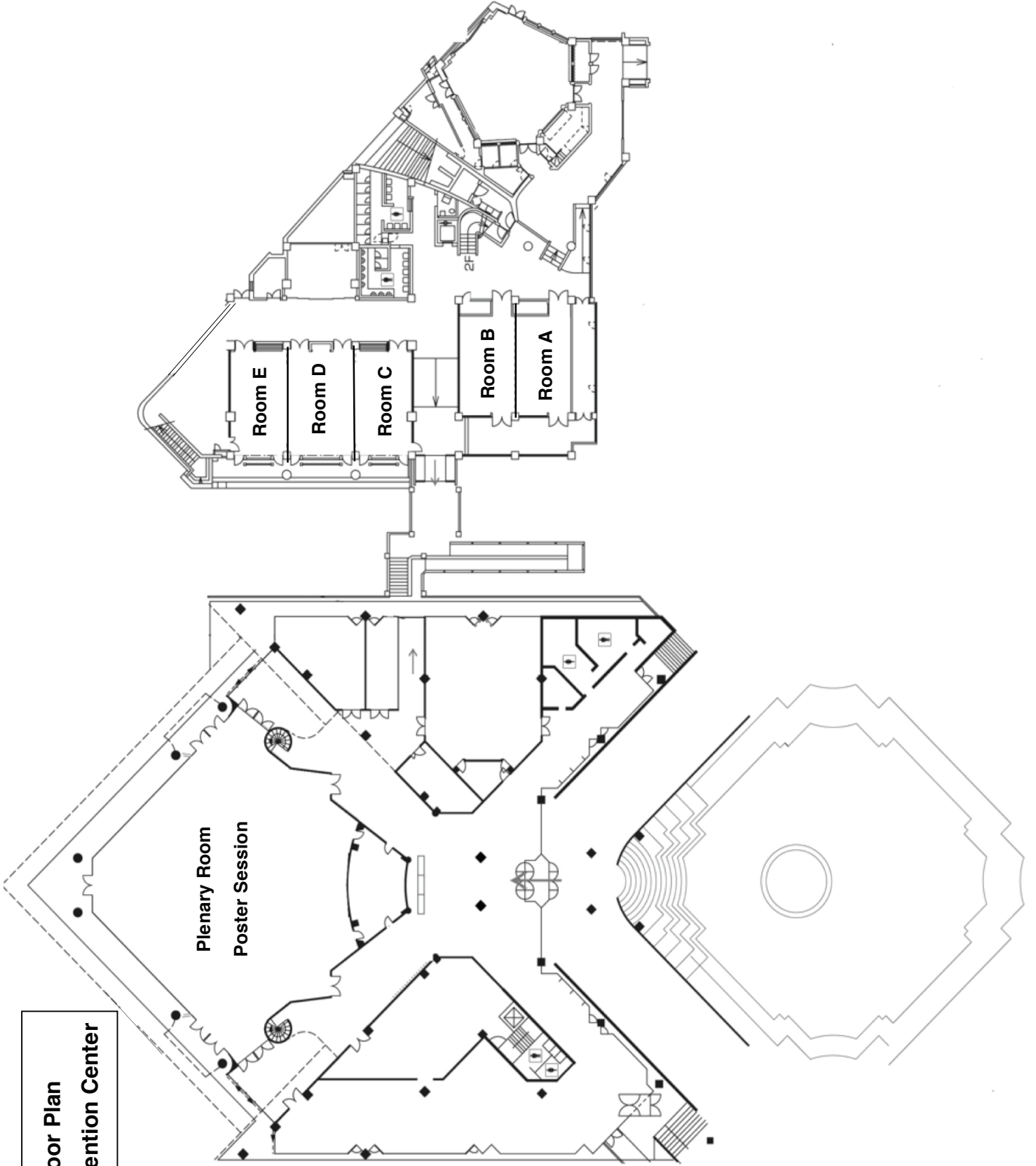
Thursday, April 23

	Plenary Room	Room A	Room B	Room C	Room D	Room E
9:00-9:15	Opening					
9:15-10:00	Invited Lecture 1 Dae-Eun Kim Yonsei University, Korea					
10:00-10:30	Keynote Lecture 1 Eiichirou Tanaka, Saitama University, Japan					
10:30-10:45	Group Photo/Break					
10:45-12:15		TH-A-1 Machine Elements (1) (Joint, Bolt)	TH-B-1 Coatings and Surface Modification (1)	TH-C-1 Machine Design (1)	TH-D-1 Hydraulic / Functional Fluid Actuators	TH-E-1 Manufacturing Systems
12:15-13:15	Lunch					
13:15-14:15	Thursday Poster Session					
14:15-14:30	Break					
14:30-15:00	Keynote Lecture 2 Hanafiah Yussof, Universiti Teknologi Mara, Malaysia					
15:15-16:45		TH-A-2 Machine Elements (2) (Bearing, others)	TH-B-2 Coatings and Surface Modification (2)	TH-C-2 Machine Design (2)	TH-D-2 Pneumatic Actuators	TH-E-2 Product and Process Design (IPPD)
16:45-17:00	Break					
17:00-18:30		TH-A-3 Micro/Nano Processing/ Micro/Nano Tribology	TH-B-3 Friction and Wear Mechanism	TH-C-3 Machine Design (3)	TH-D-3 Pneumatic/ Other Actuators	TH-E-3 Injection Molding/ Printing Technology for Manufacturing

Friday, April 24

	Plenary Room	Room A	Room B	Room C	Room D	Room E
9:00-9:45	Invited Lecture 2 Koichi Suzumori, Tokyo Institute of Technology, Japan					
9:45-10:15	Keynote Lecture 3 Yoshitomo Suzuki, JATCO Ltd, Japan					
10:15-10:30	Break					
10:30-12:00		FR-A-1 Transmission (1)	FR-B-1 Sustainable Tribology/ Tribology in Manufacturing/ Maintenance Tribology	FR-C-1 Cutting (1)	FR-D-1 Electrically Driven Actuators	FR-E-1 Forming
12:00-13:00	Lunch					
13:00-13:30	Keynote Lecture 4 Hiromu Hashimoto, Tokai University, Japan					
13:30-14:30	Friday Poster Session					
14:30-14:45	Break					
14:45-16:15		FR-A-2 Transmission (2)	FR-B-2 Lubrication	FR-C-2 Cutting (2)/ Grinding/ Polishing	FR-D-2 Sensing Systems	FR-E-2 Design for Manufacturability (DFM)
	Bus departs Convention Center for Banquet at 16:30					

**ICMDT 2015 Floor Plan
Okinawa Convention Center**



Technical Program

Thursday, April 23 9:15-10:00 Plenary Room

Invited Lecture 1 Chair: Noritsugu Umehara, Nagoya University, Japan

INV-1	Functional Coatings for Tribological Applications Dae-Eun Kim <i>Yonsei University, Korea</i>	2
-------	--	---

Friday, April 24 9:00-9:45 Plenary Room

Invited Lecture 2 Chair: Sangho Park, Chungnam National University, Korea

INV-2	New Pneumatic Artificial Muscle Realizing Giacometti Robotics and Soft Robotics Koichi Suzumori <i>Tokyo Institute of Technology, Japan</i>	4
-------	--	---

Thursday, April 23 10:00-10:30 Plenary Room

Keynote Lecture 1 Chair: Hiroshi Ishida, Tokyo University of Agriculture and Technology, Japan

KN-1	Development of Life Support Devices Using Inclusive Design Eiichirou Tanaka <i>Saitama University, Japan</i>	6
------	---	---

Thursday, April 23 14:30-15:00 Plenary Room

Keynote Lecture 2 Chair: Masahiro Ohka, Nagoya University, Japan

KN-2	NAO ASK ROBIN Project: Employing Humanoid Robot NAO as a Tool to Assist Emotion Recognition for Children with Autism Spectrum Disorder (ASD) Hanafiah Yussof, Syamimi Shamsuddin, Mohd Azfar Miskam <i>Universiti Teknologi MARA, Malaysia</i>	8
------	---	---

Friday, April 24 9:45-10:15 Plenary Room

Keynote Lecture 3 Chair: Syuhei Kurokawa, Kyushu University, Japan

KN-3	Innovative “Monozukuri” for Global Automotive Transmissions Yoshitomo Suzuki <i>JATCO Ltd, Japan</i>	10
------	---	----

Friday, April 24 13:00-13:30 Plenary Room

Keynote Lecture 4 Chair: Noritsugu Umehara, Nagoya University, Japan

KN-4	Tribology in Web Handling Hiromu Hashimoto <i>Tokai University, Japan</i>	12
------	--	----

Thursday, April 23 10:45-12:15 Room A

Machine Elements (1) (Joint, Bolt) Chair: Shinji Hashimura, Shibaura Institute of Technology, Japan

TH-A-1-1	Novel Joint Applicable in Off-Centered Condition Keiji Imado*, Kiyoshi Terada**, Thomas Harran* <i>*Oita University, Japan, **NTN Corporation, Japan</i>	14
TH-A-1-2	Tightening Reliability Using Elliptical Confidence Limit Soichi Hareyama, Ken-ichi Manabe <i>Tokyo Metropolitan University, Japan</i>	16
TH-A-1-3	Lifetime Prediction to Fatigue and Loosening Failure of Bolted Joint Soichi Hareyama, Ken-ichi Manabe <i>Tokyo Metropolitan University, Japan</i>	18
TH-A-1-4	Self-Loosening Behaviour of Multi-Bolted Joints – Requirements for Engineering Design in Real Applications Shiva Kumar Manoharan, Christoph Friedrich <i>University of Siegen, Germany</i>	20
TH-A-1-5	On the Thread Torque Induced by the Slippage at Mating Threads in Bolt/Nut Assembly under Repeated Tensile Loading Masaya Hagiwara, Fuyuhiko Ikezawa <i>Nagoya Institute of Technology, Japan</i>	22

TH-A-1-6	Optimal Design of Vision Illumination Optics for Inspection of Screw Threads Keun Park*, Seung-Woo Ra** *Seoul National University of Science and Technology, Korea, **Seoul Metal Co., Korea.....	24
-----------------	---	----

Thursday, April 23 15:15-16:30 Room A

Machine Elements (2) (Bearing, others) Chair: Hideki Ogata, IHI, Japan

TH-A-2-1	Comprehensive Evaluation for Performance of Ball Bearing Having Ceramics Rolling Elements (Electrical Pitting, Vibration Acceleration, Internal Wear and Degradation of Grease) Shoji Noguchi*, Tohru Kanada** *Tokyo University of Science, Japan, **Kanto Gakuin University, Japan.....	26
TH-A-2-2	Influence of Manufacturing Process on Rolling Fatigue of Steel Ball Ryousuke Ano*, Masahiro Fujii*, Hiroshi Ohsaki** *Okayama University, Japan, **Amatsuji Steel Ball Mfg. Co., Ltd., Japan.....	28
TH-A-2-3	Reduced Ordered Modeling of Rotor-Oil Film Bearing System by Filtering Large Eigenvalues for Hardware-In-the-Loop Simulator Wataru Tsunoda*, Wataru Hijikata*, Tadahiko Shinshi*, Hiroyuki Fujiwara**, Osami Matsushita** *Tokyo Institute of Technology, Japan, **National Defense Academy, Japan.....	30
TH-A-2-4	The Modified Stiffness Prediction of Compressive Helical Coil Spring by DESPM Yu Lim Kim*, Sung Hoon Kim**, Seong Won Choi***, Kyu Zong Cho* *Chonnam National University, Korea, **Nambu University, Korea, ***ENS Ing, Korea.....	32
TH-A-2-5	The Relationship of Incidence Angle of Sunlight and Amount of Sunlight Generation Jin-Won Chang, Saeng-Soo Kim, Jae-Kyoo Lim, Jong-Jo Lee Chonbuk National University, Korea.....	34

Thursday, April 23 17:00-18:30 Room A

Micro/Nano Processing/ Micro/Nano Tribology Chair: Hiroyuki Kousaka, Nagoya University, Japan

TH-A-3-1	The Effect of Texturing and Wettability on Growth of Frost Takayuki Tokoroyama, Shinpei Ito Akita University, Japan.....	36
TH-A-3-2	Superhydrophobic Hierarchical Structures Produced by Novel Low-Cost Stamp Fabrication and Hot-Embossing of Thermoplastic Film Sol-Yi Han*, Chae-Hee Lim*, Jae-Dong Eo**, Kwang Kim*, Wook-Bae Kim* *Korea Polytechnic University, Korea, **SNDENG Co., Ltd., Korea.....	38
TH-A-3-3	Fundamental Study on the Mechanical Properties of Multi-layer Graphene Structure Kuk-Jin Seo*, Hyun-Joon Kim**, Dae-Eun Kim* *Yonsei University, Korea, **Kyungpook National University, Korea.....	40
TH-A-3-4	A Study on Surface Morphology of a Triboelectric Nanogenerator Based on Contact-Separation Mode M. A. Parvez Mahmud*, Jaejong Lee***, Kee-Bong Choi*** *University of Science and Technology, Korea, **Korea Institute of Machinery and Materials, Korea.....	42
TH-A-3-5	Investigation of Wear Characteristics of Nano-structured Surface Using AFM Hyun-Joon Kim*, Dae-Eun Kim** *Kyungpook National University, Korea, **Yonsei University, Korea.....	44
TH-A-3-6	Comparison of the Tribological Performance of HIP and SP Sintered Si₃N₄-MLG Nanocomposites Maria Maros B.*, Alexandra K. Németh*, Zsolt Maros*, Zoltán Károly**, Eszter Bódis**, Katalin Balázs**, Orsolya Tapasztó** *University of Miskolc, Hungary, **HAS, Hungary.....	46

Thursday, April 23 10:45-12:15 Room B

Coatings and Surface Modification (1) Chair: Hatsuhiko Usami, Meijo University, Japan

TH-B-1-1	Surface Characteristics of Plasma Nitrided 12% Chrome Steels Lyta Liem, Farid Triawan, Hideaki Maeda Torishima Pump Mfg. Co., Ltd., Japan.....	48
TH-B-1-2	Improvement in Adhesive Property of DLC Film Coated on Inner Surface of Narrow Metal Tube by MVP Method Yoshihiko Hagiyama, Hiroyuki Kousaka, Noritsugu Umehara Nagoya University, Japan.....	50

TH-B-1-3	Torque Reduction Technology of Oil Sealing System by Surface Coating Takeshi Kunishima, Takeshi Kawabayashi, Takanori Kurokawa, Hirokazu Arai <i>JTEKT CORPORATION, Japan</i>	52
TH-B-1-4	Effects of Temperature and Counterpart Material on Wear Property of CNx and DLC Takuya Yamanouchi*, Yukio Tanaka**, Shingo Kawara*, Deng Xingrui*, Noritsugu Umehara*, Hiroyuki Kousaka* <i>*Nagoya University, Japan, **Torishima Pump Mfg. Co., Ltd., Japan</i>	54
TH-B-1-5	The Effect of Contact Length on Friction Force of Looped Carbon Fiber Brush When It Starts Sliding Takuya Shitaka*, Yosuke Tsukiyama**, Isami Nitta**, Noritsugu Umehara*, Shingo Kawara*, Hiroyuki Kousaka*, Deng Xingrui* <i>*Nagoya University, Japan, **Niigata University, Japan</i>	56
TH-B-1-6	Analysis of Wear Track on DLC after Sliding with MoDTC Containing Lubricants Kentaro Omura*, Kenji Ohara**, Kiyoshi Hanyuda**, Yasushi Kawamura**, Noritsugu Umehara*, Hiroyuki Kousaka*, Deng Xingrui* <i>*Nagoya University, Japan, **Showa Shell Sekiyu K.K., Japan</i>	58

Thursday, April 23 15:15-16:30 Room B**Coatings and Surface Modification (2) Chair: Takayuki Tokoroyama, Akita University, Japan**

TH-B-2-1	In-situ Observation of Transformed Layer in the Friction Area of a-C:H Sliding against Sapphire (α-Al₂O₃) Hidenori Nishimura, Noritsugu Umehara, Hiroyuki Kousaka, Xingrui Deng <i>Nagoya University, Japan</i>	60
TH-B-2-2	Discussion of Super Low Friction Mechanism of CNx Coating Sliding Against CNx in Oil Kazuyuki Ichimura, Xingrui Deng, Noritsugu Umehara, Hiroyuki Kousaka, Kenji Ishikawa <i>Nagoya University, Japan</i>	62
TH-B-2-3	Research on Thermal Stability of DLC by Using In-situ Environmental Scanning Electron Microscope Xingrui Deng, Hiroto Izuoka, Hiroyuki Kousaka, Noritsugu Umehara <i>Nagoya University, Japan</i>	64
TH-B-2-4	Effects of Residual Gases during Deposition on the Friction Properties of Si-containing a-C:H Films Hotaka Shibasawa*, Hiroyuki Kousaka***, Noritsugu Umehara*, Xingrui Deng* <i>*Nagoya University, Japan, **CREST, Japan Science and Technology Agency, Japan</i>	66
TH-B-2-5	The Role of Metal-Rich Tribofilm on the Load Dependent Friction Behavior of Metal Diamondlike-Carbon Nano-Composite Coatings Minoru Goto*, Julien Fontaine**, Takanori Takeno***, Hiroyuki Miki***, Kosuke Ito**** <i>*Ube National College of Technology, Japan, **Ecole Centrale de Lyon, France, ***Tohoku University, Japan, ****Nihon University, Japan</i>	68

Thursday, April 23 17:00-18:30 Room B**Friction and Wear Mechanism Chair: Alan Hase, Saitama Institute of Technology, Japan**

TH-B-3-1	Relationship between Friction Force and Real Contact Area Observed by Laser Microscope with Wide Field of View Yosuke Tsukiyama, Naoya Fukuda, Takuto Masuda, Isami Nitta <i>Niigata University, Japan</i>	70
TH-B-3-2	Investigation of Friction Increment between Two Film Surfaces by Electric Field Jeongoo Kang, Hyunduk Shin, Jeha Ryu <i>Gwangju Institute of Science and Technology, Korea</i>	72
TH-B-3-3	Erosive Wear Mechanisms of Metal on Fine Particle Peening Process Koichiro Nambu*, Hitoshi Toya**, Hatsuhiro Usami**, Yukio Takizawa***, Keju Chou***, Misaki Saito***, Yoshikazu Yamada****, Masafumi Ando**** <i>*Suzuka National College of Technology, Japan, **Meijo University, Japan, ***Itoh Kikoh Co., Ltd., Japan, ****IKK Shot Co., Ltd., Japan</i>	74
TH-B-3-4	Wear Mode Transition of Polyamide 66 Resins Filled with Hard Particulate or Fibrous Filler Kei Shibata, Moeko Kishi, Mei Fukuda, Takeshi Yamaguchi, Kazuo Hokkirigawa <i>Tohoku University, Japan</i>	76

TH-B-3-5	Effect of Mating Material on the Friction-induced Structure-change of DLC Film Eitaro Nakatani, Hiroyuki Kousaka, Xingrui Deng, Noritsugu Umehara <i>*Nagoya University, Japan, **CREST, Japan Science and Technology Agency, Japan</i>	78
TH-B-3-6	Effects of Temperature and Oxygen Concentration of Water on Wear of Diamond-Like Carbon (DLC) under Pressurized Hot Water M.Z.M. Rody*, K. Okuno*, N. Umehara*, N. Inayoshi**, K. Sasaki**, S. Kawara*, H. Kousaka*, X. Deng* <i>*Nagoya University, Japan, **DENSO Corporation, Japan</i>	80

Thursday, April 23 10:45-12:00 Room C

Machine Design (1) Chair: Nobuhiko Henmi, Shinshu University, Japan

TH-C-1-1	XY and Z Scanner Development for High Accuracy AFM Byoung-Woon Ahn, Hyun-Suk Oh, Ah-Jin Jo, Sang-Joon Cho, Sang-il Park <i>Park Systems Corp., Korea</i>	82
TH-C-1-2	Research on Drive Mechanism of Leveling Machine for Seeding Bed Kazuhiro Iwata*, Yoshio Tsuji*, Akira Sanada*, Hideyuki Kanashima** <i>*Industrial Technology Center of Okayama Prefecture, Japan, **MINORU Industrial Co., Ltd., Japan</i>	84
TH-C-1-3	Design of Ultrasonic Vibrator for Dental Surgery using FEA Ki-Moon Park*, In Jun Yoon**, Tae Jo Ko* <i>*Yeungnam University, Korea, **OSG Korea Co., Korea</i>	86
TH-C-1-4	Development of the Motion Assistance Apparatus for the Promotion of Exercise for the Elderly Eiichirou Tanaka*, Ryosuke Niwa**, Kazuki Osawa**, Keyaki Nakajima**, Keiichi Muramatsu*, Keiichi Watanuki*, Shozo Saegusa***, Louis Yuge**** <i>*Saitama University, Japan, **Shibaura Institute of Technoloty, Japan, ***Shujitsu University, Japan, ****Hiroshima University, Japan</i>	88
TH-C-1-5	Aiming Error Analysis of the Gun on the Ground Combat Vehicle Running on the Bumpy Road Jae-Bok Song, Sang-Young Choi, Kang Park <i>Myongji University, Korea</i>	90

Thursday, April 23 15:15-16:45 Room C

Machine Design (2) Chair: Jun Nango, Yamagata University, Japan

TH-C-2-1	Evaluation of the Walking Assistance Apparatus for Practical Use Eiichirou Tanaka*, Ryosuke Niwa**, Keyaki Nakajima**, Keiichi Muramatsu*, Keiichi Watanuki*, Shozo Saegusa***, Louis Yuge**** <i>*Saitama University, Japan, **Shibaura Institute of Technology, Japan, ***Shujitsu University, Japan, ****Hiroshima University, Japan</i>	92
TH-C-2-2	Digital Modeling and Manufacture of Planetary Gear Drive Using Circular-Arc Tooth-Trace Gears Keiji Sonoda*, Kazuki Takenouchi**, Shigetaka Iketaki*** <i>*Sojo University, Japan, **Kyushu University, Japan, ***Yutaka Seimitsu Kogyo, Ltd., Japan</i>	94
TH-C-2-3	Actively Controlled Variable Displacement Vane Pump for Engine Lubrication Bui Ngoc Minh Truong, Dinh Quang Truong, To Xuan Dinh, Kyoung Kwan Ahn, Jae Shin Lee <i>University of Ulsan, Korea</i>	96
TH-C-2-4	Estimation of Radial Pressure and Stem Resistance Force on a Gland Packing Shinichi Enoki*, Shingo Murakami*, Masahiro Ueno**, Shun Kawai** <i>*National Institute of Technology, Nara College, Japan, **DIGIC Co., Ltd., Japan</i>	98
TH-C-2-5	A Research about Utilizing the Generalized Surgical Process Model with Surgical Workflow Manager Hyun-Tae Hwang*, Woong Yang*, Soo-Hong Lee*, Myon Woong Park**, Young Tae Sohn**, Jae Kwan Kim**, Dahee Jung** <i>*Yonsei University, Korea, **Korea Institute of Science and Technology, Korea</i>	100
TH-C-2-6	A Method for Persistent Identification of Topological Entities in a Parametric CAD Model Shahjadi Hisan Farjana*, Duhwan Mun**, Soonhung Han* <i>*KAIST, Korea, **Kyungpook National University, Korea</i>	102

Thursday, April 23 17:00-18:30 Room C**Machine Design (3) Chair: Yoshihiro Kai, Tokai University, Japan**

TH-C-3-1	CFD Simulation of Multi-phase Mixing Flow in Mud Mixing System Tae-Young Kim, Jong-Chun Park <i>Pusan National University, Korea</i>	104
TH-C-3-2	Simulation for Penetration of Shaped Charge under Intense Electric Current Pulse Hyeong-Gyu Park*, Dong-Kyu Kim**, Si-Woo Kim**, Jae-Hyun Joo**, Woo-Jin Song*, Jeong Kim* * <i>Pusan National University, Korea</i> , ** <i>Agency for Defense Development, Korea</i>	106
TH-C-3-3	Two-Arms Micromanipulator by Use of Pantograph Mechanisms for Gripping-and-Assembling of Micro-Objects Mikio Horie <i>Tokyo Institute of Technology, Japan</i>	108
TH-C-3-4	Deformation Behavior of AL6061-T6 under Compressive Impact Test using Split Hopkinson Pressure Bar Woo-jin An, Min-a Woo, Hak-Gon Noh, Jeong Kim <i>Pusan National University, Korea</i>	110
TH-C-3-5	Study on Armature's Contact Force and Temperature Effected by Its Various Shape in Electromagnetic Launcher (EML) Hong-Kyo Kim, Beom-Soo Kang, Hak-Gon Noh, Jeong Kim <i>Pusan National University, Korea</i>	112
TH-C-3-6	Development of Humanoid Hand which Can Grasp a Fragile Object Naoki Fukaya*, Shigeki Toyama** * <i>Tokyo Metropolitan College of Industrial Technology, Japan</i> , ** <i>Tokyo University of Agriculture and Technology, Japan</i>	114

Thursday, April 23 10:45-12:15 Room D**Hydraulic/ Functional Fluid Actuators Chair: Kenjiro Takemura, Keio University, Japan**

TH-D-1-1	Multi-physics Analysis of the Electro-hydraulic Servo Valve So-Nam Yun, In-Seob Park, Young-Bog Ham, Yoshito Tanaka <i>Korea Institute of Machinery & Materials, Korea</i>	116
TH-D-1-2	Experimental Analysis of Water Pump Driving Mechanism Using Orthogonal Double-slider Joint Jun Nango*, Toshiomi Koguchi*, Takumi Yoshizawa** * <i>Yamagata University, Japan</i> , ** <i>Z Mechanism Technical Research Center Co.,Ltd., Japan</i>	118
TH-D-1-3	Direct Drive Volume Control Actuator for Fuel Injection System of Marine Diesel Engines Kazushi Sanada <i>Yokohama National University, Japan</i>	120
TH-D-1-4	Magneto-Rheological Damper Modeling and Application to Sensorless Force Damping Control System Dao Thanh Liem, Dinh Quang Truong, Young Jin Yum, Kyoung Kwan Ahn <i>University of Ulsan, Korea</i>	122
TH-D-1-5	A Novel 3D-Printed Finger Integrated with ECF Micropump Dong Han*, Hongri Gu*, Joon-wan Kim*, Shinichi Yokota*, Kazuya Edamura** * <i>Tokyo Institute of Technology, Japan</i> , ** <i>New Technology Management Co., Ltd., Japan</i>	124
TH-D-1-6	Proposal of DRIE-Fabricated Silicon Electrode Pairs for ECF Micropumps Misaki Shimizu*, Joon-wan Kim*, Shinichi Yokota*, Kazuya Edamura** * <i>Tokyo Institute of Technology, Japan</i> , ** <i>New Technology Management Co., Ltd., Japan</i>	126

Thursday, April 23 15:15-16:45 Room D**Pneumatic Actuators Chair: Joon-Wan Kim, Tokyo Institute of Technology, Japan**

TH-D-2-1	Displacement and Gripping Detection by Piezoelectric Polymer Sensors for Soft Actuators Yusuke Okamoto*, Takefumi Kanda*, Shuichi Wakimoto*, Koichi Suzumori** * <i>Okayama University, Japan</i> , ** <i>Tokyo Institute of Technology, Japan</i>	128
TH-D-2-2	Fabrication and Evaluation of Soft Film Actuator for Low Temperature Environment Daisuke Yamaguchi, Tatsuya Hanaki, Yuji Ishino, Masayuki Hara, Masaya Takasaki, Takeshi Mizuno <i>Saitama University, Japan</i>	130

TH-D-2-3	A Prototype of Multifunctional Finger Joints Rehabilitation Device Using Pneumatic Soft Actuators Hironari Taniguchi, Yusuke Naito <i>National Institute of Technology, Tsuyama College, Japan</i>	132
TH-D-2-4	Pressure Control of a Miniature Rubber Muscle Driven by Gas-Liquid Phase-Change Mingzhao Cheng*, Tomonori Kato*, Shunta Honda*, Kazuki Sakuragi*, Manabu Ono** <i>*Fukuoka Institute of Technology, Japan, **Tokyo Metropolitan College of Industrial Technology, Japan</i>	134
TH-D-2-5	Research on Controllability of the Particle Excitation Flow Control Valve Daisuke Hirooka*, Tomomi Yamaguchi*, Naomichi Furushiro*, Koichi Suzumori**, Takefumi Kanda*** <i>*Kansai University, Japan, **Tokyo Institute of Technology, Japan, ***Okayama University, Japan</i>	136
TH-D-2-6	Analysis of Flow Control Servo Valve with Nozzle-Flapper through Mathematical Modeling Ji-U Kim*, Hang-Bong Shin**, Jung-Ho Park*, Yoshito Tanaka*, So-Nam Yun* <i>*Korea Institute of Machinery & Materials, Korea, **SG Servo, Korea</i>	138

Thursday, April 23 17:00-18:30 Room D

Pneumatic / Other Actuators Chair: Masaya Takasaki, Saitama University, Japan

TH-D-3-1	New Gas Rubber Actuator Driven with Electrolysis/Synthesis of Water Akira Wada*, Koichi Suzumori*, Hidehiro Kametani**, Takaaki Kitamori*, Shuichi Wakimoto** <i>*Tokyo Institute of Technology, Japan, **Okayama University, Japan</i>	140
TH-D-3-2	Development of an Adsorption Suction Cup with Integrated Micro Suction Cups Takao Hishikawa*, Shuichi Wakimoto*, Koichi Suzumori**, Takefumi Kanda* <i>*Okayama University, Japan, **Tokyo Institute of Technology, Japan</i>	142
TH-D-3-3	Relationship between Flapping Motion and Aerodynamic Force of Dragonfly Fuma Sakai, Hiromu Hashimoto <i>Tokai University, Japan</i>	144
TH-D-3-4	Mechanism for Droplet Using Hydrophilic/Hydrophobic Rubber Materials Kazuyuki Shimogawa*, Shuichi Wakimoto*, Koichi Suzumori**, Yoshihisa Morishige*, Takefumi Kanda* <i>*Okayama University, Japan, **Tokyo Institute of Technology, Japan</i>	146
TH-D-3-5	A Pneumatically Assisted Dielectric Elastomer Actuator to Create Hydraulically-Coupled Surface Bulging Kazuma Takei, Minsung Cho, Akio Yamamoto <i>The University of Tokyo, Japan</i>	148
TH-D-3-6	Positioning Accuracy and Position Keeping Performance under Heavy Load by Differential Rotary to Linear Conversion Mechanism Masanori Seki*, Ichiro Shimizu*, Masahiro Fujii** <i>*Okayama University of Science, Japan, **Okayama University, Japan</i>	150

Thursday, April 23 10:45-11:45 Room E

Manufacturing Systems Chair: Soo-Hong Lee, Yonsei University, Korea

TH-E-1-1	Sharing 3D Design Model in Real-time Conference and Facilitate Decision Making in Collaborative Design Process by Web Framework Jiaqi Lu, Seongho Kim, Hyun-Tae Hwang, Soo-Hong Lee <i>Yonsei University, Korea</i>	152
TH-E-1-2	Kinematic Analysis of Underactuated Spatial Parallel Mechanism with Elastic Elements for Flexible Multi-DOF Joints Nobuyuki Iwatsuki, Ikuma Ikeda, Takahiro Suwa <i>Tokyo Institute of Technology, Japan</i>	154
TH-E-1-3	Internal Stress Analysis of Wound Roll Considering Film Thickness Variation and Elastic Deformation Seiya Iiyama, Hikaru Sugiishi, Yuta Sunami, Hiromu Hashimoto <i>Tokai University, Japan</i>	156
TH-E-1-5	A Study on the Energy Consumption of Machine Tools' Each Axis by Machining Strategies Jae-Hyeok Kim, Oscar Velasquez Arriaza, Seok-Woo Lee, Kyung-Hee Park, Dong Yoon Lee <i>Korea Institute of Industrial Technology, Korea</i>	158

Thursday, April 23 15:15-16:45 Room E**Product and Process Design (IPPD) Chair: Hae-Jin Choi, Chung-Ang University, Korea**

TH-E-2-1	An Inductive Robust Design Method for Multi-Level Design Problems: a Method for Handling Uncertainty in Materials and Product Design Sungwoo Jang, Hae-Jin Choi <i>Chung-Ang University, Korea</i>	160
TH-E-2-2	A Study on Modeling Customer Preferences for Conceptual Design Soonyoung Han, Hae-Jin Choi <i>Chung-Ang University, Korea</i>	162
TH-E-2-3	Verification of Product Design Using Regulation Knowledgebase and Web Service Ikjune Kim*, Byung Chul Kim**, Duhwan Mun*** *Korea Atomic Energy Research Institute, Korea, **Dong-A University, Korea, ***Kyungpook National University, Korea	164
TH-E-2-4	An Investigation into the Fastening Performance of a Serration Bolt Jin-Han Jung*, Hyun-Kyu Lee*, Myung-Geun Jang*, Seung-Woo Ra**, Keun Park*, Jong-Bong Kim* *Seoul National University of Science and Technology, Korea, **Seoul Metal., Korea	166
TH-E-2-5	Low Velocity Impact Behavior of Fiber-Metal Laminates Based on Self-reinforced Polypropylene Byoung-Eon Lee, Eu-Tteum Park, Dong-Sik Kang, Beom-Soo Kang, Woo-Jin Song <i>Pusan National University, Korea</i>	168
TH-E-2-6	Full Three Dimensional Layers for 5-axis 3D Metal Printing Kyubok Lee, Haeseong Jee <i>Hong Ik University, Korea</i>	170

Thursday, April 23 17:00-18:30 Room E**Injection Molding/ Printing Technology for Manufacturing****Chair: Keun Park, Seoul National University of Science and Technology, Korea**

TH-E-3-1	Proposal for Evaluation Method on Aesthetic Surface of CFRP by Using Ellipsometer Takayuki Kawasaki, Motoyuki Murashima, Noritsugu Umehara, Hiroyuki Kousaka <i>Nagoya University, Japan</i>	172
TH-E-3-2	Manufacture of Large Sized Flat Panel Airlift Photobioreactor (FPA PBR) Case with Characteristic Shape Using Thermoforming Process Ho-Jin Lee, Dong-Gyu Ahn <i>Chosun University, Korea</i>	174
TH-E-3-3	Fabrication of a SUS 316L Threaded Elbow Fitting by Metal Injection Molding Jaeyoung Kim*, Seong-Taek Chung**, Sung-Jo Kim***, Seokyoung Ahn* *Pusan National University, Korea, **CetaTech, Korea, ***Samwon Tech, Korea.....	176
TH-E-3-4	Development of R2R Cylindrical Bed Screen Printing System with Damped Motorizing Accumulator and Virtual Key-Key Align Control Algorithm JangHwan Lee*, OkJin Kim*, YoungMin Lee*, YoungJin Kim*, TaeSu Chun*, YongRak Choi**, KiTaek Kim**, JaeWoong Yu**, DongKwon Choi* *Sung An Machinery, Korea, **Kyung Hee University, Korea.....	178
TH-E-3-5	Case Study: A Hybrid Model for 3D Printed Casts Seong-Won Jeong, Huhn Kim <i>Seoul National University of Science and Technology, Korea</i>	180
TH-E-3-6	Effect of Layer Thickness on Surface Morphology of Inkjet Printed Silver Nanoparticles Yoon Jae Moon***, Jun Young Hwang*, Heuiseok Kang*, Kyungtae Kang*, Seung Jae Moon** *Korea Institute of Industrial Technology, Korea, **Hanyang University, Korea	182

Friday, April 24 10:30-11:45 Room A**Transmission (1) Chair: Morimasa Nakamura, Kyoto Institute of Technology, Japan**

FR-A-1-1	Investigation of Dynamic Behavior of Planet Gear under Three Axes Driving Planetary Gear Set Masao Nakagawa, Mohamed Ali Ben Abbes, Toshiki Hirogaki, Eiichi Aoyama <i>Doshisha University, Japan</i>	184
FR-A-1-2	Dynamic Behavior Analysis of a Pair of Ground Spur Gears Shuting Li, Atsushi Nishimura <i>Shimane University, Japan</i>	186

FR-A-1-3	Relative Motional and Modal Analysis of Planetary Gear Train Meshing Using a Torsional Damped Model Based on Bond Graph Mohamed Ali Ben Abbes, Masao Nakagawa, Toshiki Hirogaki, Eiichi Aoyama <i>Doshisha University, Japan</i>	188
FR-A-1-4	Evaluation of Handle Rotational Feeling in Fishing Reels Using a Bone Conduction Speaker Based on Transmission Error of Gear Pairs Tetsuo Inoue*, Syuhei Kurokawa**, Takashi Maeno***, Yasutoshi Makino**** *Shimano.Inc, Japan, **Kyushu University, Japan, ***Keio University, Japan, ****The University of Tokyo, Japan.....	190
FR-A-1-5	Experimental Investigation of Vibration Behavior of a Planetary Gear System Shigeki Matsumura, Haruo Houjoh <i>Tokyo Institute of Technology, Japan</i>	192

Friday, April 24 14:45-16:00 Room A

Transmission (2) Chair: Masahiro Fujii, Okayama University, Japan

FR-A-2-1	Damage Diagnosis of Gear Tooth Surface with a Nearest Neighbor Method Kosuke Okada, Kazuteru Nagamura, Kiyotaka Ikejo, Mitsuo Hashimoto, Qingrong Fan <i>Hiroshima University, Japan</i>	194
FR-A-2-2	Effects of Finishing Process of Mating Steel Gear on Load Capacity of Plastic Gear Ichiro Moriwaki, Yuki Nishio, Morimasa Nakamura, Daisuke Iba <i>Kyoto Institute of Technology, Japan</i>	196
FR-A-2-3	Experimental Investigation of Vacuuming a Gear Box by the Interior Gear Pair for Decreasing Windage Loss Haruo Houjoh*, Naoki Abiko*, Ryo Koitabashi**, Takeshi Iino*, Shigeki Matsumura* *Tokyo Institute of Technology, Japan, **Mitsubishi Hitachi Power Systems, Ltd., Japan.....	198
FR-A-2-4	Changes in Contact Stresses on a High-speed Microgear Due to Frictional Heat Cheol Kim*, Hyeong-Seok Kim*, Seho Kwak** *Kyungpook National University, Korea, **Saeshin Precision Co., Ltd., Korea.....	200
FR-A-2-5	Influence of Pressure Angle on Load Carrying Capacity of Crossed Helical Gears Ema Tamura*, Ryoza Nemoto*, Natsuhiko Seyama*, Eiichirou Tanaka** *Tokyo Metropolitan College of Industrial Engineering, Japan, **Saitama University, Japan.....	202

Friday, April 24 10:30-12:00 Room B

Sustainable Tribology/ Tribology in Manufacturing/ Maintenance Tribology

Chair: Toshiaki Wakabayashi, Kagawa University, Japan

FR-B-1-1	Development of Adhesion Control Method for Thermoplastic Resin with AC Electric Field Motoyuki Murashima, Noritsugu Umehara, Hiroyuki Kousaka <i>Nagoya University, Japan</i>	204
FR-B-1-2	A Study on Identification of Tribological Process on Rake Face of Cutting Tool Using Acoustic Emission Technique Alan Hase <i>Saitama Institute of Technology, Japan</i>	206
FR-B-1-3	Colorimetric Analysis for the Estimation of Oxidative Deterioration of Turbine Oils Tomohiko Kon*, Tomomi Honda*, Eiki Kitahara*, Akihiko Yano**, Akira Sasaki*** *University of Fukui, Japan, **Mitsubishi Heavy Industries Co., Ltd., Japan, ***Maintek Consultant, Japan....	208
FR-B-1-4	Development of Degradation Diagnosis Method for Amine Antioxidant by the Colorimetric Analysis of Membrane Patch Daisuke Hamano, Tomomi Honda <i>University of Fukui, Japan</i>	210
FR-B-1-5	A Study on the Effect of Spray Slurry Nozzle in Copper CMP Results Dasol Lee*, Hyunseop Lee**, Hon-Zong Choi***, Haedo Jeong* *Pusan National University, Korea, **Tongmyong University, Korea, ***Korea Institute of Industrial Technology (KITECH), Korea.....	212
FR-B-1-6	Role of Surface Topography on Wettability and Tribological Properties H.S. Grewal, Eui-Sung Yoon <i>Korea Institute of Science and Technology, Korea</i>	214

Friday, April 24 14:45-16:00 Room B

Lubrication	Chair: Tomomi Honda, University of Fukui, Japan	
FR-B-2-1	Effect of Contact Load and Temperature on Tribological Properties of a-C:H under PAO Lubrication	
	Xiang Li, Noritsugu Umehara, Xingrui Deng, Hiroyuki Kousaka <i>Nagoya University, Japan</i>	216
FR-B-2-2	Effects of the Mechanical Properties of the Grease Thickener on the Bearing Noise Reduction	
	Kanako Takahara, Kazunori Miyake, Ryuji Nakata, Hirokazu Arai <i>JTEKT Corporation, Japan</i>	218
FR-B-2-3	Development of Low-Oil Supply Journal Bearing for Steam Turbine	
	Motoki Sato*, Kenta Suzuki*, Makoto Hemmi*, Kenichi Murata** *Hitachi, Ltd., Japan, **Mitsubishi Hitachi Power Systems, Ltd., Japan.....	220
FR-B-2-4	Grease Decomposition and Hydrogen Generation by Contact with Nascent Steel Surface	
	Toshiaki Wakabayashi*, Yasuha Tokumo**, Kiyomi Sakamoto**, Yuji Shitara** *Kagawa University, Japan, **JX Nippon Oil & Energy Corporation, Japan.....	222
FR-B-2-5	Structure and Shear Properties of Boundary Layers for Friction Reduction	
	Tomoko Hirayama***, Ryota Kawamura*, Koichi Saeki*, Kazuki Yamada*, Yusuke Hashimoto*, Naoki Yamashita*, Shota Akimoto*, Takashi Matsuoka* *Doshisha University, Japan, **JST Presto, Japan.....	224

Friday, April 24 10:30-12:00 Room C

Cutting (1)	Chair: Dong Yoon Lee, Korea Institute of Industrial Technology, Korea	
FR-C-1-1	Examination about Reduce Surface Defects in Ultra-precision Cutting of Al-Mg Alloys	
	Tomohiro Iida*, Yukio Maeda*, Daisuke Hirase*, Hideaki Tanaka**, Kazuya Kato**, Takanori Yazawa*** *Toyama Prefectural University, Japan, **Shonan Institute of Technology, Japan, ***Nagasaki University, Japan.....	226
FR-C-1-2	Tool Wear Characteristics of Nickel-Based Super Alloy Cutting with Cooling Systems	
	Shinji Yamada*, Yukio Maeda*, Hideaki Tanaka**, Kazuya Kato**, Takanori Yazawa** *Toyama Prefectural University, Japan, **Shonan Institute of Technology, Japan, ***Nagasaki University, Japan.....	228
FR-C-1-3	A Novel Design Concept of Cutting Tools for CFRP Composites Focusing on Difference of Wear Ratios at Rake and Flank Faces	
	Satoru Maegawa, Yuta Morikawa, Shinya Hayakawa, Fumihiro Itoigawa, Takashi Nakamura <i>Nagoya Institute of Technology, Japan</i>	230
FR-C-1-4	Approach to Suppression of Tool Wear by Extremely Short Time Cutting	
	Yuki Terasaka, Fumihiro Itoigawa, Satoru Maegawa, Takashi Nakamura <i>Nagoya Institute of Technology, Japan</i>	232
FR-C-1-5	Sharpening of PcBN Tool for High-Precision Turning with Short Pulse Laser — Improvement of Finished Surface Quality	
	Shinya Suganuma*, Fumihiro Itoigawa*, Kei-ichi Kawata**, Shinya Hayakawa*, Takashi Nakamura* *Nagoya Institute of Technology, Japan, **Aichi Center for Industry and Science Technology, Japan.....	234
FR-C-1-6	Wheel Profile for Irregular Flute Profile in Helical Grooving	
	Van-Hien Nguyen, Byeong-Chan Kwon, Sung-Lim Ko <i>Konkuk University, Korea</i>	236

Friday, April 24 14:45-16:15 Room C

Cutting (2)/ Grinding/ Polishing	Chair: Sang Won Lee, Sungkyunkwan University, Korea	
FR-C-2-1	Experimental Study on Micro-drilling Process of Titanium Alloy Using Nanofluid Minimum Quantity Lubrication (MQL)	
	Jung Soo Nam, Jin Woo Kim, Young Chang Kim, Sang Won Lee <i>Sungkyunkwan University, Korea</i>	238
FR-C-2-2	Energy Consumption Analysis Considering the Dynamic Variations Produced by the NC Controllers	
	Oscar Velásquez A.*, Jae-Hyeok Kim*, Cheol-soo Lee**, Eun-Young Heo**, Dong-Won Kim***, Dong Yoon Lee* *Korea Institute of Industrial Technology, Korea, **Sogang University, Korea, ***Chonbuk National University, Korea.....	240

FR-C-2-3	Study on Prevention Mechanism of Chip Snarling for Tapping Tool Covered with Nickel-Phosphorus/Abrasive Particles Composite Film Yasuyoshi Saito*, Yuki Kadota*, Takeshi Yamaguchi*, Kei Shibata*, Takeshi Kubo**, Wataru Watanabe**, Satoru Oyama**, Kazuo Hokkirigawa* *Tohoku University, Japan, **Miyagi Tanoi Mfg. Co., Ltd., Japan.....	242
FR-C-2-4	Grinding of Micro-grooves in Borosilicate Glass by Using Electroplated Diamond Grinding Wheel Daisuke Goto*, Yukio Maeda*, Norifumi Imai*, Hideaki Tanaka**, Kazuya Kato**, Takanori Yazawa* *Toyama Prefectural University, Japan, **Shonan Institute of Technology, Japan.....	244
FR-C-2-5	Suction Deburring for Intersection Holes Byeong-Chan Kwon*, Kwon-Hee Kim**, Sung Lim Ko* *Konkuk University, Korea, **Korea University, Korea.....	246
FR-C-2-6	Comparison of Non-uniformity According to Wafer Pressurizing Method in Chemical Mechanical Polishing Eunjeong Park*, Changsuk Lee*, Jaehong Park**, Honzong Choi***, Haedo Jeong* *Pusan National University, Korea, **Nitta Haas Incorporated, Japan, ***Korea Institute of Industrial Technology (KITECH), Korea.....	248

Friday, April 24 10:30-12:00 Room D

Electrically Driven Actuators Chair: Takefumi Kanda, Okayama University, Japan

FR-D-1-1	Torque and Thrust Control of a Rotational/Linear 2 Degrees of Freedom Switched Reluctance Motor Yasukazu Sato, Yoshiki Kanno Yokohama National University, Japan.....	250
FR-D-1-2	Design and Application of Active Magnetic Bearings for an Industrial Turbo-Compressor Myounggyu Noh*, Seongki Baek*, Sunggyu Nam*, Young-Woo Park*, Jinhee Jeong** *Chungnam National University, Korea, **LG Electronics, Korea.....	252
FR-D-1-3	Planar 2-DOF Electrostatic Actuator with Layered Orthogonal Electrodes Ryuta Iguchi, Akio Yamamoto The University of Tokyo, Japan.....	254
FR-D-1-4	Control of XY Stage using Ultrasonic Linear Motor for Positioning and Continuous Motion Dong-Jin Lee, You-Young Kim, Min-Keon Lee, Sun-Kyu Lee Gwangju Institute of Science and Technology, Korea.....	256
FR-D-1-5	Spherical Ultrasonic Motor for Space Taro Oohashi*, Uichi Nishizawa*, Naoki Fukaya**, Shigeki Toyama* *Tokyo University of Agriculture and Technology, Japan, **Tokyo Metropolitan College of Industrial Technology, Japan.....	258
FR-D-1-6	Development of Shape Memory Alloy Actuator Mounted Cooling Mechanism for Externally Powered Prosthetic Hand for Children Atsunori Hashimoto, Hironari Taniguchi, Syunsuke Iduhara National Institute of Technology, Tsuyama College, Japan.....	260

Friday, April 24 14:45-16:15 Room D

Sensing Systems Chair: Akio Yamamoto, The University of Tokyo, Japan

FR-D-2-1	High Accuracy Atomic Force Microscope with Self-Optimizing Scan Control Ah-Jin Jo, Byoung-Woon Ahn, Sang-Han Chung, Sang-Joon Cho, Sang-il Park Park Systems Corp., Korea.....	262
FR-D-2-2	Low-Cost Fabrication of Metal-Based Transparent Touch Sensors Using Laser Direct Patterning Method Bongchul Kang*, Seokwoo Son**, Minyang Yang** *Kumoh National Institute of Technology (KIT), Korea, **Korea Advanced Institute of Science and Technology (KAIST), Korea.....	264
FR-D-2-3	Design and Validation of Noncontact Inductive Pressure Sensor Myounggyu D. Noh, Seongki Baek, Young-Woo Park Chungnam National University, Korea.....	266
FR-D-2-4	Active Airflow Generation in Gas Sensing System to Enhance Its Directivity Haruka Matsukura, Takafumi Kusunoki, Yuki Arai, Hiroshi Ishida Tokyo University of Agriculture and Technology, Japan.....	268

FR-D-2-5	Maximum Angle Induced by Kinesthetic Illusion under Different Accelerations of Sinusoidal Vibrostimulation Koichi Akahori*, Masakazu Honda**, Tetsu Miyaoka***, Masahiro Ohka* *Nagoya University, Japan, **Industrial Research Institute of Shizuoka Prefecture, Japan, ***Shizuoka Institute of Science and Technology, Japan	270
FR-D-2-6	Determination of the Wrist Tendon Most Conducive to a Vivid Kinesthetic Illusion Yuki Kato*, Masakazu Honda**, Tetsu Miyaoka***, Masahiro Ohka* *Nagoya University, Japan, **Industrial Research Institute of Shizuoka Prefecture, Japan, ***Shizuoka Institute of Science and Technology, Japan	272

Friday, April 24 10:30-11:45 Room E

Forming	Chair: Dong-Gyu Ahn, Chosun University, Korea	
FR-E-1-1	Fabrication of Aircraft Winglet Mold using Multi-point Dieless Forming Technology Ji-woo Park, Jeong Kim, Tae-Wan Ku, Beom-Soo Kang Pusan National University, Korea	274
FR-E-1-2	Design of Apparatus for Flexibly-Reconfigurable Roll Forming Process for 3D Curved Sheet Forming and its Implementation Jun-Seok Yoon, Hyeong-Ho Kim, Jeong Kim, Beom-Soo Kang Pusan National University, Korea	276
FR-E-1-3	Numerical Verification on Formability of Metallic Alloys for Skin Structure Using Multi-point Dieless Forming Misganaw Abebe Baye, Tae-Wan Ku, Beom-Soo Kang Pusan National University, Korea	278
FR-E-1-4	Formability Enhancement Effect of Interaction between Tool and Workpiece on Electromagnetic Forming Process YeonHee Lee, WooJin An, HakGon Noh, Jeong Kim Pusan National University, Korea	280
FR-E-1-5	Influence of Geometric Parameters on Surface Deflection in Rectangular Embossing Wan-Jin Chung, Jin-Hak Kim Seoul National University of Science and Technology, Korea.....	282

Friday, April 24 14:45-15:45 Room E**Design for Manufacturability (DFM)****Chair: Hyung Wook Park, Ulsan National Institute of Science and Technology, Korea**

FR-E-2-1	Numerical Prediction of Dynamic Loads on 6-DOF Motion Platform for Sloshing Test Using Co-simulation between MPS and MFBD Hee-Sung Shin, Sung-Pill Kim, Soo-Hoon Bae, Jong-Chun Park Pusan National University, Korea	284
FR-E-2-2	Design and Development of Off-line Programming System for Welding Robot Cell Pramod Munasinghe*, Nuwan Wickramasinghe*, Than Lin*, Erik L. J. Bohez*, Liu Liang Bo** *Asian Institute of Technology, Thailand, **AAPICO Hitech Public Company Limited, Thailand.....	286
FR-E-2-3	Evaluation on the Joining Strength of Fiber Metal Laminates and Aluminum Alloy 5052 Joined by Tapered-Hole Clinching Dong-Sik Kang, Byoung-Eon Lee, Eu-Tteum Park, Jeong Kim, Beom-Soo Kang, Woo-Jin Song Pusan National University, Korea	288
FR-E-2-4	Temperature-Dependent Flow Stress Modeling of Al Alloy-SRPP Laminated Material Eu-Tteum Park, Dong-Sik Kang, Byoung-Eon Lee, Jeong Kim, Beom-Soo Kang, Woo-Jin Song Pusan National University, Korea	290

Thursday, April 23 13:15-14:15 Plenary Room**Thursday Poster Session**

TH-PO-01	Tribological Properties of Graphene Oxide Dispersed in Fluorine-Containing Imidazolium-Derived Ionic Liquid Masahiro Kondo, Hiroshi Kinoshita, Masahiro Fujii Okayama University, Japan.....	292
TH-PO-02	Effect of Laser Micro Texturing on the Frictional Properties of Ti Material Yusuke Aida, Masanori Honda, Tsuyoshi Kakiuchi, Yosuke Tsukiyama, Isami Nitta Niigata University, Japan	294

TH-PO-03	Effect of Lateral Force on Dynamic Friction Behaviors of Pneumatic Cylinder Yasunori Wakasawa*, Yuta Kohashi**, Hideki Yanada** *Toyota National College of Technology, Japan, **Toyohashi University of Technology, Japan.....	296
TH-PO-04	Improvement of Tribological Properties in C/C Composites by Surface Texturing Satoshi Hoshino, Chiharu Tadokoro, Shinya Sasaki Tokyo University of Science, Japan	298
TH-PO-05	Tribological Properties of Graphene Oxide as Lubricating Additive in Water and Lubricant Oils Hiroshi Kinoshita, Hideki Ono, Aidil Azli Alias, Yuta Nishina, Masahiro Fujii Okayama University, Japan.....	300
TH-PO-06	Magnetic Ionic Liquid for Vacuum-compatible Non-contact Seal Takao Okabe, Daichi Moritaka, Kei Somaya, Masaaki Miyatake, Jun Taniguchi, Yukishige Kondo, Shigeoka Yoshimoto, Shinya Sasaki Tokyo University of Science, Japan	302
TH-PO-07	Velocity Slip and Viscous Heating in Copper/Water Interface Quyên Van Dinh, BoHung Kim University of Ulsan, Korea	304
TH-PO-08	Static and Dynamic Characteristics of Water-lubricated Hydrostatic Thrust Bearings with Self Controlled Restrictor Kazuki Fukuyama, Yusuke Iwahashi, Masaaki Miyatake, Kei Somaya, Shigeoka Yoshimoto Tokyo University of Science, Japan	306
TH-PO-09	Static Characteristics of Water-Lubricated Hydrostatic Thrust Bearings with Porous Land Region and Fixed Restrictor Masanori Kuniyoshi, Naoki Hanawa, Masaaki Miyatake, Kei Somaya, Shigeoka Yoshimoto Tokyo University of Science, Japan	308
TH-PO-10	Conceptual Design Study of Ex-Vessel Cooling System for In-Vessel Retention of Large Scale Nuclear Power Plants in Severe Accidents Hyunwoo Lee*, Soonkyoo Han**, Sangnyung Kim***, Sangho Park****, Yongse Kwon* *Korea Atomic Energy Research Institute, Korea, **Korea Institute of Nuclear Safety, Korea, ***Kyung Hee University, Korea, ****Chungnam National University, Korea	310
TH-PO-11	Dynamic Characteristics of Small Aerodynamic Foil Thrust Bearing Satoshi Mizushima, Kei Somaya, Masaaki Miyatake, Shigeoka Yoshimoto Tokyo University of Science, Japan	312
TH-PO-12	ZnDTP Derived Tribofilm Characterization by 3D Scanning Electron Microscope Observation K. A. Melardot Aboua*, X. Deng*, H. A. Tasdemir*, H. Kousaka*, N. Umehara*, Y. Mabuchi**, T. Higuchi** *Nagoya University, Japan, **Nissan Motor Co., Japan.....	314
TH-PO-13	Precious Metal Electroplating to Carbon Nanotube Films and Their Contact Electrical Resistance Performance under Micro Loads Yusuke Yuki Yoshi, Yuma Yokoi, Hiroshi Kinoshita, Masahiro Fujii Okayama University, Japan.....	316
TH-PO-14	A Silicon Ring Model for Micro Resonator with Thermo-elastic Damping Seok-Joo Kang, Ji-Hwan Kim Seoul National University, Korea	318
TH-PO-15	A Study on Optimum Structure of Planar Stack for Microfluidic Fuel Cell Ki-won Oh, Guk-ki Ahn, Cheolhee Lee, Yoomin Ahn Hanyang University, Korea.....	320
TH-PO-16	Fabrication of Si Nanowire-based Photodetector on Flexible Polymer Substrate using Pattern Transfer Method Hocheol Shin, Dong-Ki Lee, Seong Keol Kim, Young Seog Kim, Younghak Cho Seoul National University of Science & Technology, Korea.....	322
TH-PO-17	A Drag Force Type Air Flowmeter with the Corrugation Structure for Vehicle Applications Cheol Min Park, Dae Keun Choi, Sang Hoon Lee Seoul National University of Science and Technology, Korea.....	324
TH-PO-18	Proposal of Pumping Aqueous Solution Using ECF Micropump with Diffuser & Nozzle Mechanism Tatsuya Matsubara*, Joon-wan Kim*, Shinichi Yokota*, Kazuya Edamura** *Tokyo Institute of Technology, Japan, **New Technology Management Co., Ltd., Japan	326

TH-PO-19	Precise Structural Analysis Considering Residual Stress of Casings Using Finite Volume Method and Finite Element Method Jae Hyun Yu, Zhi Jun Zhao, Sang Hu Park <i>Pusan National University, Korea</i>	328
TH-PO-20	Thermo-Mechanical Analysis of DAM Structure in Wafer Level Packaging Process Jong-Hyeong Kim, Hyun-Jun Ko, Seung-Yong Lim <i>Seoul National University of Science & Technology, Korea</i>	330
TH-PO-21	Evaluation for Dynamic Hydrophobicity of Silicone/VGCF Composite Sheet with Surface Topography Kenji Yanagisawa <i>National Institute of Technology, Nagano College, Japan</i>	332
TH-PO-22	Evaluations of Quality and Mechanical Properties of Carbon Nanotubes Yarns Processing Electricity Daisuke Suzuki, Hiroshi Kinoshita, Toru Iijima, Yasuhiko Hayashi, Masahiro Fujii <i>Okayama University, Japan</i>	334
TH-PO-23	A Study on Cause of Yellowing in Laser Ablation of Silver Nanowire Network and Its Suppression Process Jong-Eun Park*, Junesik Hwang*, Sung-Hak Cho**, Jong-Kweon Park**, Minyang Yang* * <i>Korea Advanced Institute of Science and Technology, Korea,</i> ** <i>Korea Institute of Machinery and Materials, Korea</i>	336
TH-PO-24	High Accuracy Scanning Spreading Resistance Microscopy in Vacuum Environment Byoung-Woon Ahn, Ho-Kyun Jinn, Dong-Ryul Kim, Ho-Hwan Lee, Sang-Joon Cho, Sang-il Park <i>Park Systems Corp., Korea</i>	338
TH-PO-25	An Experimental Study on Development of Environmental Control System for Ultra-Nano Precision Machine Ji-hyun Cho*, Chul-sook Kim*, Tae-beom Seo*, Seung-kuk Ro**, Jong-kwon Park** * <i>Inha University, Korea,</i> ** <i>Korea Institute of Machinery and Materials, Korea</i>	340
TH-PO-26	Investigation of Hot Embossing Process Using Soft Micromold Bom-ye Lee*, Kyoung Je Cha**, Bong-Kee Lee* * <i>Chonnam National University, Korea,</i> ** <i>Korea Institute of Industrial Technology, Korea</i>	342
TH-PO-27	Development of End Point Detection System for Ion Beam Machining Equipment Using Secondary Electron Monitoring Gyuho Kim*, Hang-Eun Joe*, Tae-Gon Kim**, Seok-Woo Lee**, Byung-Kwon Min* * <i>Yonsei University, Korea,</i> ** <i>Korea Institute of Industrial Technology, Korea</i>	344
TH-PO-28	Research for Improved Flexible Tactile Sensor Sensitivity Hae-yong Yun*, Ho-chan Kim*, In-hwan Lee** * <i>Andong National University, Korea,</i> ** <i>Chungbuk National University, Korea</i>	346
TH-PO-29	Research to the Plating on Plastics (ABS and PLA) Hae-ong Yun*, Ho-chan Kim*, In-hwan Lee**, Sung-ki Lyu*** * <i>Andong National University, Korea,</i> ** <i>Chungbuk National University, Korea,</i> *** <i>Gyeongsang National University, Korea</i>	348
TH-PO-30	Fast Stabilization of Web Tension in Drying Process of Roll-to-roll Printing Equipment for Printed Electronics Sung Woong Jeon, Cheol Kim, Jong-Chan Park, Chung Hwan Kim <i>Chungnam National University, Korea</i>	350
TH-PO-31	Measurement of Doctoring Angle in Printing Process Sung Woong Jeon, Cheol Kim, Jong-Chan Park, Chung Hwan Kim <i>Chungnam National University, Korea</i>	352
TH-PO-32	Printing of Multi-Layered Conductive Lines on a Micro-Channeled Substrate Jun Young Hwang, Yoon Jae Moon, Kwan-Hyun Cho, Sang-Ho Lee, Kiyoung Kim, Kyungtae Kang, Heuiseok Kang <i>Korea Institute of Industrial Technology, Korea</i>	354
TH-PO-33	Microfabrication of Silver Conductive Patterns by Inkjet Printing and Heated Gas Sintering Processes Kwon-Yong Shin*, Nam Son Park**, Jun Young Hwang*, Kyungtae Kang*, Sang-Ho Lee* * <i>KITECH, Korea,</i> ** <i>JESAGI HANKOOK Ltd., Korea</i>	356
TH-PO-34	Ergonomic Design of a Car Audio Button Hyo-Chan Kwon*, Kwon-Hee Kim*, Chang-Hee Cho*, Soo-Won Chae*, Seong-Yun Seo** * <i>Korea University, Korea,</i> ** <i>LG Electronics, Korea</i>	358

TH-PO-35	Dynamic Axial Crush of Rectangular Tubes with Perforations Jung-Hoon Kim, Kwon-Hee Kim, Chang-Hee Cho, Soo-Won Chae, Young-Gwan Kim, Seon-Ung Choi <i>Korea University, Korea</i>	360
TH-PO-36	CAE-Based Robust Optimization for Micro Flexure-Hinge Considering Manufacturing Reliability Seokkwan Hong*, Chul-Jin Hwang*, Sung-Woong Choi**, Moon-Do Lee***, Jeongjin Kang* * <i>Korea Institute of Industrial Technology, Korea</i> , ** <i>Micromold Co., Ltd., Korea</i> , *** <i>Optis Co., Ltd., Korea</i>	362
TH-PO-37	Manufacture of the Hardfaced Hot-Forging Die Using Direct Metal 3D Printing Technology Dong-Gyu Ahn, Ho-Jin Lee, Dae-Sun Guk <i>Chosun University, Korea</i>	364
TH-PO-38	System Efficiency Evaluation of the Spherical Coordinate 3D Scanning System Heeyoung Maeng, Nayeon Kim, Sangwoo Kim, Sangwook Park <i>Seoul National University of Science and Technology, Korea</i> (This paper will be presented in Friday Poster Session)	366
TH-PO-39	System of Electrostatic Powder Coating for the 3D Scanning of Diffused Reflecting Surfaces Heeyoung Maeng, Nayeon Kim, Myoung Sang Lee, Jongheon An <i>Seoul National University of Science and Technology, Korea</i>	368
TH-PO-40	Everyone Can Play! Development of Device and Application for Improving Motor Function or Increasing Physical Strength Tadaaki Ikehara, Ryo Kumeda, Takuto Yoshida, Kohei Maekawa, Ryota Saito <i>Tokyo Metropolitan College of Industrial Technology, Japan</i>	370
TH-PO-41	A Study on the Reliability of Acoustic Diaphragm with the Accelerated Thermal Aging Test Sang Hyuk Lee, Daehwan Kim, Taehyun Lee, Kyungha Ryu, Jaehyung Kim <i>Korea Institute of Machinery & Materials, Korea</i>	372
TH-PO-42	A Framework for Reliability Assessment on the Operability of Thermally Aged Air-Operated Valve Taehyun Lee, Sang Hyuk Lee, Daehwan Kim, Kyungha Ryu, Jaehyung Kim <i>Korea Institute of Machinery & Materials, Korea</i>	374
TH-PO-43	Development of Tactile Evaluation System Based on Hierarchical Tactile Perceptive Process Shogo Kumamoto*, Iza Husna Mohamad Hashim*, Kenjiro Takemura*, Takashi Maeno*, Shin Okuda**, Yukio Mori** * <i>Keio University, Japan</i> , ** <i>Nanjo Auto Interior Co., Ltd., Japan</i>	376
TH-PO-44	Implementation of Chaotic Rikitake Systems Based on OPA Circuits Yi-You Hou <i>Far East University, Taiwan</i>	378
TH-PO-45	A CFD Study on Flow Characteristics of the Duct with Multi-Holes Type Nozzles by Shape Variations in a Stenter Kyu-Hoi Do*, Ho-Joon Lee*, Kyung-Chul Cho*, Si-Woo Park*, Dae-Kyu Park*, Soo-Youn Kim** * <i>Korea Textile Machinery Research Institute, Korea</i> , ** <i>Yeungnam University, Korea</i>	380
TH-PO-46	Development of Automated Guidance System Test Handler Based on ISO 12188-2 JoonYong Kim*, Sung-Bo Shim*, Young-Joo Kim** * <i>Seoul National University, Korea</i> , ** <i>Korea Institute of Industrial Technology, Korea</i>	382
TH-PO-47	Electron Beam Welding Technology and EGR Valve Syrten for Diesel Automobiles Jeng-O Kim, Jae-Hoon Lee, Seung-Woo Lee <i>Korea Institute of Machinery & Materials, Korea</i>	384
TH-PO-48	Comparison between Solenoid and Piezoelectric Driving for Micro-Injection of Liquid Young-Bog Ham*, Kyung-Cheol Shin*, Gi-Tae Lee*, Byeung-Cheol An*, So-Nam Yun*, Soo-Kyung Chung** * <i>Korea Institute of Machinery & Materials (KIMM), Korea</i> , ** <i>Agency for Defense Development, Korea</i>	386
TH-PO-49	Relationship between Fatigue Limit and Crack Initiation Mechanism Chobin Makabe <i>University of the Ryukyus, Japan</i>	388
TH-PO-50	Fast Generation Method of CAM Model for Machining of Jet Engine Compressor Case Using Shape Searching Byung Chul Kim*, Duhwan Mun**, Ilhwan Song*** * <i>Dong-A University, Korea</i> , ** <i>Kyungpook National University, Korea</i> , *** <i>Samsung Techwin, Korea</i>	390

TH-PO-51	An Experimental Research of Parameter Searching for Minimum Droplet Dispensing Young-Bog Ham*, Gi-Tae Lee*, Kyung-Cheol Shin*, Byeung-Cheol An*, Jung-Ho Park*, Sook-Kyung Chung** *Korea Institute of Machinery & Materials (KIMM), Korea, **Agency for Defense Development, Korea.....	392
TH-PO-52	Design & Fabrication of Driving Parts of 4-dish Solar Collector System Jeong-Won Lee*, Tai-Il Seo**, Chang-Woo Son**, Hyoung-Jin Seo**, Youn-Seung Jeong*** *Korea Institute of Industrial Technology, Korea, **Incheon National University, Korea, ***Yuhan College, Korea.....	394
TH-PO-53	Mechanical Characterization of Gels and Formulation of Nonlinear Visco-Hyperelastic Material Model Kiyotaka Ishikawa, Masaki Fujikawa, Chobin Makabe University of the Ryukyus, Japan.....	396
TH-PO-54	Condition Monitoring of Bearing System using Multiscale Wavelet Scalogram Bong-Hwan Koh, Uk Jung Dongguk University, Korea.....	398
TH-PO-55	Driving Simulation for Hybrid Electric Vehicle of Our Own Making Jinseong Kim, Gisu Kim, Jaehoon Shin, Yeongil Park Seoul National University of Science and Technology, Korea.....	400
TH-PO-56	Geometric Error Measurement of a Rotary Axis by a High-Precision Laser Interferometer Tran Anh Vo, T.H. Duong, N.H. Tran, N.T. Nguyen, X.L. Trinh, Kim HyunChul Inje University, Korea.....	402

Friday, April 24 13:20-14:30 Plenary Room
Friday Poster Session

FR-PO-01	An Experimental Study on Characteristics of Spray Coating for Producing Flame-Retardant Fabric with a Thin Coated Layer Eun-Ha Lee, Ho-Joon Lee, Kyoung-Chol Cho, Kyu-Hoi Do, Si-Woo Park, Dae-Gyu Park Korea Textile Machinery Research Institute, Korea.....	404
FR-PO-02	Tribological Properties of Solid Lubricant Penetrated Metal Surface in Lubricated Condition Hatsuhiko Usami*, Tomomi Honda**, Yuji Mihara*** *Meijo University, Japan, **University of Fukui, Japan, ***Tokyo City University, Japan.....	406
FR-PO-03	Thermal Effects on High-Speed Shear-Driven Flow in an Optical Fiber Coating System Shin Park, Kyoungjin Kim, Ho Sang Kwak Kumoh National Institute of Technology, Korea.....	408
FR-PO-04	Adhesion and Composition Change of Tin Alloy Plasma Thermal Spray Coating Toshiyuki Saito, Takumi Mio, Miwa Hokii, Mototake Furuhashi JTEKT Corporation, Japan.....	410
FR-PO-05	A Method to Improve the Patterning of ITO with Thin Gold Masking Layer Coated on Glass Substrate using Nanosecond Fiber Laser and Etching Nguyen Ngoc Tan, Duong Thanh Hung, Vo Tran Anh, Trinh Xuan Long, Kim HyunChul Inje University, Korea.....	412
FR-PO-06	3-D Printing as a Novel Surface Texturing Process Kan Sugiyama, Chiharu Tadokoro, Shinya Sasaki Tokyo University of Science, Japan.....	414
FR-PO-07	Investigation of Eigenvalue Behaviour in the Asymptotic Analysis of a Three Body Contact Problem Hyung-Kyu Kim, Young-Ho Lee Korea Atomic Energy Research Institute, Korea..... (This paper will be presented in Thursday Poster Session)	416
FR-PO-08	Prototype of a Rotary Servo Valve for Water Hydraulics Kenji Suzuki Kanagawa University, Japan.....	418
FR-PO-09	Fully Automated Cartridge for Sample Preparation and Analysis of Nucleic Acid Dongkyu Lee, Bongseop Kwak, Kang-Ho Lee, Jongsu Yun, Kisoo Jeong, Ohwon Kwon Korea Institute of Machinery and Materials, Korea.....	420

FR-PO-10	A Method of Reducing the Windage Power Loss of a High Speed Rotor Using a Viscous Vacuum Pump Combined with Aerodynamic Step Bearing Pads Fumiya Asami*, Shigeka Yoshimoto*, Masaaki Miyatake*, Kei Somaya*, Eitaro Tanaka**, Takuma Yamauchi** <i>*Tokyo University of Science, Japan, **Denso Corporation, Japan</i>	422
FR-PO-11	Design of Bolted Joints Using 3D-FE Analysis (Development of Single Body Bolt/Nut Model Having Equivalent Rigidity to Actual Bolt/Nut Assembly) Tomohiro Kawamura, Daigo Fukazawa, Masaya Hagiwara <i>Nagoya Institute of Technology, Japan</i>	424
FR-PO-12	Nanoscale Measurement of Whole Cylinder Surface using a Wide Field-of-View Laser Interferometer Isami Nitta, Yosuke Tsukiyama, Shunsuke Sakuma <i>Niigata University, Japan</i>	426
FR-PO-13	A Wheeled Mobile Robot with Velocity and Contact Force-Based Mechanical Safety Devices: New Design of the Contact Force Detection Mechanism Toshinori Sakaushi, Yoshihiro Kai <i>Tokai University, Japan</i>	428
FR-PO-14	Design and Control of Vibration Reduction Mechanism for Precision Stage of Laser Drilling Process Chang-hoon Seo*, Sung-taek Hong*, Min-Sung Hong*, Hyo Young Kim**, Moon Gu Lee* <i>*Ajou University, Korea, **Korea Institute of Industrial Technology (KITECH), Korea</i>	430
FR-PO-15	Analysis of Load Distribution and Load Sharing According to Bearing Characteristics on the Pitch Reducer for Wind Turbines Young-Jun Park*, Jeong-Gil Kim**, Geun-Ho Lee*, Yong-Yun Nam* <i>*Korea Institute of Machinery and Materials, Korea, **Korea Institute of Industrial Technology, Korea</i>	432
FR-PO-16	Optimal Design of Planet Carrier in the Slewing Reducer for Tower Crane Young-Jun Park, Seung-Je Cho, Jeong-Woo Han, Geun-Ho Lee <i>Korea Institute of Machinery and Materials, Korea</i>	434
FR-PO-17	Pressure Pulsation and Driving Torque Analysis for Positive-Displacement Rotary Clap Pumps S. B. Shim*, Y. J. Park**, J. M. Kim***, Y. J. Kim****, K. U. Kim* <i>*Seoul National University, Korea, **Korea Institute of Machinery and Materials, Korea, ***ClapMC Co. Ltd., Korea, ****Korea Institute of Industrial Technology, Korea</i>	436
FR-PO-18	High Accuracy Atomic Force Microscope System for 450mm Wafers Hyo-Sang Kim, Byoung-Woon Ahn, Tae-Kyung Kong, Sang-Joon Cho, Sang-il Park <i>Park Systems Corp., Korea</i>	438
FR-PO-19	Study on Integrated Characteristics of a High Precision Spindle Supported by Aerostatic Bearings Daisuke Wakabayashi, Masaaki Miyatake, Kei Somaya, Shigeka Yoshimoto <i>Tokyo University of Science, Japan</i>	440
FR-PO-20	The Investigation of Distribution of Stress on the Taper Roller Bearings for Performance Conditions Ji Woo Nam*, Seong Wook Cho*, Hong Sun Ryou*, Woo Jun Lee**, Hyung Jun Kim*** <i>*Chung-Ang University, Korea, **FADAM Ltd., Korea, ***HONG IN Ltd., Korea</i>	442
FR-PO-21	Hydrostatic Gas Journal Bearings with Asymmetrical Arranged Inherent Orifices to Support Large Load Rotors (Verification of Rotor Vibration Characteristics by Rotational Tests) Tomohiko Ise, Takaaki Itoga, Toshihiko Asami <i>University of Hyogo, Japan</i>	444
FR-PO-22	Swarm Intelligence Based on Modified PSO Algorithm for the Optimization of Axial-Flow Pump Impeller Fuqing Miao*, Hong-Seok Park**, Cholmin Kim*, Seokyoung Ahn* <i>*Pusan National University, Korea, **University of Ulsan, Korea</i>	446
FR-PO-23	Shape Optimization of Condenser-Type Dehumidification System by the Design of Experiments (DOE) Eun-A Jeong*, Ji-U Kim*, Kee Yoon Lee**, Eun Joo Lee**, So-Nam Yun* <i>*Korea Institute of Machinery & Materials (KIMM), Korea, **ChungNam National University, Korea</i>	448

FR-PO-24	Development of a Biped Walking PET Robot with a Stuffed Bear Motif (2nd Report, Improvement of Mechanism and Behavior) Yuichi Nakazato, Takashi Nakayama, Akihito Ito, Kensuke Takita, Masaru Higuchi <i>Nippon Institute of Technology, Japan</i>	450
FR-PO-25	Self-loosening Characteristics of Bolted Joints Lubricated by Different Lubricants Shinji Hashimura*, Kyoichi Komatsu**, Takefumi Otsu*** * <i>Shibaura Institute of Technology, Japan</i> , ** <i>Tohnichi Mfg. Co., Ltd., Japan</i> , *** <i>Kurume National College of Technology, Japan</i>	452
FR-PO-26	Inverse and Forward Kinematic Analysis of a 3-RRS Parallel Manipulator with Double-Tripods Dong-Mok Lee, Jeong-Won Seo, Seung-Han Yang <i>Kyungpook National University, Korea</i>	454
FR-PO-27	Kinematic Design of a Spherical Parallel Mechanism with Variable Target Point Having a Large Practical Workspace Yukio Takeda, Masanori Teramoto, Daisuke Matsuura <i>Tokyo Institute of Technology, Japan</i>	456
FR-PO-28	Fundamental Research of Haptic Device for Traction Feeling Nobuhiko Henmi, Shin-ya Yamazaki <i>Shinshu University, Japan</i>	458
FR-PO-29	Three-Dimensional Modeling of Metallic Bridge Actuation in a Microscale Thin Film Igniter Jaeho Choi, Kyoungjin Kim, Ho Sang Kwak <i>Kumoh National Institute of Technology, Korea</i>	460
FR-PO-30	Proposal of Pen Tablet Type Tactile Display Using Stylus with Built-in Ultrasonic Transducer Kazuhiko Hasebe, Yuji Ishino, Masayuki Hara, Daisuke Yamaguchi, Masaya Takasaki, Takeshi Mizuno <i>Saitama University, Japan</i>	462
FR-PO-31	Development of a Soft Microgripper Using Divided-Electrode Type Flexible ER Valves Kazuhiro Yoshida, Souta Hara, Sang In Eom, Shinichi Yokota <i>Tokyo Institute of Technology, Japan</i>	464
FR-PO-32	Numerical Simulation of Electro-conjugation Fluid Flow Considering Electric Double Layer Yoshiki Iijima*, Kyohei Hosoda*, Kenjiro Takemura*, Shinichi Yokota**, Kazuya Edamura*** * <i>Keio University, Japan</i> , ** <i>Tokyo Institute of Technology, Japan</i> , *** <i>New Technology Management Co., Ltd., Japan</i>	466
FR-PO-33	Study on Mechanism of Applying Magnetic Field by Permanent Magnet for MR Fluid Clutch System Yorihiko Yano*, Katsuhiro Hirata**, Takahiro Yoshikawa*, Koki Fujita* * <i>National Institute of Technology, Nara College, Japan</i> , ** <i>Osaka University, Japan</i>	468
FR-PO-34	Magnetic Actuator for the Air Bearing Spindle System Jonghyun Kim, Sun-Kyu Lee <i>Gwangju Institute of Science and Technology, Korea</i>	470
FR-PO-35	2-DoF Electromagnetic Actuator Bu Hyun Shin, Youngshik Kim, Bongjo Ryu <i>Hanbat National University, Korea</i>	472
FR-PO-36	Identification and Control Design of Voice Coil Actuated Stabilization Optical Image System Chibum Lee, Sang Ho Cha, Young-Seog Kim <i>Seoul National University of Science & Technology, Korea</i>	474
FR-PO-37	Fabrication of a MEMS-Based Electro-Rheological Microfinger System with an Alternating Pressure Source Tomoya Miyoshi, Kazuhiro Yoshida, Joon-wan Kim, Sang In Eom, Shinichi Yokota <i>Tokyo Institute of Technology, Japan</i>	476
FR-PO-38	A Flexure-based High Stiffness Stage Driven by a Differential Force of Piezo Actuators Kee-Bong Choi, Jaejoing Lee, Geehong Kim, Hyungjun Lim <i>Korea Institute of Machinery and Materials, Korea</i>	478
FR-PO-39	Design of ER Braking Device for Micro-robot in Micromouse Contest Haruka Kambe, Sayako Sakama, Takanori Togawa, Yutaka Tanaka <i>Hosei University, Japan</i>	480

FR-PO-40	Proposal on Mathematical Model for Bulk Modulus of Hydraulic Oil Containing Air Bubbles Sayako Sakama*, Yutaka Tanaka*, Hiroyuki Goto** *Hosei University, Japan, **Japan Society for the Promotion of Machine Industry, Japan.....	482
FR-PO-42	Influence of the Preheated Workpiece on the Cryogenic Based Milling of Ti-6Al-4V Ineon Lee, Do Young Kim, Vivek Bajpai, Hyung Wook Park Ulsan National Institute of Science and Technology, Korea.....	484
FR-PO-43	Development of Multi Embossing Process of Stainless Steel Sheet with 50um Thickness Sungho Chang*, Kwangho Shin**, Youngmoo Heo**, Jongdeok Kim**, Yonggi Won***, Jikyung Yang**** *GOSolutec, Korea, **Korea Institute of Industrial Technology, Korea, ***Biz&Mold Co., Ltd., Korea, ****KMP Co., Ltd., Korea.....	486
FR-PO-44	Study on the Optimal Cutting Condition of the Vibration Assisted Milling in Feed Direction to Improve the Surface Roughness Kwang-Il Lee, Su-Min An, Seung-Han Yang Kyungpook National University, Korea.....	488
FR-PO-45	A Study on Tool Geometry for Thick Plate Forming of Hollow Partitioned Turbine Blade Gi-Bum Park*, Yu-Beom Kim*, Jae-Young Jeon**, Beom-Soo Kang*, Tae-Wan Ku* *Pusan National University, Korea, **Power MnC Co., Ltd., Korea.....	490
FR-PO-46	Effect of Mandrel Position on Formability of U-Shaped Alloy 690 Tube Using Rotary Draw Bending Process Yu-Beom Kim, Gi-Bum Park, Beom-Soo Kang, Tae-Wan Ku Pusan National University, Korea.....	492
FR-PO-47	Effect of Cryogenic Machining for Titanium Alloy Based on Internal and External Spray System Kyung-Hee Park, Gi-Dong Yang, M. A. Suhaimi, Dong Yoon Lee, Tae-Gon Kim, Seok-Woo Lee Korea Institute of Industrial Technology, Korea.....	494
FR-PO-48	Simulation of Machining Error Induced by Tool Deflection in the NC Milling Process Segon Heo*, Chan-Hong Lee*, Byung-Kwon Min** *Korea Institute of Machinery & Materials, Korea, **Yonsei University, Korea.....	496
FR-PO-49	Investigation of Crack Removal and Surface Smoothing in Abrasive-Blasted Micro-Grooves by Fluid Jet Polishing Chae-Hee Lim, Sol-Yi Han, Wook-Bae Kim Korea Polytechnic University, Korea.....	498
FR-PO-50	Study on the Adhesion Force of Double Injection-Molding Test Specimen using the Thermoplastic Resin and LSR YoungBae Ko*, Hoon Cho*, GilSang Yoon*, YongJun Jeon*, HyungPil Park*, MinJae Song*, BaegSoon Cha*, SeungHyun Cho** *Korea Institute of Industrial Technology, Korea, **University of Dongyang Mirae, Korea.....	500
FR-PO-51	Design of Wire to Board Insulation Displacement Connector for Simplification of Assembling Processes Youngmoo Heo*, Jongdeok Kim*, Hasung Lee**, Sitae Won***, Sunjin Yoon**** *Korea Institute of Industrial Technology, Korea, **Yuhan Univeristy, Korea, ***Seoul National University of Science and Technology, Korea, ****CNPLUS Co., Ltd., Korea.....	502
FR-PO-52	Moldflow Analysis for Producing the Bushing in a Turbocharger Using Metal Injection Molding Ho-Joon Lee*, Bo-Gyu Park*, Kyoung-Chol Cho*, Si-Woo Park*, Dae-Gyu Park*, Jea-Ok Jung**, Chan-Yeol Seo**, Min-Chul Kim** *Korea Textile Machinery Research Institute, Korea, **PIM Korea Ltd, Korea.....	504
FR-PO-53	Finite Element Simulation of Injection Blow Molding Process for the Thick-walled PET Bottle Min-Jae Song***, Yoon-Ho Roh***, Baeg-Soon Cha* *Korea Institute of Industrial Technology, Korea, **Korea University, Korea, ***Moltech Korea, Korea.....	506
FR-PO-54	A Study on Compound Contents for Plastic Injection Molding Products of Metallic Resin Pigment Gyu-Sang Lee*, Dong-Hyun Jin**, Ju-Eun An**, Gyeong-Ah Kang**, Jae-Seob Kwak** *LG Inc., Korea, **Pukyung National University, Korea.....	508

FR-PO-55	Knowledge Based Overflow Design Utilizing Web Jiwoong Lee, Soo-Hong Lee <i>Yonsei University, Korea</i>	510
FR-PO-56	Energy Consumption Simulation of Feed Drive System of Machine Tools Operated with Tool Path from Roughing to Finishing Processes Zen Kimura, Akio Hayashi, Yohichi Nakao <i>Kanagawa University, Japan</i>	512
FR-PO-57	Development of Dual Metal Powder Metallurgy Molding Process for Gear Include Oil-less-Bearing Bo-Gyu Park*, Jae-Hun Jung**, Duk-Joo Kim**, Kyu-Sang Cho*** * <i>Korea Textile Machinery Research Institute, Korea</i> , ** <i>Daekwang Sinter Metal Co., Ltd., Korea</i> , *** <i>Andong National University, Korea</i>	514
FR-PO-58	Metal Injection Molding Analysis of WGV Head in a Turbocharger of 2000cc Gasoline Automobiles Bo-Gyu Park*, Dae-Kyu Park*, Sang-Yoon Kim*, Si-Woo Park*, Jae-Ok Jung** * <i>Korea Textile Machinery Research Institute, Korea</i> , ** <i>PIM Korea, Korea</i>	516
FR-PO-59	Experimental Research on the Dispensing Conditions of a Conductive Material using the Taguchi Method Min-Kyung Kim, In Hwan Lee, Hae Yong Cho <i>Chungbuk National University, Korea</i>	518
FR-PO-60	Collection of Physiological Human Standard Reference Data to Making Accurate DHM Model for Manufacturing System Murali Subramaniyam***, Seung Nam Min***, Se Jin Park**, Sangho Park* * <i>Chungnam National University, Korea</i> , ** <i>Korea Research Institute of Standards and Science, Korea</i> , *** <i>Shinsung University, Korea</i>	520