

# Technical Program

Thursday, April 25 9:15-10:35 Room E (Emerald)

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**Plenary Lecture 1, 2** Chair : Sang Won Lee (Sungkyunkwan University, Korea).

**PL-1 In-situ observation of friction surface with reflectance spectroscopy**

Noritsugu Umehara

*Nagoya University, Japan*

**PL-2 Highly Efficient Machining of Digital image on the Mold Surface using an Electromagnetically Suspended Air spindle**

Sun-kyu Lee

*Gwangju institute of Science and Technology, Korea*

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Friday, April 26 9:00-10:20 Room E (Emerald)

**Plenary Lecture 3, 4** Chair : Kenjiro Takemura (Keio University, Japan)

**PL-3 How fast a world changes!**

Soo-Hong Lee

*Yonsei University, Korea*

**PL-4 Extreme Human Centered Engineering**

Ken Endo

*Xiborg Inc., Japan, Sony Computer Science Laboratories, Inc., Japan*

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Thursday, April 25 10:50-12:20 Room A (Pearl)

**Printing Technology for Manufacturing(1)** Chair : Motoyuki Murashima, Nagoya University, Japan

**TH-A-1-1 Preparation of an RMS (Ready-Made STL) model for metal 3-D Printing**

Haeseong Jee, Myoung-Gyu Kim

*Hongik University, Korea*

**TH-A-1-2 Biomedical research and applications with optical microfluidic system & novel 3D additive manufacturing**

Yong-Jin Yoon, Suhan Lee, Jinhong Noh, Yoseop Choi

*Korea Advanced Institute of Science and Technology, Korea*

**TH-A-1-3 A geometric property of melt-electrowritten microfiber structures**

Young Hun Jeong, Nhat Tung Nguyen

*Kyungpook National University, Korea*

**TH-A-1-4 Process Parameter Identification to Improve the Printed Line Quality in Aerosol Jet Printing**

Seung Ki Moon\*, Haining Zhang\*, Zhong Yang Chua\*, Byunghoon Lee\*\*, Jamyong Koo\*\*

*\*Nanyang Technological University, Singapore, \*\*Samsung Electronics Co., Ltd., Korea*

**TH-A-1-5 Mechanical properties validation of multiple inner lattice structures using effective elastic properties**

Ho seung Jeong, Sang Hu Park, Dong Seok Kang, Qingye Jin

*Pusan National University, Korea*

**Printing Technology for Manufacturing(2) Chair : Haeseong Jee, Hongik University, Korea**

- TH-A-2-3 Lightweight Design of Multi-Lattice Structures and Evaluation of Its Mechanical Properties by Quarter Compression Test**  
Qingye Jin, Sang Hu Park, Dong Seok Kang, Ho seung Jeong  
*Pusan National University, Korea*
- TH-A-2-4 Tribological properties of novel 3D micro-textured sliding-surface fabricated by metal 3D printer**  
Naohide Matsuoka, Hiroaki Maeda, Kenta Takahashi, Shinya Sasaki  
*Tokyo University of Science, Japan*
- TH-A-2-5 Design of a trawl door with adaptively controllable flap imitated from a bird's wing**  
Ji Won Lee\*, Hong Keun Yoon\*\*, Yeon Ju Park\*\*, Sang Hu Park\*  
*\*Pusan National University, Korea, \*\*Bminternational Co.,Ltd., Korea*
- FR-A-1-6 Indices for tool wear monitoring in CFRP drilling**  
Kyeong Bin Kim, Young Hun Jeong  
*Kyungpook National University, Korea*

**Injection Molding Chair : Yong-Jin Yoon, Korea Advanced Institute of Science and Technology, Korea**

- TH-A-3-1 High-frequency induction heating for polymer/metal hybrid molding**  
Keun Park, Hyun Joong Lee  
*Seoul National University of Science and Technology, Korea*
- TH-A-3-2 Correlation between demolding force and physical property of molded resin in injection molding**  
Kazuyoshi Oota\*, Wataru Natsu\*, Masayuki Okabe\*\*, Yuya Aihoshi\*\*, Misato Nagasawa\*\*\*  
*\*Tokyo University of Agriculture and Technology, Japan, \*\*Polytechnic University, Japan, \*\*\*Sanden Advanced Technology Corp., Japan*
- TH-A-3-3 Temperature distribution of mold and molded product and its influence on demolding force in injection molding process**  
Haruki Nakamura, Kazuyoshi Oota, Wataru Natsu  
*Tokyo University of Agriculture and Technology, Japan*
- TH-A-3-4 Optimization of mold temperature profile and process parameters for minimizing weldline and cycle time in rapid heating cycle molding**  
Ryoto Ishizuki\*, Satoshi Kitayama\*, Masahiro Takano\*\*, Yoshikazu Kubo\*\*\*, Shuji Aiba\*\*\*  
*\*Kanazawa University, Japan, \*\*Machinery and Metal, Industrial Research Institute of Ishikawa, Japan, \*\*\*Sodick Co., Ltd., Japan*
- TH-A-3-5 Optimization of variable injection velocity for weldline reduction in plastic injection molding**  
Sara Hashimoto\*, Satoshi Kitayama\*, Masahiro Takano\*\*, Yoshikazu Kubo\*\*\*, Shuji Aiba\*\*\*  
*\*Kanazawa University, Japan, \*\*Machinery and Metal, Industrial Research Institute of Ishikawa, Japan, \*\*\*Sodick Co., Ltd., Japan*
- TH-A-3-6 Development of a continuous roll molding system with a vitreous carbon roll mold**  
Jun Kim, Muhammad Refatul Haq, Young kyu Kim, Seok min Kim  
*Chung Ang University, Korea*

**Machine Elements(1) Chair : Yasuyoshi Tozaki, Kindai University, Japan**

- TH-B-1-1 Effects of oil film behavior on roller surface on cooling in traction drives**  
Naoki Muraoka  
*Tokai University, Japan*
- TH-B-1-2 Investigation of transient response of differential planetary gear train during reverse rotation via high-speed camera monitoring**  
Tomoki Fukuda, Masao Nakagawa, Seiya Hamada, Toshiki Hirogaki, Eiichi Aoyama  
*Doshisha University, Japan*
- TH-B-1-3 Study on Supply Direction of Lubricating Oil by Using CFD Analysis in Traction Drive**  
Masayuki Ochiai, Takuya Suwa, Hiromu Hashimoto  
*Tokai University, Japan*
- TH-B-1-4 Optimization of the pin shape to minimize power loss of chain for continuously variable transmission (CVT)**  
Teruhiko Nakazawa\*, Haruhiro Hattori\*, Ichiro Tarutani\*, Shinji Yasuhara\*\*, Tsuyoshi Inoue\*\*\*  
*\*Toyota Central R&D Labs., Inc., Japan, \*\*JTEKT Corp., Japan, \*\*\*Nagoya University, Japan*
- TH-B-1-6 Modeling Methodology for Dynamic Characteristics Analysis of Multi-Axis Feed Drive Systems Including Rotating Units**  
SeoJun Hong, Myeong Yeon Park, Jay-Il Jeong  
*Kookmin University, Korea*

**Machine Elements(2) Chair : Hidetaka Koga, ISUZU Motors Ltd., Japan**

- TH-B-2-1 Influence of Trochoidal Interference near Base Circle of Helical Gear on Pitting Failure**  
Koji Kumagai\*, Kunihiko Morikawa\*, Atsushi Hayata\*, Yuta Naito\*, Syuhei Kurokawa\*\*,  
*\*Nissan Motor Co., Ltd., Japan, \*\*Kyusyu University, Japan*
- TH-B-2-2 Evaluating the multi-thread-worm and helical gear for a walking assistance device**  
Yohsiki Yamamoto, Kazuki Osawa, Eiichiro Tanaka  
*Waseda University, Japan*
- TH-B-2-3 Networks of tooth helix deviations of hobbed, grinded and super-finished gears**  
Hiroki Inoue\*, Daisuke Iba\*, Hidekatsu Noda\*, Myungsoo Kim\*\*, Ichiro Moriwaki\*  
*\*Kyoto Institute of Technology, Japan, \*\*Osaka seimitsu kikai, Japan*
- TH-B-2-4 Influence of meshing positions and case-carburizing of gear side surfaces on bending fatigue strength of case-carburized helical gears with large helix angles**  
Mikiya Yamaoka\*, Motomu Tanaka\*, Masaya Kumada\*, Kengo Nojima\*\*, Ryosuke Nishi\*, Yuichi Ono\*, Takao Koide\*  
*\*Tottori University, Japan, \*\*Tottori Institute of Industrial Technology, Japan*
- TH-B-2-5 Study on surface temperature evaluation method of hardened helical gear with lengthwise sliding velocity**  
Tomoaki Nara, Yasuyoshi Tozaki, Takuya Goto, Ryota Hosaka  
*Kindai University, Japan*

**TH-B-2-6 Hobbing-Machine-Diagnosis System with Artificial Intelligence: Hobbing Simulation for Learning**

**Data**

Kunitoshi Kawano\*, Daisuke Iba\*\*, Kouichirou Uriu\*, Ichiro Moriwaki\*\*

\*Kashifuji Works, Ltd., Japan, \*\*Kyoto Institute of Technology, Japan

Thursday, April 25 16:45-18:15 Room B(Cattleya)

**Machine Elements(3) Chair : Takao Koide, Tottori University, Japan**

**TH-B-3-1 Study on tooth profile measurement using contour shape measuring instrument**

Ryohei Ishimaru, Naoshi Izumi

National Institute of Technology, Kurume College, Japan

**TH-B-3-2 Robustness evaluation of vibration-based gear crack detection system using a convolutional neural network**

Kien Huy Bui, Daisuke Iba, Yunosuke Ishii, Yusuke Tsutsui, Nanako Miura, Takashi Iizuka, Arata Masuda, Akira Sone, Ichiro Moriwaki

Kyoto Institute of Technology, Japan

**TH-B-3-3 Development of In-Situ Portable Gear Damage Diagnostic System Using Laser Reflection**

Chinn Yee Lim\*, Jyun-Rong Zhuang\*, Masahiro Yasuda\*\*, Kikuno Furuta\*\*, Fumitake Kida\*\*, Masakazu Nakasako\*\*\*, Kiyotaka Ikejo\*\*\*\*, Eiichiro Tanaka\*

\*Waseda University, Japan, \*\*Kokura Tetsudo Co., Ltd., Japan, \*\*\*National Institute of Technology, Kure College, Japan, \*\*\*\*Hiroshima Univeristy, Japan

**TH-B-3-4 Evaluation of Printed Crack Detection Sensors by Static Load and Endurance Test of Gears**

Yusuke Matsushita, Daisuke Iba, Shintaro Fuatagawa, Nanako Miura, Takashi Izuka, Arata Masuda, Akira Sone, Ichiro Moriwaki

Kyoto Institute of Technology, Japan

**TH-B-3-5 Proposal of Machining Mark Model for Gear Tooth Surface Using Slices of Two-Dimensional Spectrum**

Junichi Hongu, Hiroki Noborio, Takao Koide, Atsutaka Tamura

Tottori University, Japan

Thursday, April 25 10:50-12:20 Room C(Orchid)

**Machine Design(1) Chair : Yoshihiro Kai, Tokai University, Japan**

**TH-C-1-1 Modeling and Control System Design of Self-Standable Motorcycle**

Susumu Hara, Koki Nakagami

Nagoya University, Japan

**TH-C-1-3 Development of the Walking Assistive Device Able to Walk on Stairs Using Zero-Moment Point Control Method**

Bo Rong Yang, Hee Hyol Lee, Eiichiro Tanaka

Waseda University, Japan

**TH-C-1-4 A 3Dimensional ball rotating control system with active-casters**

Shunsuke Inui, Masayoshi Wada

Tokyo University of Agriculture and Technology, Japan

**TH-C-1-5 Research on Enhancing Stiffness of a Micro Blade**

Daeyoung Ji\*, Kang Soo Lee\*, Jung Su Mun\*\*

\*Hanbat National University, Korea, \*\*I. D. T. Ltd., Korea

**TH-C-1-6 Displacement analysis of a 3-DOF parallel mechanism for thumb rehabilitation**

Woo-hyeok Choi, Yukio Takeda

*Tokyo Institute of Technology, Japan*

**Thursday, April 25 13:30-15:00 Room C(Orchid)**

**Machine Design(2) Chair : Eiichiro Tanaka, Waseda University, Japan**

**TH-C-2-1 Study on design of linear motion-rotational motion transformer using a double eccentric crank**

Jun Nango, Hiroto Anbe, Kouhei Murakami

*Yamagata University, Japan*

**TH-C-2-3 Cylinder-shaped robot with symmetric stretching mechanism by using eight directional bars**

Takeshi Okuno\*, Geunho Lee\*, Chulmin Kwon\*\*

*\*University of Miyazaki, Japan, \*\*Korea Evaluation Institute of Industrial Technology, Korea*

**TH-C-2-5 Compact root-vegetable harvesting assist robot capable of using with standing posture**

Shousuke Hamada, Ishimoto Atsushi, Lee Geunho

*University of Miyazaki, Japan*

**TH-C-2-6 Specification Design of Sea-water High Pressure Piston Pump for Scientific Submarine in Deep Sea**

Mojiz Abbas Trimzi\*, Young-Bog Ham\*\*, Jung-Ho Park\*\*, So-Nam Yun\*\*, Yong-Gil Kim\*\*\*, Dang-Ju

Kim\*\*\*, Ho-Yeon Son\*\*\*, Pan-Mook Lee\*\*\*\*

*\*University of Science & Technology, Korea, \*\*Korea Institute of Machinery and Materials, Korea,*

*\*\*\*Daiho Hydraulic Co. Ltd., Korea, \*\*\*\*Maritime and Ocean Engineering Research Institute, Korea*

**Thursday, April 25 16:45-18:15 Room C(Orchid)**

**Machine Design(3) Chair : Jun Nango, Yamagata University, Japan**

**TH-C-3-1 Case study: Effectiveness of a sketch learning model for engineering major students**

Seongwon Jeong

*Seoul National University of Science and Technology, Korea*

**TH-C-3-2 A Flexibly Grasping and Manipulating Mechanism Composed of Many Elastic Cords**

Naoto Kondoh, Nobuyuki Iwatsuki, Ikuma Ikeda, Nozomu Miyata

*Tokyo Institute of Technology, Japan*

**TH-C-3-4 Development of an upper-limb assistance device based on the predictable motion recognition system**

Hao Yang, Yun-Ting Liao, Hee-Hyol Lee, Eiichiro Tanaka

*Waseda University, Japan*

**TH-C-3-5 Design optimization of redundantly planar parallel kinematic mechanism for performing finish cut to improve surface roughness of FDM 3D printed sculptures**

Donghun Lee, Minbok Lee

*Soongsil University, Korea*

**Thursday, April 25 10:50-12:20 Room D(Rose)**

**Actuator Systems (1) Chair : Kenjiro Takemura, Keio University, Japan**

**TH-D-1-1 Fabrication process of a McKibben artificial muscle with SMP fibers by a braider machine**

Koya Matsushita, Shuichi Wakimoto, Shigeyoshi Yahara, Takefumi Kanda

*Okayama University, Japan*

- TH-D-1-2 Evaluation of a small three-way valve driven by a single piezoelectric vibrator for hydraulic actuator system**  
 Hikaru Yamamoto\*, Takefumi Kanda\*, Syuichi Wakimoto\*, Kou Hashimoto\*, Haruto Takami\*, Norihisa Seno\*\*, Koichi Suzumori\*\*, Takahiro Ukida\*\*, Hiroyuki Nabae\*\*  
 \*Okayama University, Japan, \*\*Tokyo Institute of Technology, Japan
- TH-D-1-3 A Study on an In-Pipe Mobile Micromachine Having a Fluid Inertia Micropump**  
 Yuki Tamanoi, Ryota Horai, Kazuhiro Yoshida, Sang In Eom, Joon-wan Kim  
 Tokyo Institute of Technology, Japan
- TH-D-1-4 Controlling electrospray-deposited pattern by changing electrical field on a stencil mask**  
 Khoa Nhat Dang Nguyen, Kazuhiro Yoshida, Joon-Wan Kim  
 Tokyo Institute of Technology, Japan
- TH-D-1-5 Development of Mobile Pneumatic Assist Wear System for Preventing Fall Accidents from Wheel Chairs**  
 Makoto Takada\*, Kan Ishida\*, Shuichi Wakimoto\*, Takeji Ueda\*\*, Takefumi Kanda\*  
 \*Okayama University, Japan, \*\*Energyfront Ltd., Japan
- TH-D-1-6 Development of pneumatic finger-wrist extension rehabilitation device**  
 Yasuko Matsui, Daiki Hosomi, Masahiro Takaiwa  
 Tokushima University, Japan

**Thursday, April 25 13:30-15:00 Room D(Rose)**

**Actuator Systems (2) Chair : Joonwan Kim, Tokyo Institute of Technology, Japan**

- TH-D-2-1 Development of a lightweight jumping unit using SMA actuators for a small lunar rover**  
 Tomoki Hirota\*, Hironari Taniguchi\*, Masato Tanaka\*\*  
 \*Osaka Institute of Technology, Japan, \*\*Astro Technology SOHLA, Japan
- TH-D-2-2 Development of an Externally Powered Prosthetic Hand for Children Using Miniature McKibben Soft Actuators**  
 Nobuo Takemoto\*, Hironari Taniguchi\*, Shuichi Wakimoto\*\*, Kouyou Asano\*\*, Kousuke Morinaga\*\*\*, Takehumi Kanda\*\*  
 \*Osaka Institute of Technology, Japan, \*\*Okayama University, Japan, \*\*\*Hiroshima International University, Japan
- TH-D-2-3 Formulation of Tactile Gestalt to Express Variation in Velvet Hand Illusion Caused by Out-of-Phase Cycles of Two Wires**  
 Masahiro Ohka, Hiraku Komura, Toshiki Nakamura  
 Nagoya University, Japan
- TH-D-2-4 Combined Effect of Kinesthetic Illusion and Rubber Hand Illusion**  
 Hiraku Komura\*, Tomoki Shimura\*, Masakazu Honda\*\*, Masahiro Ohka\*  
 \*Nagoya University, Japan, \*\*Industrial Research Institute of Shizuoka Prefecture, Japan
- TH-D-2-5 A Pseudo High-Speed High-Resolution Capturing Method for Fuel Injection Process by Using Phase-Shift Photographing**  
 Kazuyuki Kojima, Feng Yuanrun, Hideaki Takahashi, Hiroyuki Sato  
 Shonan Institute of Technology, Japan

**TH-D-2-6 Hyperbola-Based DoA Estimation Scheme and Prototype Implementation toward Robot Tracking Applications**

Geunho Lee, Myungsik Kim

*University of Miyazaki, Japan*

**Thursday, April 25 16:45-18:15 Room D(Rose)**

**Actuator Systems (3) Chair : Takefumi Kanda, Okayama University, Japan**

**TH-D-3-1 Development of Robot Chicken for Promoting Chicks' Feeding Behavior: Feasibility Study**

Tomoki Uno, Minami Owada, Akifumi Yamamoto, Christian Bilgera, Tsuyoshi Shimmura, Hiroshi Ishida

*Tokyo University of Agriculture and Technology, Japan*

**TH-D-3-2 An Intelligent Solution of Industrial Robot Health Monitoring based on IoT System Design and Deep Learning Technique**

Huan Van Pham, Soonyoung Han, Jiung Huh, Hae-jin Choi

*Chung-Ang University, Korea*

**TH-D-3-3 Estimation of WorldSID Thorax Kinematics Using Multiple 3-Axis Accelerometers**

Yeseop Park, Youkeun K. Oh

*Hongik University, Korea*

**TH-D-3-4 Fabrication of Glass Molded Nanohole Array for Enhanced Raman Spectroscopy Application**

Seok-Min Kim, Jun Kim, Mohsin Ali Badshah, Jonghyun Ju, Muhammad Refatul Haq, Xun Lu

*Chung-Ang University, Korea*

**TH-D-3-5 Development of one-axis active controlled bearingless motor working at extremely low temperature**

Hirohisa Kato, Mochimitsu Komori, Ken-ichi Asami, Nobuo Sakai, Zenzo Yukitake

*Kyushu Institute of Technology, Japan*

**Thursday, April 25 10:50-12:20 Room E(Emerald lobby)**

**Coatings and Surface Modification (1) Chair : Motohisa Hirano, Hosei University, Japan**

**TH-E-1-1 Correlation between the characteristic behavior of soft-metallic nano-crystals in the soft-metal/DLC nanocomposite coatings and the tribological properties**

Minoru Goto, Masataka Maruyama

*National Institute of Technology, Ube College, Japan*

**TH-E-1-2 Mechanism of improvement wear resistance about CNx coating overcoat on a-C:H coating in oil lubrication**

Shigehiro Ito\*, Noritsugu Umahara\*, Takayuki Tokoroyama\*, Motoyuki Murashima\*, Manabu Izumida\*\*, Naohisa Kawakami\*\*

*\*Nagoya University, Japan, \*\*Daido Metal Co., Ltd., Japan*

**TH-E-1-3 The tribological properties of DLCs with various dopants and clarification of the mechanism at 200°C**

Ruixi Zhang, Noritsugu Umehara, Takayuki Tokoroyama, Motoyuki Murashima

*Nagoya University, Japan*

**TH-E-1-4 Control of Transfer Film for Low Friction of Mechanical Seals using Carbon Nitride Coatings**

Kazuya Kuriyagawa, Koshi Adachi

*Tohoku University, Japan*

**TH-E-1-5 Influence of high-density plasma on the structure of a-C:H films deposited by plasma CVD**

Miyu Furuhashi, Hiroyuki Kousaka, Tatsuya Furuki

*Gifu University, Japan*

**TH-E-1-6 Friction and wear properties of hard coatings under lubrication with low viscosity fully formulated oil**  
Kiichi Nakagome, Hikaru Okubo, Seiya Watanabe, Shinya Sasaki  
*Tokyo University of Science, Japan*

**Thursday, April 25 13:30-15:00 Room E(Emerald lobby)**

**Coatings and Surface Modification (2) Chair : Shouhei Kawada, Tokyo University of Science, Japan**

**TH-E-2-1 Improvement of electrical, optical, mechanical and tribological characteristics of flexible transparent conductive electrodes**

Chang-Lae Kim\*, Dae-Eun Kim\*\*

\*Chosun University, Japan, \*\*Yonsei University, Korea

**TH-E-2-2 Measurement of real contact area of rubber platen rollers**

Isami Nitta\*, Kento Tamura\*, Yosuke Tsukiyama\*, Tomoko Wauke\*\*, Hiroto Terao\*\*

\*Niigata University, Japan, \*\*ALPS Electric Co., Ltd., Japan

**TH-E-2-3 Real contact area observation on Paper materials**

Yosuke Tsukiyama, Isami Nitta

*Niigata University*

**TH-E-2-4 Preventing Coagulated-Blood Adhesion on a Coated Electrosurgical Knife**

Masahiro Kobayashi, Noritsugu Umehara, Takayuki Tokoroyama, Motoyuki Murashima

*Nagoya University, Japan*

**TH-E-2-5 Tribological behavior of silicon carbide coating films for ceramic-on-ceramic artificial joints**

Tadashi Shiota\*, Miho Akiyama\*, Daiki Taniya\*, Yuya Omiya\*, Toshiyuki Ikoma\*\*, Masahiro Fujii\*

\*Okayama University, Japan, \*\*Tokyo Institute of Technology, Japan

**Thursday, April 25 16:45-18:15 Room E(Emerald lobby)**

**Friction and Wear Chair : Chang-Lae Kim, Chosun University, Korea**

**TH-E-3-1 Generation of Low Friction by Native-Rich Protein film**

Koki Kanda, Yoshiyuki Ueno, Koshi Adachi

*Tohoku University, Japan*

**TH-E-3-2 Effect of mesh structure of tetrahedral amorphous carbon (ta-C) coating on friction and wear properties under base-oil lubrication condition with regard to fracture behavior**

Mohd Muhyiddin Bin Mustafa\*, Noritsugu Umehara\*, Takayuki Tokoroyama\*, Motoyuki Murashima\*, Akinori Shibata\*\*, Yoshiharu Utsumi\*\*, Hideki Moriguchi\*\*

\*Nagoya University, Japan, \*\*ITF Inc., Japan

**TH-E-3-3 Understanding morphology and tribological behavior of ta-C coating deposited by FCVA method**

Woo-Young Lee\*, Young-Jun Jang\*\*, Takayuki Tokoroyama\*, Motoyuki Murashima\*, Noritsugu Umehara\*

\*Nagoya University, Japan, \*\*Korea Institute of Materials Science, Korea

**TH-E-3-4 Effect of doped tantalum in ta-CN<sub>x</sub> film or tantalum as counterpart material on the friction and wear properties of ta-CN<sub>x</sub>**

Koki Hojo, Motoyuki Murashima, Takayuki Tokoroyama, Noritsugu Umehara,

*Nagoya University, Japan*

**TH-E-3-5 Influence of pulley misalignment on power transmitting efficiency and transmitting torque of metal V-belt type continuously variable transmission at steady state**

Takuma Ohashi\*, Kiyotaka Obunai\*, Kazuya Okubo\*, Kyohei Sakagami\*\*, Toru Yagasaki\*\*

\*Doshisha University, Japan, \*\*HONDA R&D Co. Ltd., Japan



**Cutting/ Forming/ Grinding(1) Chair : Ryutaro Tanaka, Hiroshima University, Japan**

**FR-A-1-1 Accuracy of Spring-Back Factor Applied for V-Bending Die Design**

Sutasn Thipprakmas

*King Mongkut's University of Technology Thonburi, Thailand*

**FR-A-1-2 Shearing clearance and shaving allowance to minimize die-roll formation in shaving process**

Arkarapon Sontamino, Sutasn Thipprakmas

*King Mongkut's University of Technology Thonburi, Thailand*

**FR-A-1-3 Free-form draw-bead application in deep-drawing process**

Wiriyakorn Phanitwong\*, Sutasn Thipprakmas\*\*

*\*University of Technology Rattanakosin, Thailand, \*\*King Mongkut's University of Technology Thonburi, Thailand*

**FR-A-1-4 Application of lubricant zoning in deep-drawing process**

Sutasn Thipprakmasa\*, Jaksawat Sriborwornmongkol\*, Wiriyakorn Phanitwong\*\*

*\*King Mongkut's University of Technology Thonburi, Thailand, \*\*University of Technology Rattanakosin, Thailand*

**FR-A-1-5 The CNC integrated multi-sensor tool monitoring system**

Jaehyeok Kim, Gidong Yang, Dongyoon Lee

*Korea Institute of Industrial Technology (KITECH), Korea*

**Cutting/ Forming/ Grinding(2) Chair : Sutasn Thipprakmas, King Mongkut's University of Technology Thonburi, Thailand**

**FR-A-2-1 Effect of Feed Rate on Tool Wear in Up Cut End Milling of AISI 1050 at Different Cutting Speed**

Ryutaro Tanaka, Tai Yi Yeh, Kota Matsuda, Katsuhiko Sekiya, Keiji Yamada

*Hiroshima University, Japan*

**FR-A-2-2 Surface Quality Evaluation of 0.2% C and AISI 304 Steels in Turning with Sustainable lubricating Condition**

Krishan Chanaka Wickramasinghe\*, G. I. P Perera\*, Himan KG Punchihewa\*\*, Hiroyuki Sasahara\*\*\*

*\*University of Ruhuna, Sri Lanka, \*\*University of Moratuwe, Sri Lanka, \*\*\*Tokyo University of Agriculture and Technology, Japan*

**FR-A-2-3 A novel non-conventional method for real-time tool condition monitoring through vibration and noise analysis**

Ahmad Shahir Jamaludin\*, Ainur Munira Rosli\*, Amiril Sahab Abdul Sani\*, Mohd Nizar Mhd Razali\*, Mohd Shahril Osman\*\*, Hosokawa Akira\*\*\*

*\*Universiti Malaysia Pahang, Malaysia, \*\*University College of Technology Sarawak, Malaysia, \*\*\*Kanazawa University, Japan*

**FR-A-2-4 Influence of Friction Characteristic of Cutting Fluid Evaluated by Cutting Force in Micro Feed End Milling on Surface Roughness**

Tai Yi Yeh\*, Ryutaro Tanaka\*, Katsuhiko Sekiya\*, Keiji Yamada\*, Shih Jui Chen\*\*

*\*Hiroshima University, Japan, \*\*National Central University, Taiwan*

**FR-A-2-5 Application of Rough Grinding Wheel and Slant Feed Grinding to High Efficiency Machining of CFRP with Coolant Supplying from Inside of Grinding Wheel**

Masahiro Kawabata\*, Rei Koyasu\*\*, Hiroyuki Sasahara\*

\*Tokyo University of Agriculture and Technology, Japan, \*\*Heiwa Sangyo Co., Ltd., Japan

**Friday, April 26 14:15-15:45 Room B(Cattleya)**

**Machine Elements(4) Chair : Shinji Hashimura, Shibaura Institute of Technology, Japan**

**FR-B-1-1 A study on influence of surface roughness on bearing surface in torque control method using lubricants**

Shota Inoue\*, Shinji Hashimura\*, Takefumi Otsu\*\*, Kyoichi Komatsu\*\*\*

\*Shibaura Institute of Technology, Japan, \*\*Oita University, Japan, \*\*\*Tohnichi Mfg. Co., Ltd., Japan

**FR-B-1-2 Effect of Bending Moment on the Fatigue Strength of a Bolt in Bolt/Nut Assembly**

Masaya Hagiwara, Ryota Suzuki, Yutaka Inagaki

Nagoya Institute of Technology, Japan

**FR-B-1-3 Effects of Surface Conditions on Embedment in Bolted Joints**

Masataka Nomura, Toshimichi Fukuoka, Masanori Takezaki

Kobe University, Japan

**FR-B-1-4 Influence of Tightening Speed on Rapture of Screw Threads**

Yuya Omiya, Hayaki Kawaguchi, Tadashi Shiota, Masahiro Fujii

Okayama University, Japan

**Friday, April 26 16:10-17:40 Room B(Cattleya)**

**Sustainable Tribology Chair : Koki Kanda, Tohoku University, Japan**

**FR-B-2-1 Performance Evaluation of Phosphorus-containing Compounds Combined with Sulfurized Olefin and Overbased Calcium Sulfonate in Cold Forming**

Tomohiro Takaki\*, Kazuhiro Yagishita\*, Toshiaki Wakabayashi\*\*

\*JXTG Nippon Oil & Energy Corp., Japan, \*\*Kagawa University, Japan

**FR-B-2-2 Self-formation of low frictional interface in engine oil with silicon-containing aluminum alloy**

Kento Ihara, Yasuhisa Yamamoto, Koshi Adachi

Tohoku University, Japan

**FR-B-2-3 Development of control method for friction stabilization**

Takazumi Yamada, Noritugu Umehara, Takayuki Tokoroyama, Motoyuki Murashima

Nagoya university, Japan

**FR-B-2-4 Relationship between Casting Condition and Gas Porosity in Magnesium Alloy Die Casting**

Yuki Kashiwabara\*, Lidiana Binti Roslan\*\*, Mohd Danial Ibrahim\*\*, Masayuki Ochiai\*, Hiromu Hashimoto\*, Yuta Sunami\*

\*Tokai University, Japan, \*\*Universiti Malaysia Sarawak, Malaysia

**FR-B-2-5 Application of grease lubrication to sliding surfaces of Cu-dispersed PTFE**

Taisei Osawa\*, Satoru Maegawa\*, Takashi Nakamura\*\*, Fumihiro Itoigawa\*

\*Nagoya Institute of Technology, Japan, \*\*Nagoya university, Japan

**FR-B-2-6 Hydrodynamic lubrication performance of parallel thrust bearings with dimples**

Terunao Kishida\*, Norifumi Miyanaga\*, Jun Tomioka\*\*

\*Kanto Gakuin University, Japan, \*\*Waseda University, Japan

**Manufacturing Systems(1) Chair : Hiroyuki Kousaka, Gifu University, Japan**

- FR-C-1-2 Experimental study on the robot arm based hole drilling process for carbon fiber reinforced plastics**  
Dongchan Kim, Jae woo Seo, O-seop Kwon, Ji su Kim, Hyung wook Park  
*Ulsan National Institute of Science and Technology, Korea*
- FR-C-1-3 Positioning solution in reconfigurable fixtures for machining free form CFRP sheets**  
Minh Duc Do, Mingeon Kim, Duy Hung Nguyen, Hae-Jin Choi  
*Chung-Ang University, Korea*
- FR-C-1-4 A Study on Computer Aided Process Planning of Parts Machining under Fixing Limitations**  
Wataru Komatsu, Yuki Inoue, Keiichi Nakamoto  
*Tokyo University of Agriculture and Technology, Japan*
- FR-C-1-5 Proposal of Complex Parts Machining Securing Dynamic Stiffness of Workpiece During a Rough Machining Operation**  
Maho Kumanotani, Hitoshi Kushino, Keiichi Nakamoto  
*Tokyo University of Agriculture and Technology, Japan*
- FR-C-1-6 Development of highly sensitive antibody chip for identification of semen**  
Seong Min Lee, Xun Lu, Mohsin Ali Badshah, Naseam Abbas, Seok Min Kim  
*Chung-Ang University, Korea*

**Manufacturing Systems(2) Chair : Keiichi Nakamoto, Tokyo University of Agriculture and Technology, Japan**

- FR-C-2-1 Problems of class imbalance and multiclass classification in artificial intelligences for the product quality control**  
Hae-Jin Choi, Soonyoung Han  
*Chung-Ang University, Korea*
- FR-C-2-2 Segmentation of Knee MR Images using Watershed-based Technique**  
Jaewoo Shin, Youkeun K Oh  
*Hongik University, Korea*
- FR-C-2-3 Posture optimization and compliance control for the family of the kinematic redundant parallel robots with rotational mechanisms embedded in the moving part**  
Rei Tsuchihara, Takashi Harada  
*Kindai University, Japan*
- FR-C-2-4 Inductive design exploration method with active sampling for handling high computational cost**  
Sungwoo Jang, Hae-Jin Choi  
*Chung-Ang University, Korea*
- FR-C-2-5 The Impact of the New iPhone Announcement on the Stock Prices of Apple's Supply Chain in Taiwan**  
Bi-Huei Tsai, Ching-Feng Chen  
*National Chiao Tung University, Taiwan*

**Polishing Chair : Noritsugu Umehara, Nagoya University, Japan**

- FR-D-1-1 Effect of spray nozzle position on pad temperature distribution and wafer non-uniformity**  
Kihun Lee, Haedo Jeong, Dasol Lee, Seonho Jeong, Donghwan Lee  
*Pusan National University, Korea*

- FR-D-1-2 FEM stress analysis between copper and polymer interface in package substrate CMP**  
Seonho Jeong, Kihun Lee, Donghwan Lee, Somjin Shin, Haedo Jeong  
*Pusan National University, Korea*
- FR-D-1-3 Simulation of CMP polishing pad profile according to diamond arrangement of conditioning disk**  
Donghwan Lee\*, Heado Jeong\*, Hanchul Cho\*\*, Dasol Lee\*, Seonho Jeong\*  
*\*Pusan National University, Korea, \*\*Korea Institute of Industrial Technology, Korea*
- FR-D-1-4 Elucidation of interaction in lapping process using low hardness abrasive grains and hard abrasive grains**  
Hiroaki Takeno\*, Takayuki Tokoroyama\*, Noritsugu Umehara\*, Motoyuki Murashima\*, Shogo Chiba\*\*  
*\*Nagoya University, Japan, \*\*Saito Optical Science Ltd., Japan*
- FR-D-1-5 Colloidal slurry activation by AC electric field for reduction of slurry consumption**  
Dasol Lee\*, Kihun Lee\*, Seonho Jeong\*, Minjong Yuh\*\*, Haedo Jeong\*  
*\*Pusan National University, Korea, \*\*G&P Technology, Korea*

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**Friday, April 26 16:10-17:40 Room D(Rose)**

**Rapid Prototyping Chair : Young Hun Jeong, Kyungpook National University, Korea**

- FR-D-2-1 Permeability of Release Agent inside the Porous Structure Built by Metal-based Additive Manufacturing**  
Tatsuaki Furumoto\*, Ryo Ikeya\*, Makoto Nikawa\*\*, Nobuhisa Hayashi\*\*\*, Yuki Hori\*\*\*  
*\*Kanazawa University, Japan, \*\*Gifu University, Japan, \*\*\*Shippo Moulds Co., Ltd., Japan*
- FR-D-2-2 Relationship between spatter particle behavior and volume specific energy density in SLM process**  
Kazushi Oishi\*, Tatsuaki Furumoto\*, Kyota Egashira\*, Satoshi Abe\*\*, Yohei Hashimoto\*, Tomohiro Koyano\*, Akira Hosokawa\*  
*\*Kanazawa University, Japan, \*\*Panasonic Corporation Eco Solutions Company, Japan*
- FR-D-2-3 A Study on Thermo-Mechanical Characteristics for a Multi-Layer Deposition Using a Wire Feeding Type DED Process**  
Bih-Lii Chua\*, Dong-Gyu Ahn\*, Jae-Gu Kim\*\*  
*\*Chosun University, Korea, \*\*Korea Institute of Machinery and Materials, Korea*
- FR-D-2-4 Experimental Characterization on Functionally Graded Material of Stainless Steel 316L and Inconel 718 Fabricated by Directed Energy Deposition**  
Jung Sub Kim, Sang Won Lee  
*Sungkyunkwan University, Korea*

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**Friday, April 26 14:15-15:45 Room E(Emerald lobby)**

**Friction and Wear /Micro Tribology Chair : Yousuke Tsukiyama, Niigata University, Japan**

- FR-E-1-1 Friction and Wear of a Medical Mouthguard Material in Reciprocating and Unidirectional Rotation Sliding**  
Tomoharu Akagaki, Takuya Nitadori, Taiki Nishimura  
*National Institute of Technology, Hachinohe College, Japan*
- FR-E-1-2 Development of new active friction control system with morphing surface (Smart Surface) in dry Condition**  
Yusuke Imaizumi, Motoyuki Murashima, Noritsugu Umehara, Takayuki Tokoroyama  
*Nagoya University, Japan*

- FR-E-1-3 Increase in EHL Oil Film Thickness by Microdimples on Contact Surface under Squeezing Motion**  
Daiki Matsuoka, Tomoko Hirayama, Takashi Matsuoka, Hidetoshi Sakamoto  
*Doshisha University, Japan*
- FR-E-1-4 Improvement of Run-Out Characteristics by Partial Texturing on Journal Bearing under Periodic Fluctuating Load**  
Suzuka Okumura\*, Tomoko Hirayama\*, Shinichiro Ido\*\*, Yoshimi Ikeda\*\*, Tatsuya Sasaki\*\*  
*\*Doshisha University, Japan, \*\*Mitsubishi Electric Corporation, Japan*
- FR-E-1-5 New Oil Supply Technology for Hybrid Ceramic Bearing for Space Applications -Evaluation of Oil Flow Characteristics from the Oil Supply System-**  
Toru Kamiya\*, Kazuyoshi Yamakawa\*, Kazuhisa Kitamura\*, Akira Koyama\*, Kazuaki Maniwa\*\*, Shingo Obara\*\*  
*\*JTEKT Corp., Japan, \*\*Aerospace Exploration Agency, Japan*
- FR-E-1-6 Development of equipment to make failure in a test bearing to be used for bearing diagnosis experiments**  
Taiga Uchihashi, Toshiki Kobayashi, Nobuhiko Henmi  
*Shinshu University, Japan*

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**Friday, April 26 16:10-17:40 Room E(Emerald lobby)**

- Friction and Wear /Micro Tribology Chair : Minoru Goto, National Institute of Technology, Ube College, Japan**
- FR-E-2-1 Atomistic Friction Phase Diagram and Non-linear Dynamical Effects in Frictional Energy Dissipation**  
Motohisa Hirano, Shuta Inoue, Kenta Kimura  
*Hosei University, Japan*
- FR-E-2-2 Tribological Performances of Halogen-free Ionic Liquids against a-C: H and ta-C Film under Vacuum Condition**  
Shouhei Kawada, Shinya Sasaki, Masaaki Miyatake  
*Tokyo University of Science, Japan*
- FR-E-2-3 In-situ observation of growth process of anticorrosion films formed on brass surface using Otto-SPR microscope**  
Takamasa Kawasaki\*, Satoru Maegawa\*, Kentaro Tamura\*\*, Kazuhiro Yagisita\*\*, Takashi Nakamura\*\*\*, Fumihiro Itoigawa\*  
*\*Nagoya Institute of Technology, Japan, \*\*JXTG Nippon Oil & Energy Corp., Japan, \*\*\*Nagoya University, Japan*
- FR-E-2-4 Measurement of temperature dependences of micro scale lubrication properties using AFM**  
Motoi Miyazawa, Yasuhisa Ando, Yasutaka Takeuchi  
*Tokyo University of Agriculture and Technology, Japan*
- FR-E-2-5 Improvement in Sliding Property of Carbon Steel by Cavitation Peening**  
Masanori Seki\*, Hitoshi Soyama\*\*, Masahiro Fujii\*\*\*  
*\*Okayama University of Science, Japan, \*\*Tohoku University, Japan, \*\*\*Okayama University, Japan*
- FR-E-2-6 Study of Mechanical properties of Electro-Spun Polyacrylonitrile Nano-fibrous Separator According to Thermal Press Temperature**  
Minchoel Kim, Taejo Ko, Waqas Ul Arifeen, Dong Ting  
*Yeungnam University, Korea*

**Thursday Poster Session**

- TH-PO-01 Driving Test of Non-involute Tooth Profile Gear Pump to Reduce Driving Noise**  
Natsuhiko Seyama, Hideto Mashidori, Ema Tamura, Hiroshi Umezawa  
*Tokyo Metropolitan College of Industrial Technology, Japan*
- TH-PO-02 Tapping Screw Threads with Ultrasonic Vibration**  
Manabu Okada\*, Yousuke Hanamura\*\*, Tan Tawfiq\*\*\*, Balqis Hanis binti Ali\*\*\*\*  
*\*National Institute of Technology, Japan, \*\*Tokyo University of Agriculture and Technology, Japan, \*\*\*Toyohashi University of Technology, Japan, \*\*\*\*Kuroda Precision Industries Ltd., Japan*
- TH-PO-03 Effect of Grease Composition on Bulk Temperature of Plastic Spur Gear**  
Jinta Goto\*, Hiroki Makino\*\*, Tomohiro Kuratani\*\*, Yousuke Kimura\*\*, Takayoshi Itagaki\*, Mikio Takahashi\*, Hideo Takahashi\*  
*\*National Institute of Technology, Kisarazu College, Japan, \*\*Nippeco Ltd., Japan*
- TH-PO-04 Loadability of Hexagon Socket Countersunk Head Screws (Effect of Head Shape on the Loadability)**  
Yuto Takeuchi, Masaya Hagiwara  
*Nagoya Institute of Technology, Japan*
- TH-PO-05 A Study on the Equivalent Bulge Joint Model of Nuclear Fuel Cell Assemblies**  
Jae Kyu Park, Taek Jin Jang, Hyeon Jun Jung, Se Hoon Lim, Jong-Bong Kim  
*Seoul National University of Science and Technology, Korea*
- TH-PO-06 Observation of dependence of ta-C surface graphitization on Deep ultraviolet laser intensity**  
Tomomi Kozu\*, Makoto Yamaguchi\*, Masahiro Kawaguchi\*\*, Masamichi Yoshimura\*\*\*  
*\*Akita University, Japan, \*\*Tokyo Metropolitan Industrial Technology Research Institute, Japan, \*\*\*Toyota Technological Institute, Japan*
- TH-PO-07 Influence of Ion Dosages of Ru Implanted WC-based Cold Sprayed Coatings on Sliding Wear Properties**  
Peerawatt Nunthavarawong\*, Natasha Sacks\*\*,\*\*\*, Ionel Botef\*\*,\*\*\*  
*\*King Mongkut's University of Technology North Bangkok, Thailand, \*\*University of the Witwatersrand, South Africa, \*\*\*DST-NRF Centre of Excellence in Strong Materials, South Africa*
- TH-PO-08 Ultrasonic Nano Surface Modification for Improving Surface Quality of SUS316L built by Direct Energy Deposition**  
Do-Sik Shim, Min Seop Kim, Young Kwan Cho, Sang Hu Park  
*Korea Maritime and Ocean University, Korea, Pusan National University, Korea*
- TH-PO-09 Green and Facile Synthesis of Dual Functional Cellulose Hybrid Membranes: A Study on Conducting and Antibacterial Properties**  
Zahid Hanif, Dae Yong Shin, Sung Jea Park  
*Korea University of Technology and Education, Korea*
- TH-PO-10 Influence of paper lint adhesion on the wear form of rubber roller for paper feed**  
Tetsuya Tsumori, Yosuke Tsukiyama, Isami Nitta  
*Niigata University, Japan*

- TH-PO-11 Tribological properties between fishing rod guides and fishing lines made with various materials under water environment**  
Naoya Nakabayashi, Naohiro Matsumoto, Hiroshi Kinoshita  
*University of Hyogo, Japan*
- TH-PO-12 Tribological property of cellulose nanofiber water dispersion using various lubricating materials**  
Yoichi Inada, Naohiro Matsumoto, Hiroshi Kinoshita  
*University of Hyogo, Japan*
- TH-PO-13 Fatigue Life of Small Ball Bearing in Case of Non-Lubrication (at axial load 10N 4000min<sup>-1</sup>)**  
Suguru Takeshita, Tomoya Hotta  
*Kanto Gakuin University, Japan*
- TH-PO-14 Influence of Axial External Vibration to Damage of Small Ball Bearings (In Case of Giving Axial Vibration up to 49.5Hz and 2.5m/s<sup>2</sup>)**  
Roberto Hamada\*, Tomoya Hotta\*, Shouji Noguchi\*\*  
*\*Kanto Gakuin University, Japan, \*\*Tokyo University of Science, Japan*
- TH-PO-15 Performance Evaluation for Bubble Eliminator with CFD ? Effect of Computational Model and Mesh ?**  
Ryo Takamizawa\*, Ryosuke Funachi\*, Sayako Sakama\*\*, Yutaka Tanaka\*  
*\*Hosei University, Japan, \*\*Aoyama Gakuin University, Japan*
- TH-PO-16 Numerical and Experimental Study on Characteristics of a Milling Spindle Supported by Aerostatic Bearings**  
Keita Shimada, Shouhei Kawada, Masaaki Miyatake, Shigeka Yoshimoto  
*Tokyo University of Science, Japan*
- TH-PO-17 Contactless gripper using ultrasonic levitation for handling light objects**  
Yusaku Katayama, Shouhei Kawada, Masaaki Miyatake, Shigeka Yoshimoto  
*Tokyo University of Science, Japan*
- TH-PO-18 Characteristics of Aerodynamic Foil Thrust Bearings Manufactured Using Direct Metal Printing Technology**  
Zheng Chuanyu, Alzarooni Rashid, Shouhei Kawada, Masaaki Miyatake, Shigeka Yoshimoto  
*Tokyo University of Science, Japan*
- TH-PO-19 A Method of Reducing Windage Power Loss of a High-Speed Motor Using a Viscous Vacuum Pump**  
Junpei Horiike, Daiki Sato, Shouhei Kawada, Masaaki Miyatake, Shigeka Yoshimoto  
*Tokyo University of Science, Japan*
- TH-PO-20 Proposal of Innovative Oil-hydraulic Component to Reduce Pressure Pulsation**  
Misaki Hashimoto\*, Yasuo Sakurai\*, Norikazu Hyodo\*\*, Kenichi Aiba\*\*  
*\*Ashikaga University, Japan, \*\*Tokyo Keiki Corp., Japan*
- TH-PO-21 FM-AFM atomic-scale observation of the adsorption film structure in oiliness agent solution on steel surface**  
Yuko Sato, Haruka Ouchi, Kaisei Sato, Seiya Watanabe, Shinya Sasaki  
*Tokyo University of Science, Japan*

- TH-PO-22 Flow Visualization on Fluidic Diodes and Tube Banks Using 2D-Time-SLIP MRI and 2D-PIV-Pilot Study of a Noncontact Observation Technique on Fluid Machinery-**  
 Kazunori Hosotani\*, Kotaro Oka\*, Kazuhiro Takeuchi\*\*, Atsushi Ono\*\*\*, Yusuke Hashiguchi\*\*\*\*, Toru Ishihara\*  
*\*National Institute of Technology, Tsuyama College, Japan, \*\*National Hospital Organization Okayama Medical Center, Japan, \*\*\*Kawasaki University of Medical Welfare, Japan, \*\*\*\*Kousei hospital, Japan*
- TH-PO-23 Influence of Grease Rheology on Frictional Torque of Radial Ball Bearings**  
 Norifumi Miyanaga\*, Mitsumi Nihei\*, Jun Tomioka\*\*  
*\*Kanto Gakuin University, Japan, \*\*Waseda University, Japan*
- TH-PO-24 Film formation properties of PIB lubricant for use in screw tightening in various operating conditions**  
 Takefumi Otsu\*, Kyoichi Komatsu\*\*, Shinji Hashimura\*\*\*  
*\*Oita University, Japan, \*\*Tohnichi Mfg. Co., Ltd., Japan, \*\*\*Shibaura Institute of Technology, Japan*
- TH-PO-25 Design of a New Velocity-Based Mechanical Safety Device for Wheeled Mobile Robots**  
 Yoshiaki Sato\*, Shuhei Shinoda\*, Yuma Sato\*, Yoshihiro Kai\*, Kenichi Abe\*\*, Hiroshi Wada\*\*\*  
*\*Tokai University, Japan, \*\*Kanagawa Institute of Industrial Science and Technology, Japan, \*\*\*DOUBLE Research and Development Co., Ltd., Japan*
- TH-PO-26 Design of a Wheeled Mobile Robot Equipped with New Velocity-Based Mechanical Safety Devices**  
 Shuhei Shinoda\*, Yoshiaki Sato\*, Yuma Sato\*, Yoshihiro Kai\*, Abe Kenichi\*\*, Hiroshi Wada\*\*\*  
*\*Tokai University, Japan, \*\*Kanagawa Institute of Industrial Science and Technology, Japan, \*\*\*DOUBLE Research and Development Co., Ltd., Japan*
- TH-PO-27 Multi-Objective Optimization Technique applying to Shape Optimization for Large-Scale Wind Turbine Generator**  
 Seunggho Han, Hyungjun Patk  
*Dong-A University, Korea*
- TH-PO-28 Development of a compact velocity-based mechanical safety device for rehabilitation assist suits: Detailed design**  
 Yoshihiro Kai, Tsubasa Kaneda, Keisuke Ikeda  
*Tokai University, Japan*
- TH-PO-29 Design of a 5-axis manipulator for the finishing application**  
 Sangki Park, Daegwon Koh, Jaeyoon Shim, Sun-Kyu Lee  
*Gwangju Institute of Science and Technology, Korea*
- TH-PO-30 Force Analysis of Pin Ball Lock Using DAFUL**  
 Hee Yong Kang, Hyeon Ho Shin, Sung Mo Yang, Que Man Kim  
*Chonbuk National University, Korea*
- TH-PO-31 Wrench-closure and Non-slipping Condition of a Frictional Cable-Driven Planar Parallel Robot with Kinematic Redundancy**  
 Koki Hirotsato, Takashi Harada  
*Kindai University, Japan*
- TH-PO-32 Rotational plating process design with computational flow analysis**  
 Joo-Pyo Hong\*, Midum Jung\*\*  
*\*KOREATECH, Korea, \*\*Solution Lab, Korea*



- TH-PO-33 Comparison between functional tolerancing and manufacturing-oriented tolerancing methods in GD&T and development of a trade-off tolerancing method**  
Daehyun Son, Minyoung Park, Hyunjune Yim  
*Hongik University, Korea*
- TH-PO-34 Definition of training data structure for deep learning model to recognize engineering drawings in image format**  
Eun-seop Yu, Duhwan Mun  
*Kyungpook National University, Korea*
- TH-PO-35 Two-dimensional Delaunay triangulation of a bone from a CT image considering its heterogeneity**  
Byung Chul Kim, Junho Lee  
*Korea University of Technology and Education, Korea*
- TH-PO-36 Motion Accuracy of Spherical Coordinate Type Driving Mechanism for Automated 3D Scanning**  
Changhyuk Lim, Jiwan Kang, Heeyoung Maeng  
*Seoul National University of Science and Technology, Korea*
- TH-PO-37 Development of Hydraulic Manipulator of Armored Robot for Disaster Response**  
Jong Geol Kim, Sang Hyun Park, Dong Bin Shin, Maolin Jin  
*KIRO, Korea*
- TH-PO-38 A Study on Induction Motor Shaft Vibration and Noise Characteristic Analysis**  
MyeongJin Ko, Sung-Ho Lee, Hyoun-Seon Shim, Soon-Sub Park  
*Korea Institute of Industrial Technology, Korea*
- TH-PO-39 Safety evaluation of autonomous vehicle in the condition of the cut-in situation**  
Seohang Lee, Sanghyeop Park, Jayil Jeong  
*Kookmin University, Korea*
- TH-PO-40 Parameter Estimation of Anthropometric Dummy's Rib Using System Identification**  
JaeJong Lim, ~~Suji Kwon~~, Youkeun K Oh  
*Hongik University, Korea*
- TH-PO-41 Fabrication Design of Magnetic Field Applying Mechanism using Permanent Magnet for MRF Clutch**  
Yorihiko Yano<sup>\*</sup>, Shunsuke Kawamura<sup>\*</sup>, Kota Tsuda<sup>\*</sup>, Katsuhiro Hirata<sup>\*\*</sup>  
*<sup>\*</sup>National Institute of Technology, Nara College, Japan, <sup>\*\*</sup>Osaka University, Japan*
- TH-PO-42 Design of Personal Mobility Vehicle Using Tripod Parallel Mechanism**  
Tomomasa Nakamura, Masahiro Ikeda, Yutaka Tanaka  
*Hosei University, Japan*
- TH-PO-43 Design and Fabrication of ER Braking Device for Small Mobile Robot**  
Takuma Tachibana, Takanori Togawa, Yutaka Tanaka  
*Hosei University, Japan*
- TH-PO-44 Development of a jellyfish soft robot using shape memory alloy actuators**  
Hironari Taniguchi<sup>\*</sup>, Tatsuki Ohno<sup>\*</sup>, Kazumori Hosotani<sup>\*\*</sup>, Yusuke Inoue<sup>\*\*</sup>  
*<sup>\*</sup>Osaka Institute of Technology, Japan, <sup>\*\*</sup>National Institute of Technology, Tsuyama College, Japan*
- TH-PO-45 Power-saving non-electromagnetic control of magnetorheological fluid actuator device**  
Yasukazu Sato, Yuki Nakamura  
*Yokohama National University, Japan*

- TH-PO-46 High-efficient electro-hydraulic power transmission by servomotor-driven variable displacement hydraulic pump**  
Seiya Itagaki, Ha Tham Phan, Yasukazu Sato  
*Yokohama National University, Japan*
- TH-PO-47 Characteristics of In-pipe Mobile Robot with snake-like drive mechanism using pneumatic actuator**  
Toyomi Miyagawa, Tomohiro Koso  
*Nippon Institute of Technology, Japan*
- TH-PO-48 Study on compact and lightweight mechanism for pet robot used in reminiscence therapy**  
Yuchi Nakazato\*, Kenta Kyojima\*\*, Nobuhiko Araki\*\*, Kensuke Takita\*, Masaru Higuchi\*  
*\*Nippon Institute of Technology, \*\*Grad school of Mechanical Systems Engineering, Nippon Institute of Technology, Japan*
- TH-PO-49 The cleaning module for underwater remotely operated vehicle**  
Jinho Lee\*, Seok-Woo Lee\*, Cheol Ho Kim\*, Tae-gon Kim\*, Hyo-young Kim\*, Kang Woo Shin\*, An-Mok Jeong\*, Jong Uk An\*, Hyun Ho Lee\*\*  
*\*Korea Institution of Industrial Technology, Korea, \*\*Ajou University, Korea*
- TH-PO-50 A design of multiple-motion mode switching robot**  
Xiaotian Sun, Soo-Hong Lee  
*Yonsei University, Korea*
- TH-PO-51 Study on impact factor calculation method for AT crane using transient response analysis**  
Mansoo Go, Soonki Kwon  
*Hoseo University, Korea*
- TH-PO-52 Study on weight reduction of semiconductor inspection equipment using sensitivity analysis**  
Soonki Kwon, Mansoo Koh  
*Hoseo University, Korea*
- TH-PO-53 Development of toe assisting device for assisting walking**  
Ujo Hasegawa, Naoki Fukaya  
*Tokyo Metropolitan College of Industrial Technology, Japan*
- TH-PO-54 A Study on Improving the Power of Paper-Based Microfluidic Electrochemical Fuel Cell**  
Cheonho Lee, Guitao Yang, Noh Hyun Park, Do-gyun Jung, Yoomin Ahn  
*Hanyang University, Korea*
- TH-PO-55 Fabrication of Si Nanowire Photodetector using Simple Wet Etching Process**  
Dong-Ki Lee, Joo Yong Kwon, Young Hak Cho  
*Seoul National University of Science and Technology, Korea*
- TH-PO-56 Trespasser Surveillance System for a Fish Farm**  
ChangHo Yu  
*Pusan National University, Korea*
- TH-PO-57 Safety assessment methods of ACC and AEBS functions in cut-out situations reflected accidents**  
Sanghyeop Park, Jayil Jeong, Seohang Lee  
*Kookmin University, Korea*
- TH-PO-58 Monitoring the Optical Power of LED by Combining Radiation type Thermocouple**  
Youyoung Kim, Daegwon Koh, Sun-Kyu Lee  
*Gwangju Institute of Science and Technology, Korea*

**TH-A-2-2 Light-weight heat exchanger manifold design using topology optimization and its experimental evaluation**

Jaehyun Yu\*, HanJong Kim\*, SeulBi Lee\*, Yong Son\*\*, SangHu Park\*

*\*Pusan National University, Korea, \*Korea Institute of Industrial Technology (KITECH), Korea*

**FR-PO-17 Numerical study on machining characteristics of milling process with a low temperature nitrogen gas and minimum quantity lubricant**

Woo-Yul Kim, Hong-Cheol Shin, Jin Woo Kim, Sang Won Lee, Sung-Min Kim

*Sung Kyun Kwan University, Korea*

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**Friday, April 26 10:30-12:00 Room E (Emerald lobby)**

**Friday Poster session**

**FR-PO-01 Friction characteristics of micro-textured surfaces with diamond-like carbon coating**

Shion Saito\*, Yasuhisa Ando\*, Tsuguyori Ohana\*\*

*\*Tokyo University of Agriculture and Technology, Japan,*

*\*\*National Institute of Advanced Industrial Science and Technology, Japan*

**FR-PO-02 Study on contact condition of nanomaterial through molecular dynamics simulation**

Hyun-Joon Kim\*, Koo-Hyun Chung\*\*

*\*Kyungpook National University, Korea, \*\*University of Ulsan, Korea*

**FR-PO-03 Molecular dynamics simulations of effects of inter-atomic distance on friction force**

Takumi Shimakura, Shu Kimura, Yasuhisa Ando

*Tokyo University of Agriculture and Technology, Japan*

**FR-PO-04 Investigation of tribological characteristics of multi-layered thin film**

Youn-Hoo Hwang, Seong-Yun Jung, Hyun-Joon Kim

*Kyungpook National University, Korea*

**FR-PO-05 Hardness distribution in a heavily cold-rolled SUS316LN austenitic stainless steel**

Chihiro Watanabe\*, Yoshiteru Aoyagi\*\*, Yoshikazu Todaka\*\*\*, Masakazu Kobayashi\*\*\*, Hiromi Miura\*\*\*

*\*Kanazawa University, Japan, \*\*Tohoku University, Japan, \*\*\*Toyohashi University of Technology, Japan*

**FR-PO-06 Study on the Influence of Carbon Source on Pore Structure of Ordered Porous Carbon Ultra-Thin Film**

Makio Tamada, Yuta Sunami, Hiromu Hashimoto

*Tokai University, Japan*

**FR-PO-07 Relationship between friction behavior and mechanical properties of tribo-films under boundary lubrication by using nano-indentation technique**

Yu Nito, Seiya Watanabe, Kenta Takahashi\*, Shota Ito, Shinya Sasaki

*Tokyo University of Science, Japan*

**FR-PO-08 Dynamic Characteristics of Externally Pressurized Gas Journal Bearings Characteristics With Asymmetric Gas Supply**

Tomohiko Ise\*, Kohei Nagao\*\*, Masami Matsubara\*\*, Shozo Kawamura\*\*, Tomoya Kinugawa\*\*\*, Shinya Kikutani\*\*\*, Masaya Kurokawa

*\*Kindai University, Japan, \*\*Toyohashi University of Technology, Japan, \*\*\*Starlite Co., Ltd., Japan*

**FR-PO-09 A study on modified real contact area and material removal rate model for CMP**

Hyunseop Lee

*Tongmyong University, Japan*

- FR-PO-10 Optimization of CFRP Deburring Using Dry EDM Process**  
 Ki Moon Park, Tae Jo Ko, Zhen Yu  
*Yeungnam University, Korea*
- FR-PO-11 An Experimental Research on Effect of Cutting Speed and Coating Material upon Tool Life in Dry Hobbing**  
 Akio Kubo\*, Hua Qiu\*, Hironori Matsuoka\*\*  
*\*Kyushu Sangyo University, Japan, \*\*Oita University, Japan*
- FR-PO-12 A Study on Experimental Verification and Cutting Force of Machine Tool Using NAK - 80 Plastic Mold Steel**  
 Seung-Yub Beak, Sung-Taek Jung, Seong-Hyun Kim, Hyun-Jeong Kim  
*Induk University, Korea*
- FR-PO-13 Finite Element Analysis on Dynamic Viscoelasticity of CMP Polishing Pad**  
 Haedo Jeong\*, Byeongjun Pak\*\*, Dasol Lee\*, Seonho Jeong\*, Donghwan Lee\*  
*\*Pusan National University, Korea, \*\*Korea Institute of Industrial Technology, Korea*
- FR-PO-15 EXPERIMENTAL OBSERVATION OF THE CRYOGENIC ASSISTED HARD TURNING PROCESS**  
 Hyung Wook Park\*, Dong Min Kim\*\*, Do Young Kim\*, In Su Jo\*  
*\*Ulsan National Institute of Science and Technology, Korea, \*\*Korea Institute of Industrial Technology, Korea*
- FR-PO-18 Magnetic Characteristics of rectangular ElectroMagnetic Chuck for Grinding Machine**  
 Donghyuk LEE, Heeyoung MAENG  
*Seoul Tech, Korea*
- FR-PO-19 Micromachining of polycrystalline CVD diamond coated cutting tool with femtosecond laser**  
 Xiaoxu Liu\*, Kohei Natsume\*, Satoru Maegawa\*, Fumihiro Itoigawa\*, Shingo Ono\*, Michiharu Ota\*\*  
*\*Nagoya Institute of Technology, Japan, \*\*IMRA America, Inc, Japan*
- FR-PO-20 Development of Localized Heating Module for Injection Mold**  
 Seung A Oh, Keun Park  
*Seoul National University of Science & Technology, Korea*
- FR-PO-21 Fabrication of Sinusoidal Wavy Surfaces for Cell Alignment**  
 Sung Jea Park, Sung Jea Park  
*Korea University of Technology and Education, Korea*
- FR-PO-22 Effect of processing parameters in thermoforming process of micro-structured polystyrene films**  
 Trieu Khoa Nguyen\*\*, Bong-Kee Lee\*  
*\*Chonnam National University, Korea, \*\*Industrial University of Ho Chi Minh City, Vietnam*
- FR-PO-23 Evaluation of Mechanical Properties for Tool Steel that Fabricated by Using 3D Metal Printing**  
 Sung Jong Choi\*, Ho Chan Kim\*, Jong Dock Seo\*\*  
*\*Andong National University, Korea, \*\*SHIN YOUNG Co., Ltd., Korea*
- FR-PO-24 Fabrication of antireflective glass nanostructures using vitreous carbon mold by glass imprinting**  
 Muhammad Refatul Haq, Mohsin Ali Badshah, Jun Kim, Young Kyu Kim, Seok-min Kim  
*Chung-Ang University, Korea*
- FR-PO-26 Development of the pbf type 3d printer for mouldbase and biomedical applications**  
 Min Ha Kim\*, Hyun Ah Lee\*\*, Dong Soo Kim\*\*  
*\*TOPnC Co., LTD., Korea, \*\*Hanbat National University, Korea*

- FR-PO-27 Accurate stacking of cell-laden constructs by heating module included in three-dimensional (3D) bioprinting system**  
Geunseon Ahn<sup>\*</sup>, Songwan Jin<sup>\*\*</sup>, Won-Soo Yun<sup>\*\*</sup>, Jin-Hyung Shim<sup>\*\*</sup>  
*\*T&R Biofab Co., Ltd., Korea, \*\*Korea Polytechnic University, Korea*
- FR-PO-28 Low Temperature Annealing Process For Solution Based Metal Oxide Thin Film Transistor By Using Deep UV**  
Daehwan Chae, Jaehak Shin, Jaemin Kim, Sungrim Ko  
*Konkuk University, Korea*
- FR-PO-29 3D customized tissue engineering tube mimicking mechanical property of vascular tissue**  
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*Korea Institute of Industrial Technology, Korea*
- FR-PO-30 Measurement of gaseous materials generated during FDM process of thermoplastic materials**  
Seongje Park, Jieun Lee, Jaewon Choi, Jeanho Park, Nak-Kyu Lee, Yong Son, Suk-Hee Park  
*Korea Insitute of Industrial Technology, Korea*
- FR-PO-31 Developing a Web-based system to retrieve processing conditions of 3D metal printing for the maintenance of parts**  
Inhyeok Lee<sup>\*</sup>, Taeyun Kim<sup>\*</sup>, Deajung Kim<sup>\*\*</sup>, Duhwan Mun<sup>\*</sup>  
*\*Kyungpook National University, Korea, \*\*InssTek Inc., Korea*
- FR-PO-32 Delta volume calculation for the partial damage region of parts**  
Youngki Kim<sup>\*</sup>, Kiyoun Kwon<sup>\*\*</sup>, Duhwan Mun<sup>\*\*\*</sup>, Soonhung Han<sup>\*</sup>  
*\*Korea Advanced Institute of Science and Technology, Korea, \*\*Kumoh National Institute of Technology, Korea, \*\*\*Kyungpook National University, Korea*
- FR-PO-33 Fabrication of a small sized drone with integrated structure using a Fused Deposition Modeling process**  
Hyun-Sik Kim<sup>\*</sup>, Dong-Gyu Ahn<sup>\*</sup>, Seung-Ki Moon<sup>\*\*</sup>, Dae-Yong Seong<sup>\*\*\*</sup>, Ji-Hun Hwnag<sup>\*\*\*</sup>  
*\*Chosun University, Korea, \*\*Nanyang Technological University, Korea, \*\*\*LG Electronics, Korea*
- FR-PO-34 A Study on Heat Transfer Characteristics of Selective Laser Melting Process Using Three-dimensional Finite Element Analysis**  
Lee Kwang Kyu<sup>\*</sup>, Hyun-Sik Kim<sup>\*</sup>, Ho-Jin Lee<sup>\*\*</sup>, Dong-Gyu Ahn<sup>\*</sup>, Yong Son<sup>\*\*</sup>  
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- FR-PO-35 Temperature Distribution of Food Cartridge for Food 3D Printing Heating System**  
Ju Ho Park, In Hwan Lee  
*Chungbuk National University, Korea*
- FR-PO-36 4D Printing Using Anisotropy of FDM Printed Parts**  
Bona Goo, Chae Hee Hong, Keun Park  
*Seoul National University of Science and Technology, Korea*
- FR-PO-37 Development of MID rapid processing technology using FDM 3D printing**  
Namhoon Jang, Jeonghee You, Keun Park  
*Seoul National University of Science and Technology, Korea*
- FR-PO-38 A Study on the Effects of Deposition Condition on the Deposited part with Hastelloy-X using SLM process**  
Ho-Jin Lee, Woosung Kim, Ji Hyun Sung, Dong Yong Park, Heyjin Song, Myung-Pyo Hong  
*Korea Institute of Industrial Technology, Korea*

- FR-PO-39 Direct printing of a piezoresistive pressure-sensitive material on a flexible substrate**  
Chaima Fekiri, Song Ho Kim, In Hwan Lee  
*Chungbuk National University, Korea*
- FR-PO-40 Printable MWCNT and PDMS based Pressure Sensor**  
Hochan Kim, Sungjong Choi, Jindong Kim  
*Andong National University, Korea*
- FR-PO-41 Measurement of High-Speed Impact Properties of AISI 4140 Steel by Heat Treatment Processes**  
Yongho Jeon, Moon G. Lee, Chang-Ho Jung, You-Sung Kang  
*Ajou University, Korea*
- FR-PO-42 A Study on Estimation of Welding Deformation Using Lightweight Model**  
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*Kumoh National Institute of Technology, Korea*
- FR-PO-43 Numerical Investigation on He and Ar Gas Convective Cooling for Optical Fiber Glass Drawing at Short Draw Towers**  
Kyoungjin Kim, Gia Ginelle Carandang  
*Kumoh National Institute of Technology, Korea*
- FR-PO-44 Roll to Roll laminating technology using Direct Gravure coater and Application to Pouch for Secondary Battery**  
Minsook Yu<sup>\*</sup>, Dongsoo Kim<sup>\*\*</sup>, Munyong Song<sup>\*</sup>, Minha Kim<sup>\*</sup>  
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- FR-PO-45 Enhancement of indium oxide thin film transistor by the environmental conditions and IPL irradiation energy**  
Jaehak Shin, Ko Sunglim, Kim Jaemin, Chae Daewhan  
*Konkuk University, Korea*
- FR-PO-46 Improvement of tool life in Inconel 718 turning process using cryogenic cooling**  
Kangwoo Shin, Jung-Soo Nam, Hyo-Young Kim, Seok-Woo Lee, Tae-Gon Kim  
*Korea Institute of Industrial Technology, Korea*
- FR-PO-47 Optimization of the number and layout of clamps, and the welding sequence in automotive body welding process**  
Minyoung Park, Daehyun Son, Hyunjune Yim  
*Hongik University, Korea*
- FR-PO-48 Machinability analysis in Drilling Holes using Industrial Robot**  
Hyoyoung Kim<sup>\*</sup>, Jin Ho Lee<sup>\*\*\*</sup>, Moon G. Lee<sup>\*\*</sup>, Tae Gon Kim<sup>\*</sup>, Gang U Shin<sup>\*</sup>, Seok Woo Lee<sup>\*</sup>  
*<sup>\*</sup>Korea Institute of Industrial Technology, Korea, <sup>\*\*</sup>Ajou University, Korea*
- FR-PO-50 Process Improvement of Porosity Reduction in Zinc Coated Steel Sheet Arc Welding for Automotive Industry**  
Jungho Cho<sup>\*</sup>, Sungjin Baek<sup>\*</sup>, Hunchul Jeong<sup>\*\*</sup>, Gyuyeol Bae<sup>\*\*\*</sup>  
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- FR-PO-51 Zinc Porosity Reduction Simulation of Tandem Arc Welding**  
Sungjin Baek<sup>\*</sup>, Hunchul Jeong<sup>\*\*</sup>, Dongyoon Kim<sup>\*\*\*</sup>, Moonjin Kang<sup>\*\*\*</sup>, Jungho Cho<sup>\*</sup>

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**FR-PO-52    Development of Spot-Welding Quality Prediction System Using an Industrial Robot Based on Artificial Neural Network Algorithm**

Jiwoong Lee, Inwoong Noh, Sang Ik Jeong, Sang Won Lee

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**FR-PO-53    Human-centered Product Development Framework: A Case Study on Smart-Textronics Products**

Sooyeon Leem, Sangwon Lee

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