PRESM

International Conference on
PRecision Engineering and Sustainable Manufacturing

PRESM 2022

July 20 Wed — **22** Fri, **2022**

Hybrid **Jeju Booyoung Hotel and Resort & Online**

Jungmun, Jeju-do, Korea

PROGRAM BOOK

Organizer

KSPE
Korean Society for Precision Engineering (KSPE, Korea)

Sponsors

KOFST Korean Federation of Science & Technology Societies

Jeju Convention & Visitors Bureau

PRESM 2022
International Conference on PRecision Engineering and Sustainable Manufacturing
July 20 Wed ~ July 22 Fri, 2022 Hybrid Jeju Booyoung Hotel and Resort & Online Jungmun, Jeju-do, Korea

CONTENTS

Welcome Address

Welcome to PRESM 2022

On behalf of the committee member of PRESM 2022 and Korean Society for Precision Engineering (KSPE), we would like to thank all the participants including the invited speakers, co-organizers and governmental supporters for International Conference on Precision Engineering and Sustainable Manufacturing (PRESM 2022) which will be held from July 20 to 22, 2022 in Jungmun, Jeju island, Republic of Korea.

Since 2011, PRESM has been dedicated to the development of precision engineering and sustainable manufacturing for the benefit of the global society. But over the past two years, we have faced a huge huddle, COVID-19. In such a situation, we must prepare for the 'new normal' in all environments including precision engineering. As the environment changes more and more, the exchange and development of science and technology becomes more and more important. For this purpose, we will do our best to ensure that PRESM 2022 plays an important role.

In these days, the importance of "Smart & Green" is increasing in all fields including precision engineering. PRESM 2022, based on the unique field of precision engineering, will ride the flow of the 4th industrial revolution and create a plaza that approaches the future value of Smart & Green. In particular, from PRESM 2021, the program has been significantly improved to increase audience concentration and to provide high-quality presentations, and in PRESM 2022, more advanced programs are planned.

Although it is still difficult for researchers from all over the world to freely meet and hold an active and in-depth academic conference as before, we sincerely hope that PRESM 2022 will be a fruitful academic conference through various communication methods in a given environment.

Finally, we would like to express our gratitude to the invited speakers who are willing to give valuable lectures despite busy schedules. And we hope that PRESM 2022 will live up to your expectations and that this event will allow all of you to share experiences and build networks. Thank you very much.

Chair of PRESM 2022

Seung-Han Yang
Kyungpook National University, Korea

Organizers / Sponsors

Organizer

Korean Society for Precision Engineering (KSPE, Korea)

Co-Organizers

The Japan Society for Precision Engineering (JSPE, Japan)

Taiwan Society for Precision Engineering (TSPE, Taiwan)

Sponsors

KITECH Korea Institute of Industrial Technology
KIMM 한국기계연구원 KOREA INSTITUTE OF MACHINERY & MATERIALS
DN SOLUTIONS
Sindoh
LIG Nex1
엠에스 오토텍 MS AUTOTECH CO.,LTD.
ISU PETASYS
KCTECH
KISTLER measure. analyze. innovate.
FANUC 한국화낙주식회사 KOREA FANUC CORPORATION
HYUNDAI WIA
HWASHIN
HWACHEON
hp
SK 실트론
MARYALO
ACE nanochem
ENDO ROBOTICS
G&P TECHNOLOGY
PROTOTECH (주) 프로토텍 3D Printing Total Solution
HEXAGON
WAFERFAB
Komma 한국공작기계산업협회 Korea Machine Tool Manufacturers' Association

PRESM 2022 Committee

Conference Chair

Seung-Han Yang, Kyungpook Nat'l Univ. (Korea)

Steering Committee

Chair
Sun-Kyu Lee, Gwangju Inst. of Sci. & Tech. (Korea)

Members
Dong-Woo Cho, POSTECH (Korea)
Daehie Hong, Korea Univ. (Korea)
Seong-Wook Hong, Kumoh Nat'l Inst. of Tech. (Korea)
Ichiro Inasaki, Chubu Univ. (Japan)
Haedo Jeong, Pusan Nat'l Univ. (Korea)
Dae-Eun Kim, Yonsei Univ. (Korea)
Sung-Lim Ko, Konkuk Univ. (Korea)
Choon-Man Lee, Changwon Nat'l Univ. (Korea)
Eung-Sug Lee, Korea Inst. of Mach. & Materials (Korea)
Suk Lee, Pusan Nat'l Univ. (Korea)
Banh Tien Long, Hanoi Univ. of Sci. & Tech. (Vietnam)
Hitoshi Ohmori, RIKEN (Japan)
Chun-Hong Park, Korea Inst. of Mach. & Materials (Korea)
Friedrich B. Prinz, Stanford Univ. (USA)
Chang-Sung Seok, Sungkyunkwan Univ. (Korea)
Zhongde Shan, China Academy of Machinery Sci. & Tech. (China)
Jun Yeob Song, Korea Inst. of Mach. & Materials (Korea)

Advisory Committee

Chair
Seung-Woo Kim, KAIST (Korea)

Members
Soo-Won Chae, Korea Univ. (Korea)
Hon-Zong Choi, Korea Inst. of Industrial Tech. (Korea)
Young Choi, Chung-Ang Univ. (Korea)
Jew-Sheng Hu, National Chiao Tung Univ. (Taiwan)
Jongwon Kim, Seoul Nat'l Univ. (Korea)
Seok-Hee Lee, Pusan Nat'l Univ. (Korea)
Hong-Seok Park, Univ. of Ulsan (Korea)
Si Tae Won, Seoul Nat'l Univ. of Sci. & Tech. (Korea)
Dong-Yol Yang, Gwangju Inst. of Sci. & Tech. (Korea)

PRESM 2022 Committee

Organizing Committee

Chair
Seok-Woo Lee, Korea Inst. of Industrial Tech. (Korea)

Co-Chairs
Jay-I. Jeong, Kookmin Univ. (Korea)
Jennifer Hyunjung Shin, KAIST (Korea)

Members
Joo Hyun Baek, Korea Research Inst. for defense Tech. planning and advancement (Korea)
Won Seok Chang, Korea Inst. of Mach. & Materials (Korea)
Jae-Won Choi, The Univ. of Arkron (USA)
Young Jae Choi, Korea Inst. of Industrial Tech. (Korea)
Wen Tong Chong, Univ. of Malaya (Malaysia)
Won-Shik Chu, Gyeongsang Nat'l Univ. (Korea)
Eric Dimla, RMIT Univ. (Vietnam)
Zhengchun Du, Shanghai Jiao Tong Univ. (China)
Sung-Tae Hong, Univ. of Ulsan (Korea)
Young Hun Jeong, Kyungpook Nat'l Univ. (Korea)
Jonghan Jin, Korea Research Inst. of Standards & Sci. (Korea)
Jeongdai Jo, Korea Inst. of Mach. & Materials (Korea)
Beom Joon Kim, The Univ. of Tokyo (Japan)
Chang-Ju Kim, Korea Inst. of Industrial Tech. (Korea)
Gyu Man Kim, Kyungpook Nat'l Univ. (Korea)
Joon-wan Kim, Tokyo Inst. of Tech. (Japan)
Tae-Gon Kim, Korea Inst. of Mach. & Materials (Korea)
Young Beom Kim, Hanyang Univ. (Korea)
Chunliang Kuo, Nat'l Taiwan Univ. of Sci. & Tech. (Taiwan)
Tsai Chi Kuo, Chung Yuan Christian Univ. (Taiwan)
Ji Yeon Kwon, Dongguk Univ. (Korea)
Changwoo Lee, Konkuk Univ. (Korea)
Dongjin Lee, Konkuk Univ. (Korea)
Dong-Yoon Lee, Korea Inst. of Industrial Tech. (Korea)
Hyun Wook Lee, Korea Railroad Research Inst. (Korea)
In Hwan Lee, Chungbuk Nat'l Univ. (Korea)
Kyung Chang Lee, Pukyong Nat'l Univ. (Korea)
Sang Won Lee, Sungkyunkwan Univ. (Korea)
Seung Ki Moon, Nanyang Technological Univ. (Singapore)
Thi Hong Minh Nguyen, Hanoi Univ. of Sci. & Tech. (Vietnam)
Yoojeong Noh, Pusan Nat'l Univ. (Korea)
Jeong Seok Oh, Korea Inst. of Machinery & Materials (Korea)
Sang-Hu Park, Pusan Nat'l Univ. (Korea)
Shi Hyoung Ryu, Chonbuk Nat'l Univ. (Korea)
Chang Kyu Song, Korea Inst. of Mach. & Materials (Korea)

PRESM 2022 Committee

Jin Ho Suh, Pukyong Nat'l Univ. (Korea)
Mu-Tian Yan, National Chin-Yi Univ. of Tech. (Taiwan)
Chulho Yang, Oklahoma State Univ. (USA)
Sungwon Youn, Nat'l Inst. of Advanced Industrial Sci. & Tech. (Japan)

Technical Committee

Chair

Byung-Kwon Min, Yonsei Univ. (Korea)

Co-Chairs

Young-Sam Ham, Korea Railroad Research Inst. (Korea)
Martin B.-G. Jun, Purdue Univ. (USA)
Sangkee Min, Univ. of Wisconsin-Madison (USA)
Simon Park, Univ. of Calgary (Canada)

Members

Suk-Won Cha, Seoul Nat'l Univ. (Korea)
Young-Hwan Cho, LIG Nex1 Co., Ltd. (Korea)
Young Tae Cho, Changwon Nat'l Univ. (Korea)
Chih-Hsing Chu, Nat'l Tsing-Hua Univ. (Taiwan)
Seungmin Hyun, Korea Inst. of Mach. & Materials (Korea)
Yongho Jeon, Ajou Univ. (Korea)
Maolin Jin, Korea Inst. of Robotics & Tech. Convergence (Korea)
Geon Hee Kim, Hanbat Univ. (Korea)
Jae Wan Kim, Korea Research Inst. of Standards & Sci. (Korea)
Jonghyuk Kim, Hyundai Wia Co. (Korea)
Byeong-Hee Kim, Kangwon Nat'l Univ. (Korea)
Il Yong Kim, Queen's Univ. (Canada)
Jin Ho Kim, Yeungnam Univ. (Korea)
Seung-Jong Kim, Korea Univ. (Korea)
Lawrence Kulinsky, Univ. of California (USA)
Seok-Jin Kwon, Korea Railroad Research Inst. (Korea)
Jihye Lee, Korea Inst. of Mach. & Materials (Korea)
Kang Jae Lee, DN Solutions (Korea)
Young Soo Lee, Samsung Electronics Co., Ltd. (Korea)
Caroline S. Lee, Hanyang Univ. (Korea)
Dong-Weon Lee, Chonnam Nat'l Univ. (Korea)
Jihyun Lee, Univ. of Calgary (Canada)
Ju Yeon Lee, Seoul Nat'l Univ. of Sci. & Tech. (Korea)
Chabum Lee, Texas A&M Univ. (USA)
Jiseok Lim, Yeungnam Univ. (Korea)
Marc Madou, Univ. of California (USA)
Kyuho Pae, DN Solutions (Korea)

PRESM 2022 Committee

Jitendra K. Pandey, Univ. of Petroleum & Energy Studies (India)
Hyung Gyu Park, POSTECH (Korea)
Simon S. Park, Univ. of Calgary (Canada)
Yong-Jai Park, Kangwon Nat'l Univ. (Korea)
Steve Schmid, The Univ. of North Carolina at Charlotte (USA)
Tony L. Schmitz, The Univ. of Tennessee (USA)
Jung Woo Sohn, Kumoh Nat'l Inst. of Tech. (Korea)
Yong Son, Korea Inst. of Industrial Tech. (Korea)
Chul-Ki Song, Gyeongsang Nat'l Univ. (Korea)
Yongnam Song, Korea Univ. (Korea)
Pei-Chen Su, Nanyang Tech. Univ. (Singapore)
Hitomi Yamaguchi, Univ. of Florida (USA)

Publication Committee

Chair
Sung-Hoon Ahn, Seoul Nat'l Univ. (Korea)

Co-Chairs
Baeksuk Chu, Kumoh Nat'l Inst. of Tech. (Korea)
Bo Hyun Kim, Soongsil Univ. (Korea)
Yoshimi Takeuchi, Chubu Univ. (Japan)

Members
Hyeong-Joon Ahn, Soongsil Univ. (Korea)
Jihwan An, Seoul Nat'l Univ. of Sci. & Tech. (Korea)
Ming Chen, Shanghai Jiao Tong Univ. (China)
Doo-Man Chun, Univ. of Ulsan (Korea)
Koo-Hyun Chung, Univ. of Ulsan (Korea)
Joost Duflou, Univ. of Leuven (Belgium)
Fengzhou Fang, Tianjin Univ. (China)
Christoph Herrmann, Tech. Univ. of Braunschweig (Germany)
Jihong Hwang, Seoul Nat'l Univ. of Sci. & Tech. (Korea)
Jinah Jang, POSTECH (Korea)
Hoon-Eui Jeong, UNIST (Korea)
Ki-Nam Joo, Chosun Univ. (Korea)
Hyun-Wook Kang, UNIST (Korea)
Tae June Kang, Inha Univ. (Korea)
Dong Rip Kim, Hanyang Univ. (Korea)
Dong Sung Kim, POSTECH (Korea)
Hochan Kim, Andong Nat'l Univ. (Korea)
Jaehwan Kim, Inha Univ. (Korea)
Jong-Baeg Kim, Yonsei Univ. (Korea)
Jung Kim, KAIST (Korea)
Namkeun Kim, Sogang Univ. (Korea)

Seok-min Kim, Chung-Ang Univ. (Korea)
Yangjin Kim, Pusan Nat'l Univ. (Korea)
Young Jin Kim, KAIST (Korea)
Seung Hwan Ko, Seoul Nat'l Univ. (Korea)
Moon-Kyu Kwak, Kyungpook Nat'l Univ. (Korea)
Hyunseop Lee, Dong-A Univ. (Korea)
Kwang-Il Lee, Kyungil Univ. (Korea)
Mitsutaka Matsumoto, AIST (Japan)
Duhwan Mun, Korea Univ. (Korea)
Andrew Yeh-Ching Nee, Nat'l Univ. of Singapore (Singapore)
Hyung Wook Park, UNIST (Korea)
Keun Park, Seoul Nat'l Univ. of Sci. & Tech. (Korea)
Young-Bin Park, UNIST (Korea)
Kyehan Rhee, Myongji Univ. (Korea)
Peer Woizeschke, BIAS (Germany)
Jun Yanagimoto, The Univ. of Tokyo (Japan)
Yong Jin Yoon, KAIST (Korea)
Byeng-Dong Youn, Seoul Nat'l Univ. (Korea)
Di Zhang, Shanghai Jiao Tong Univ. (China)
Chunhua Zheng, Chinese Academy of Sciences (China)

PRESM Secretariat

Byeong Kwon Lee, KSPE (Korea)
Young Sim Kim, KSPE (Korea)
Sung-Gyung Lee, KSPE (Korea)
Sang Won Kil, KSPE (Korea)
Su-Hyun Kang, KSPE (Korea)

Plenary 1

Takashi Matsumura

Professor
Department of Mechanical Engineering
Tokyo Denki University (Japan)
E-mail: tmatsumu@cck.dendai.ac.jp

Advanced Machining for Difficult-to-cut Materials

20 July (Wed.)
13:00-13:40 (40')

Session Chair
Young Hun Jeong
(Kyungpook National University, Korea)

Keywords
Cutting, Simulation, Carbon fiber reinforced plastic, Titanium alloy

Abstract
With progress of the material science and engineering, the advanced materials have been developed to achieve high mechanical strength and high fatigue resistance in many industries such as airplane industry. In medical industries, biocompatible materials have been required for implant products. When these materials are machined with inappropriate cutting parameters, the tool lives become short and the surface finishes deteriorate. Therefore, the effective cutting technologies should be discussed to promote high production rates at low machining costs in terms of the tool wear and the surface finish. The topic focuses on the cutting process of carbon fiber reinforced plastics (CFRP), titanium alloy and cobalt chromium molybdenum alloy (CCM) with the cutting simulation, which have been developed for milling and drilling. In cuttings of CFRP and the rolled titanium alloy, anisotropy is discussed in the chip formation and the cutting model. Then, some advanced controlled cutting processes are presented to improve the surface finish, the tool life and the machining rate.

Plenary 2

Dong-Woo Cho

Professor
Department of Mechanical Engineering
POSTECH (Korea)
E-mail: dwcho@postech.ac.kr

21 July (Thu.)
13:00-13:40 (40')

Session Chair
In Hwan Lee
(Chungbuk National University, Korea)

3D Cell Printing Technology with Tissue Specific Bioinks

Keywords
3D cell printing, Decellularized extracellular matrix (dECM) bioink, Tissue regeneration, Organ-on-a-chip

Abstract
The research at the Intelligent Manufacturing Systems Laboratory is in the application of 3D printing technology to the field of biomedical engineering by fabricating complex 3D structures. Specifically, the 3D printing technology lies at the basis of the research for the development of tissue regeneration and in vitro testing platforms that relate to the big picture of tissue engineering and regenerative medicine. Beyond the fabrication of 3D scaffolds, the laboratory has now developed a 3D cell/tissue printing technology for the fabrication of live scaffolds of which the integrated pre-tissues can be fabricated in a single step with the use of multiple types of cells and biological materials. In addition, the laboratory has also developed tissue- and organ- derived extracellular matrix bioink that would optimize the mimicry of the native tissue's biochemical microenvironments and enhance pre-tissues functionalities. Taken together, the re-search done at the IMS laboratory includes the development of composite cell-based scaffolds for the treatment of areas of defects and hard-to-cure diseases through the help of cell/tissue printing technology and bioink. The lab also works on the development of in vitro testing models including organ-on-a-chip, and the lab is steered towards the actual clinical application and new drug discovery. The following presentation will demonstrate the role and significance of 3D cell printing rather than ordinary 3D printing in the biomedical field and provide us with a time for deep discussions on the aforementioned research topics.

Plenary 3

Liang-Chia Chen

Professor
Department of Mechanical Engineering
National Taiwan University (Taiwan)
E-mail: lchen@ntu.edu.tw

Recent Advances in Automated Optical Inspection and Metrology for In-line Manufacturing

Keywords
Automated optical inspection, Optical metrology, Critical dimension, Semiconductor processes

Abstract
The application of automated optical inspection (AOI) to advanced manufacturing is extremely critical to assure a leading position in the globally competitive industries, like semiconductors, nanotechnology, biotechnology, opto-electronics and emerging technologies. In the past decades, great research effort had been devoted to developing novel AOI solutions for in-line optical inspection on defect detection & classification, profilometry of surface morphology, critical dimension (CD) and quality control of fabricating parts or modules, such as semiconductor wafers and IC chips. Modern enabled approaches to achieving microscopic optical inspection have adopted many novel concepts, such as diffractive image microscopy, area-scan chromatic confocal microscopy, DUV spectrum reflectometry, EUV scatterometry, or AI-based machine learning modelling, to satisfy strict inspection requirements. Nevertheless, novel system design for extremely high-resolution & high-speed microscopic AOI are yet to be developed and optimized for unlimited demands. Likewise, for the next significant move in optical nanoscopy, advanced manufacturing technologies, such as nano-scale semiconductor lithography processes and advanced IC packaging, demandingly require accurate imaging with high resolution and efficiency to be further achieved. Thus, innovative optical measurement methods are not only of academic interest, but of great significance to advanced manufacturing.

22 July (Fri.)
13:00-13:40 (40')

Session Chair
Ki-Nam Joo
(Chosun University, Korea)

Keynote Speech

Matthias Brockmann
Dr.
Mechanical Engineering
University of Applied Sciences FH Munster (Germany)

Digital Twins for Sustainable Manufacturing

The presentation focusses on characteristic values from production, which can be gained with typical sensor systems in production. These values are collected and integrated into models for the digital assessment of sustainability in the form of ESG criteria. The presentation gives an overview and a specific use case for clarification.

Seung-Kyum Choi
Associate Professor
Director of Center for Additive Manufacturing Systems (CAMS)
G. W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology (USA)

Automated Design & Data Science Approaches for Scaled-up Additive Manufacturing

Additive manufacturing (AM) technologies enable a significant amount of flexibility in the design and functionality of products by being able to place any material at any geometric position in a product. It has become a vital tool for producing unprecedented products that can outperform any product seen today. The applications of metal & non-metal AM technologies, including SLM (Selective Laser Melting), EBM (Electron Beam Melting), and stereolithography (SLA), are already popular in industrial sectors, and everyday objects are fabricated through these printers. However, there still lacks a fundamental understanding of the unpredictable effects of the current printing processes. Full-scale manufacturing with AM remains one of the biggest challenges in smart manufacturing. It currently requires time-consuming trialand-error processes to identify the best printing parameters to ensure reliable outcomes. There is still not much confidence in the structural integrity of the printed parts due to the layers being melted together. Moreover, the existing design processes for AM do not carefully reflect manufacturing constraints. This talk will present Georgia Tech's efforts to achieve the scaling of manufacturing with AM through the development of novel design & data science approaches and certification processes for AM. It will demonstrate an advanced design framework that can bridge the gap between research developments and commercial manufacturers.

Keynote Speech

Ta-Hsin Chou

Ph.D.

Deputy General Director

Office of Strategy and R&D Planning, Industrial Technology Research Institute (ITRI) (Taiwan)

Advance Green Manufacturing Technology for Printed Circuits Board Industry by Fully Additive Process

Flexible printed circuit boards were widely applied in electronic devices such as mobile phones, wearable electronics devices, and sensors recently. However, the traditional photolithography process still faced some challenges including line width decreasing, high cost of production, and high pollutes. Therefore, this study presented a new fully additive process technology which could achieve fine line width, lower cost and green manufacturing. This technology contains some unique process. First, ultra-fast UV laser system was established for groove fabrication which line width of 2.66 μm. Second, developing a powder-free catalyst copper reductive ink which suitable for fine line gravure offset printing. Third, roll-to-roll printer with printing pressure compensation and alignment system for double side printing process could reach average alignment accuracy of 4.36 μm. Fourth, roll-to-roll non-contact electroless copper plating system was used to deposit copper metal on double sides without damage during transmission process. Among these, this study presented the double side flexible printed circuit boards which line/ space of 2.38/5.62 μm on PI substrate with thickness of 25 μm. Finally, based on fully additive process, this study presents a new zero-defect fabrication process for flexible printed circuit boards by combined with intelligent and repairing methods.

Chih-Hsing Chu

Professor

Department of Industrial Engineering

Director, Alliance of Highly Interactive Augmented Reality Technologies

National Tsing Hua University (Taiwan)

Augmented Reality in Human Cyber-physical Systems toward Intelligent Manufacturing

Smart manufacturing enabled by Industry 4.0 technologies is a main driver to realize mass product customizations. Augmented reality (AR) has been commonly applied to facilitate manual operations by overlaying virtual information on physical scenes seen through a display device. Maintenance remains an indispensable process in most factories that is difficult or yet to be fully automated. Operators performing maintenance in manufacturing often work under intense pressure to quickly restore failed operations on the shop floor. They could be highly skilled in one task but insufficiently knowledgeable in another, thus requiring complimentary mixed effort to complete the task. AR-assisted tools aim to reduce their cognitive workload and improve their task performance by delivering necessary information in visual, audio, or haptic forms as needed. This paper presents a systematic literature review on AR-assisted manual maintenance in manufacturing with a focus on human-centered needs. A generic process has been proposed to classify the maintenance operations examined in the past studies into four sequential steps: inception, inspection, execution, and post-assessment, and to analyze the classification results based on the geographical location, maintenance type, AR technical elements, and integrated external sensors. The findings thus derived are expected to provide design guidelines for implementing AR applications with practical values to aid manual maintenance in future smart manufacturing environments.

Keynote Speech

Sebastian Kaiser

M. Eng.

Head of Department Machine Technologies

Institute of Production Engineering and Machine Tools (IFW)

Leibniz University Hannover (Germany)

Energy-efficient Machine Tools and Technologies

The steadily increasing global demand for energy can be attributed to a large part to the industry and causes great ecological and economic costs. The presentation will give an overview of the current energy demand of machine tools and the potential of machine and process related energy efficiency measures. It is shown that a large part of the energy must be provided by support units, which are only indirectly involved in the productive work. Based on this, design methods for reducing the energy demand of the main and support units and methods for energy-efficient operation of the machine tools are presented. Productivity is normally not affected when the efficiency improvement are implemented. The presentation ends with an outlook for future research topics and recommendations for energy-efficient machine tools.

Daewook Kim

Associate Professor of Optical Sciences and Astronomy

James C. Wyant College of Optical Sciences, University of Arizona (USA)

Optical Metrology for Extremely Large Space Telescopes beyond James Webb Space Telescope

In 2021, the James Webb Space Telescope (JWST) was successfully launched and will soon provide invaluable observations of the universe to the very edge of time and space. Already now, the next generation of optical scientists and astronomers are working to bring even more capable telescopes to light. For instance, SALTUS (Single Aperture Large Telescope for Universe Studies) is a mid/far-infrared telescope concept utilizing a ~20^{m} scale inflatable membrane mirror. The giant space telescope's end-to-end optical design unleashes the unprecedented photon collecting power of an extremely large space aperture. A series of inflatable mirror prototypes have been designed, manufactured, and tested by the SALTUS project team at the University of Arizona, L'Garde, and Northrop Grumman. High dynamic range, non-null TVAC (Thermo-Vacuum) tests utilizing deflectometry confirmed the optical performance of the inflatable mirror under space-like conditions. We built a custom deflectometer that produced high resolution surface maps of inflatable optics with a repeatability of 150 nm RMS (Root Mean Square) within a cryogenic vacuum environment. As another architecture enabling an extremely large space telescope, primary mirror segmentation is a promising solution to reveal the secrets of the deep universe. The Nautilus mission utilizes multi-order diffraction engineered (MODE) optics to create its large primary aperture by segmenting and fusing the MODE lens segments. To align and co-phase the large number of lens segments, simultaneous tip-tilt metrology of multiple segments becomes essential for on-ground testing but also for closed-loop alignment control. By relying on a sinusoidal phase pattern reflecting off the segments, the tip-tilt angles of many segments can be efficiently measured with 0.8 μrad resolution within the monitoring camera's field of view. Also, as the off-axis segments are not axially symmetric, monitoring their clocking is critical to maintain high-precision wavefront control. This approach needs to provide a simultaneous sensing outcome instead of segment-by-segment sequential scanning data. For a very large number of segments, especially, the solution must monitor multiple segments concurrently. A Polarized Imaging Interpreter (PI^{2}) to simultaneously measure rotational angles of multiple objects was developed and experimentally verified using polarization

pixelated camera. It can precisely monitor concurrent clocking motions of multiple targets within the monitoring camera's field of view for various dynamic applications. These scalable optical metrology solutions with large dynamic range, no moving-parts, and simultaneous measurement capability will allow the realization of a next generation of extremely large space telescopes beyond JWST.

Daisuke Matsuura
Associate Professor
Department of Mechanical Engineering, School of Engineering
Tokyo Institute of Technology (Japan)

Design of Human Oriented Mechanisms based on the Fusion of Tactile and Visual Sensation

In order to establish effective mechanical systems that are capable of dealing with the real world and being human inclusive, development of minimally essential but effective mechanism and software based on the consideration of kinematics and flexibility and utilization of visual and tactile sensation are needed. Design of such mechanism should overcome the trade-off problem for realizing both enough stiffness against the self-weight of the system and external load and enough high force sensitivity to acquire the tactile information. Visual sensation is advantageous from the point of view of scalability and ease of installation, and therefore is widely used in these days, but this technique essentially needs a conversion from pixel dimension to physical dimension and a fusion with tactile information, to enrich the meaningfulness and to complement a blinded situation. Mechanism design and utilization of visual information are therefore be said mutually inseparable and complemental. Based on the above background, some research projects and obtained results will be explained in this keynote speech. The projects to be introduced will be the development of a variable stiffness mechanical manipulator to perform a tactile sensing and a simple cooperative transportation system bases on a gentry hierarchical and highly distributed architecture.

Seung Ki Moon
Associate Professor
School of Mechanical and Aerospace Engineering
Nanyang Technological University (Singapore)

A Data-driven Design Framework for 3D Printed Lattice Structure Optimization and Implementation

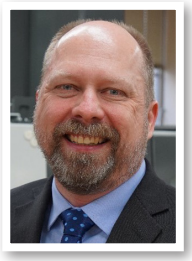
Additive manufacturing (AM) is gaining momentum from being considered as a rapid prototyping tool to final part fabrications. Common uses of AM largely include the fabrication of lattice structures to reduce weight of components. However, the reduction in mass can potentially make components susceptible to vibrations. In this research, the objective is to develop a data-driven design framework for selecting suitable lattices based on the results from design of experiments (DOE) and multidisciplinary design optimization. In the proposed framework, DOE is performed to map the relationship between the design variables and the responses. And a genetic algorithm is applied to determine a set of Pareto-optimal solutions that match the criteria of design requirements. To demonstrate the usefulness of the proposed framework, a case study is conducted to obtain high first natural frequency and minimum mass in 3D printed lattice structures fabricated by Selective Laser Sintering process. The results show the solid part has the highest first natural frequency and weight while the latticed part has a lower weight (35% Reduction) and a lower first natural frequency (20% Reduction). The difference in simulation and experimental results increase as the design parameters with a maximum of 17% in the natural frequency. The main contributions of this research include the proposed framework through which lattices can be selected and applied onto parts using simulations and an evolutionary algorithm to identify optimal designs.

Keynote Speech

Chinedum E. Okwudire
Associate Professor
Mechanical Engineering
University of Michigan (USA)

Smart Additive Manufacturing

There is a lot of excitement about the potential of smart manufacturing (involving the use of information, automation, computation, software, sensing, and networking technologies) to revolutionize the manufacturing industry, e.g., by boosting manufacturing quality and productivity at low cost. An excellent application for such "smart" technologies is additive manufacturing (AM), another area of manufacturing that is gaining a lot of traction but is plagued by quality, productivity and cost issues. In this talk, I will share (at a high level) some of my research results on smart AM, aimed at enhancing AM quality and productivity at low cost using smart technologies. Specifically, I will discuss our work on speeding up 3D printers at low cost using advanced controls and cloud computing. I will also provide an overview of our new research on intelligent online optimization of scanning sequence to reduce thermal induced errors in laser powder bed fusion AM.

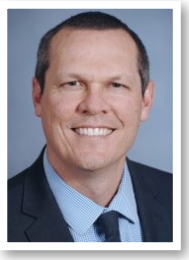


Frank Pfefferkorn
Professor
Associate Chair of Graduate Studies, Department of Mechanical Engineering
Director, Manufacturing Systems Engineering Program
University of Wisconsin-Madison (USA)

Discontinuity Formation and Detection during Friction Stir Welding of Aluminum Alloys

Internal discontinuities resulting from the friction stir welding (FSW) process can have a negative effect on the weld quality. Ideally, discontinuity formation would be avoided through careful process planning, or detected by analysis of measurable process signals (e.g., forces, torques, temperatures). To achieve these goals, we must first understand when and why discontinuities are formed. After a brief introduction to prior work on correlating process forces to discontinuity formation and size, the latest results and understanding of when and why discontinuities form as well as how they can be correlated to measurable process signals will be presented. A combination of experimental observations and numerical simulations will be presented, with a focus on the interaction between the friction stir tool probe and the underlying material. This includes a high-fidelity Finite Element Analysis (FEA) simulation of the FSW process and on the correlation of numerically obtained process force signals with the corresponding void structures. This correlation is obtained in the phase-space relating in-plane reaction forces on the tool to the tool rotation angle. The interactions of the tool geometry and tool motion with the surrounding material undergoing plastic deformation provides novel insights into various correlations of tool motion and void formation. Through this approach, it is possible to identify tool-related process conditions that can be optimized to minimize void formation and demonstrate a potential in-situ force-based void monitoring method that links to the underlying plastic flow and defect structures during the FSW process.

Keynote Speech



Tony Schmitz

Professor

University of Tennessee, Knoxville (USA)

Joint Faculty, Oak Ridge National Laboratory

A Machining Digital Twin for Hybrid Manufacturing

Hybrid manufacturing consisting of metal additively manufactured preforms and computer numerical control (CNC) machining has been established to be an effective method for high material use rates. However, hybrid manufacturing introduces unique challenges. Near-net shape designs are typically selected, which result in a smaller margin for part placement within the stock and stringent requirements for work coordinate system identification. Additionally, less stock material reduces the preform stiffness, which limits the material removal rates during machining. This paper demonstrates a digital twin for CNC machining of a wire arc additively manufactured preform that implements: 1) structured light scanning for stock model identification and tool path generation; 2) a fused filament fabrication apparatus to attach temporary fiducials and scan targets to the preform that enable coordinate system definition for both the CAM and CNC machine; 3) preform and tool tip frequency response function measurements to enable stable milling parameter selection; and 4) post-manufacturing measurements of geometry, surface finish, and structural dynamics to confirm designer intent. These efforts define key components of the machining digital twin for hybrid manufacturing.

Pei-Chen Su

Associate Professor

School of Mechanical and Aerospace Engineering

Nanyang Technological University (Singapore)

Nanoparticle Additives for Shape Memory Materials and Energy Devices

Vat photopolymerization has been used in a wide variety of applications from early-stage prototyping to industrial manufacturing of products. It allows easy fabrication of complex geometries that is usually costly for conventional manufacturing methods to fabricate. digital light processing (DLP) belongs to a family of additive manufacturing class known as vat photopolymerization, where a pool of photopolymer resin is solidified by UV light in a layer-by-layer fashion. In this talk, we introduce our resin formulation with nanoparticle additive to add the additional functionalities for targeted mechanical properties of printed parts. In particular, the dimensional accuracy of 3D printed parts in DLP by achieving a controlled UV penetration through the photopolymer resin is achieved to avoid excessive unwanted curing caused by overexposure while maintaining the superior mechanical properties of the printed part. Significant improvement in preventing unwanted curing was also observed in resin with zinc oxide nanoparticles, as evident by our printing tests on open channels and overhanging structures. Unlike the typical dye additive, Sudan I, which deteriorated the mechanical properties of printed parts, zinc oxide additives have rendered more effective curing that resulted in improved tensile strength, fracture strain and Young's modulus.

Keynote Speech

Kazuyoshi Tsuchiya
Professor
Department of Precision Engineering
Tokai University (Japan)

Microneedle Sensor Technologies for Improved Healthcare: Progress & Challenges

Microneedles that mimic female mosquito labium can be made using "the microtube production process", which the author has devised. Microneedle production comprises sputtering the microneedle material onto a rotating wire substrate at a speed of 3-5 rpm, followed by heat treatment and chemical etching of the wire substrate. As a result, a titanium microneedle that matched the labium of a female mosquito and had an outer and inner diameter of 50 and 25 micrometers was developed. In this presentation, (1) key technologies for the development of functional microtubes via thin film approach and more sophisticated uses of the microtube production method will be discussed such as a (2) technique for designing a painless microneedle for blood extraction system based on quantitative pain assessment, and (3) a concentric circle type pH Sensor based on solid materials electrodes measuring in microscopic region. More importantly, created microneedle sensor showed a Nernstian response of about 50 mV/pH. We have tested the sensor under numerous situations, such as in a variety of buffer solutions over time, and compared the reading with industry-standard pH electrodes.

PRESM 2022 Hybrid Program

PRESM 2022 will be held at Jeju Booyoung Hotel & Resort on 20-22 July, 2022. Please go through following information on how to participate.

1) Run On-site

Emerald Hall (B2), on 20-22 July, 2022

Real-time live streaming	Go to http://online.presm.org
Plenary Session	Plenary Speech : Takashi Matsumura (Tokyo Denki University, Japan) Plenary Speech : Dong-Woo Cho (POSTECH, Korea) Plenary Speech : Liang-Chia Chen (National Taiwan University, Taiwan)
Focus Session Detail see pp.21-28	A. Smart Design and Materials B. Advanced Technology in Machine Tools & Machining C. Advances in Additive Manufacturing D. Nano/Microtechnologies for Next Industries E. Hot Issues on Precision Metrology F. Korea-Germany Intelligent Manufacturing System G. Robotic Machining and Next Generation Manufacturing H. Digital Twin for Smart Manufacturing
Regular Session [Poster]	1. Manufacturing Processes 2. Machine Tools & Systems 3. Automation, Measurement & Control 4. Materials & Design 5. Micro/Nano Technology 6. New and Renewable Energy 7. Sustainable Technology
Special Session [Poster]	1. High Precision Large Area Production Technology Organized by Dr. Young-Sam Ham (Korea Railroad Research Institute) 2. High Precision Large Area Production Technology Organized by Prof. Changwan Kim (Konkuk University)

PRESM 2022 Hybrid Program

2) PRESM 2022 Program at a glance

*On-site & Real-time streaming

Time	20 July (Wed)	Time	21 July (Thu)	Time	22 July (Fri)
08:30-10:50	**Focus session Ⓐ** Smart Design and Materials	08:30-11:00	**Focus session Ⓓ** Nano/Microtechnologies for Next Industries	08:30-11:00	**Focus session Ⓖ** Robotic Machining and Next Generation Manufacturing
11:00-12:00	Poster session 1	11:00-12:00	Poster session 2	11:00-12:00	Poster session 3
	Regular session 2. Machine Tools & Systems 3. Automation, Measurement & Control 4. Materials & Design		**Regular session** 3. Automation, Measurement & Control 5. Micro/Nano Technology 6. New and Renewable Energy **Special session** 1. Railway Engineering		**Regular session** 1. Manufacturing Processes 7. Sustainable Technology **Special session** 2. High Precision Large Area Production Technology
12:00-12:50	Lunch	12:00-13:00	Lunch	12:00-13:00	Lunch
12:50-13:40	**Opening** **Plenary Session 1** Advanced Machining for Difficult-to-Cut Materials *Prof. Takashi Matsumura (Tokyo Denki University, Japan)	13:00-13:40	**Plenary Session 2** 3D Cell Printing Technology with Tissue Specific Bioinks *Prof. Dong-Woo Cho (POSTECH, Korea)	13:00-13:40	**Plenary Session 3** Recent Advances in Automated Optical Inspection and Metrology for In-Line Manufacturing *Prof. Liang-Chia Chen (National Taiwan University, Taiwan)
13:40-13:50	Break	13:40-13:50	Break	13:40-13:50	Break
13:50-17:10	**Focus session Ⓑ** Advanced Technology in Machine Tools & Machining	13:50-15:40	**Focus session Ⓔ** Hot Issues on Precision Metrology	13:50-15:40	**Focus session Ⓗ** Digital Twin for Smart Manufacturing
	Coffee Break	15:40-16:00	Coffee Break	15:40-16:00	Coffee Break
17:10-18:50	**Focus session Ⓒ** Advances in Additive Manufacturing	16:00-17:50	**Focus session Ⓕ** Korea-Germany Intelligent Manufacturing System	16:00-17:00	PRESM 2022 Awards & Farewell
Some of the regular POSTER (about 70 papers) and a Special Seession 3 (Multidisciplinary Research & Mechatronics for Aero/Defense Applications) will be on stream as MP4 video on the PRESM 2022 online website during the all three days of the conference.					

3) Run Online

PRESM 2022 Online Conference website : http://online.presm.org

*Available for the whole three days of the conference (20-22 July, 2022)

Regular Session	1. Manufacturing Processes 2. Machine Tools & Systems 3. Automation, Measurement & Control 4. Materials & Design 5. Micro/Nano Technology 6. New and Renewable Energy 7. Sustainable Technology
Special Session	3. Multidisciplinary Research & Mechatronics for Aero/Defense Applications

4) Focus Session

*It operates based on On-site presentations and conducts real-time video conferences using ZOOM.

On-site	Emerald Hall (B2), Jeju Booyoung Hotel & Resort, Korea
Real-time live streaming	Go to http://online.presm.org

[A] Smart Design and Materials

Introduction In the field of precision engineering, design and materials have been the key parameters to determine the performance of the products. Smart design and materials have been widely adopted in various scientific or industrial applications, such as the automotive, aerospace, and military industries. In this focus session, the recent progresses in several research topics related to smart design and materials will be presented.

Organizer Prof. Hyung-Wook Park (UNIST, Korea)

PT Date, Time 20 July (Wednesday) 2022, 08:30-10:50 (KST, UTC +09:00)

Details Session Chair : Prof. Jisoo Kim (Kyungpook National University) & Prof. Jayil Jeong (Kookmin University)

No.	Time	Title	Presenter
FA1	08:30-09:00 (30')	Keynote Speaker Automated Design & Data Science Approaches for Scaled-up Additive Manufacturing	**Prof. Seung-Kyum Choi** Georgia Institute of Technology, USA
FA2	09:00-09:30 (30')	Keynote Speaker Design of Human Oriented Mechanisms based on the Fusion of Tactile and Visual Sensation	**Prof. Daisuke Matsuura** Tokyo Institute of Technology, Japan
FA3	09:30-09:50 (20')	Advances in AFM-based Characterization Techniques for Piezoelectric Materials	**Prof. Kwanlae Kim** Seoul National University of Science & Technology, Korea
FA4	09:50-10:10 (20')	Synergy Effect through Convergence of Classical Mechanics and State-of-the-art Triboelectric Signal Generation Mechanism	**Prof. Dongwhi Choi** Kyung Hee University, Korea
FA5	10:10-10:30 (20')	Investigating Cryogenic Deformation Behaviour for Developing Nanocrystalline Titanium via Cryo-forging	**Prof. Tea-Sung Jun** Incheon National University, Korea
FA6	10:30-10:50 (20')	Thermophysical Properties of Eco-friendly Inorganic $MnCl_2 \cdot 4H_2O$ Phase Change Materials	**Dr. Kyung-Eun Min** Portland State University, USA

PRESM 2022 Hybrid Program

[B] Advanced Technology in Machine Tools & Machining

Introduction Machine tools and machining processes are very important fields that form the basis of the manufacturing industry, which is currently undergoing innovation such as the 4th industrial revolution.

This focus session discusses recent technological advances in machine tools and machining, including digital twins, advanced simulations, intelligent process control, and energy-saving efforts to support carbon neutrality.

Organizer Mr. Young Jae Choi (Korea Institute of Industrial Technology, Korea) &
Dr. Jeong Seok Oh (Korea Institute of Machinery & Materials, Korea)

PT Date, Time 20 July (Wednesday) 2022, 13:50-16:50 (KST, UTC +09:00)

Details Session Chairs : Prof. Martin B.-G. Jun (Purdue University)
& Dr. Jeong Seok Oh (Korea Institute of Machinery & Materials)

No.	Time	Title	Presenter
FB1	13:50-14:20 (30')	Keynote Speaker Smart Additive Manufacturing	**Prof. Chinedum E. Okwudire** University of Michigan, USA
FB2	14:20-14:50 (30')	Keynote Speaker Energy-efficient Machine Tools and Technologies	**M. Eng. Sebastian Kaiser** Institute of Production Engineering and Machine Tools (IFW), Leibniz University Hannover, Germany
FB3	14:50-15:20 (30')	Keynote Speaker A Machining Digital Twin for Hybrid Manufacturing	**Prof. Tony Schumitz** University of Tennessee, USA
	15:20-15:40 (20')	Coffee Break	
		Session Chairs : Dr. Dong Yoon Lee (Korea Institute of Industrial Technology) & Prof. Hae-Sung Yoon (Korea Aerospace University)	
FB4	15:40-16:00 (20')	Studying Crack Generation Mechanism of Single-crystal Sapphire during Ultra-precision Machining by MD Simulation-based Slip/fracture Activation Model	**Prof. Sangkee Min** University of Wisconsin-Madison, USA
FB5	16:00-16:20 (20')	Molecular Dynamics Simulation of Ultra-precision Machining of Sapphire	**Prof. Woo Kyun Kim** University of Cincinnati, USA
FB6	16:20-16:40 (20')	Performance Evaluation of Multi-axis Feed Systems Using a CAE Based Dynamic Digital Twin	**Dr. Chang-Ju Kim** Korea Institute of Machinery & Materials, Korea
FB7	16:40-17:00 (20')	Machinability Diagnosis Technique in Machining Process	**Dr. Kyung-Hee Park** Korea Institute of Industrial Technology, Korea

PRESM 2022 Hybrid Program

[C] Advances in Additive Manufacturing

Introduction The Additive Manufacturing process began as a process for manufacturing prototypes but is now being developed as a process for manufacturing actual products. In this session, the audiences will be able to find out the future of the additive manufacturing process that is confident to bring about innovation in the manufacturing process.

Organizer Prof. In Hwan Lee (Chungbuk National University, Korea)

PT Date, Time 20 July (Wednesday) 2022, 17:10-18:50 (KST, UTC +09:00)

Details Session Chair : Prof. Hyun-Wook Kang (UNIST) & Hochan Kim (Andong National University)

No.	Time	Title	Presenter
FC1	17:10-17:40 (30')	Keynote Speaker A Data-driven Design Framework for 3D Printed Lattice Structure Optimization and Implementation	**Prof. Seung Ki Moon** Nanyang Technological University, Singapore
FC2	17:40-18:10 (30')	Keynote Speaker Nanoparticle Additives for Shape Memory Materials and Energy Devices	**Prof. Pei-Chen Su** Nanyang Technological University, Singapore
FC3	18:10-18:30 (20')	Single-digit-micron-resolution Continuous Liquid Interface Production (CLIP) 3D Print Technology	**Prof. Brian Lee** Sungkyunkwan University, Korea
FC4	18:30-18:50 (20')	A Design Trade-off Method for the Additive Manufacturing Process Chain	**Prof. David Rosen** Georgia Institute of Technology, USA

PRESM 2022 Hybrid Program

[D] Nano/Microtechnologies for Next Industries

Introduction Various nanoscale and microscale manufacturing methods for electronics, healthcare, and functional materials applications will be discussed.

Organizer Prof. Jong-Baeg Kim (Yonsei University, Korea)

PT Date, Time 21 July (Thursday) 2022, 08:30-10:50 (KST, UTC +09:00)

Details Session Chairs : Prof. Moon-Kyu Kwak (Kyungpook National University) & Prof. Hoon-Eui Jeong (UNIST)

No.	Time	Title	Presenter
FD1	08:30-09:00 (30')	Keynote Speaker Advance Green Manufacturing Technology for Printed Circuits Board Industry by Fully Additive Process	**Dr. Ta-Hsin Chou** Industrial Technology Research Institute (ITRI), Taiwan
FD2	09:00-09:30 (30')	Keynote Speaker Microneedle Sensor Technologies for Improved Healthcare: Progress & Challenges	**Prof. Kazuyoshi Tsuchiya** Tokai University, Japan
FD3	09:30-09:50 (20')	A Novel Piezo-controlled Needle-free Injection System for Precise Delivery of Functional Fluids	**Dr. Mojiz Abbas Trimzi** NASEM Co., Ltd., Korea
FD4	09:50-10:10 (20')	Recent Developments in Manufacturing Tribology	**Prof. Steven Schmid** University of North Carolina at Charlotte, USA
FD5	10:10-10:30 (20')	Self-assembled Smart Scaffold for Endovascular Disease Diagnosis	**Dr. Dong-Su Kim** Chonnam National University, Korea
FD6	10:30-10:50 (20')	Experimental Study on the Magnetic and Mechanical Properties of Laser Selective Melted FeSiCr Soft Magnetic Composite	**Prof. Chunhui Chung** National Cheng Kung University, Taiwan

PRESM 2022 Hybrid Program

[E] Hot Issues on Precision Metrology

Introduction In the field of precision engineering, precision metrology becomes important for quality control. Due to the advantages of high-precision and non-destructive measurement, the optical metrology as a part of precision metrology is being widely exploited in various scientific or industrial applications, such as space optics, semiconductor and display manufacturing, and other high-technology industries. In this focus session, the recent progresses in several research topics related to optical metrology will be presented.

Organizer Dr. Jonghan Jin (Korea Research Institute of Standards & Science, Korea)

PT Date, Time 21 July (Thursday) 2022, 13:50-15:40 (KST, UTC +09:00)

Details Session Chair : Dr. Jonghan Jin (Korea Research Institute of Standards & Science) & Dr. Hyun Wook Lee (Korea Railroad Research Institute)

No.	Time	Title	Presenter
FE1	13:50-14:20 (30')	Keynote Speaker Optical Metrology for Extremely Large Space Telescopes beyond James Webb Space Telescope	**Prof. Daewook Kim** University of Arizona, USA
FE2	14:20-14:40 (20')	Optical Method for Simultaneous Measurement of Individual Layer Thicknesses in Thin-film Deposited Samples	**Dr. Jungjae Park** Korea Research Institute of Standards & Science, Korea
FE3	14:40-15:00 (20')	On-machine Surface Profiling of Precision Lens Molds Using a Radial Shearing Interferometer	**Prof. Joo Hyung Lee** Seoul National University of Science & Technology, Korea
FE4	15:00-15:20 (20')	All Fiber Distance Measurement System towards On-chip LiDAR Engine	**Dr. Yoon-Soo Jang** Korea Research Institute of Standards & Science, Korea
FE5	15:20-15:40 (20')	Ultrathin Insect-eye Camera for High-contrast Visible and Near-infrared Imaging	**Dr. Kisoo Kim** Korea Photonics Technology Institute, Korea

PRESM 2022 Hybrid Program

[F] Korea-Germany Intelligent Manufacturing System

Introduction The Korea-German Intelligent Manufacturing System (IMSL) aims to establish an intelligent manufacturing system that can predict and diagnose manufacturing system information (such as facility soundness, processing quality, energy efficiency, safety.). Seoul National University and Fraunhofer IPT/Aachen University in Germany are working together to develop appropriate smart sensor and utilize it to acquire data on the status of materials and manufacturing equipment generated in each process of the manufacturing system, including manufacturing machinery and industrial robots.

Organizer Prof. Sung-Hoon Ahn (Seoul National University, Korea)

PT Date, Time 21 July (Thursday) 2022, 16:00-17:50 (KST, UTC +09:00)

Details Session Chairs : Prof. Sung-Hoon Ahn & Dr. Ji-Ho Jeon (Seoul National University)

No.	Time	Title	Presenter
FF1	16:00-16:30 (30')	Keynote Speaker Digital Twins for Sustainable Manufacturing	**Prof. Matthias Brockmann** University of Applied Sciences FH Münster, Germany
FF2	16:30-16:50 (20')	Towards Nanostructures -Potentials of Artificial Intelligence for Large Area Diamond Turning of Micro- and Nanostructures	**Mr. Maximilian Kosel** Fraunhofer Institute for Production Technology, Germany
FF3	16:50-17:10 (20')	Future Perspectives towards Faster Development of Active Assembly Solutions for Next Generation of Industrial Applications	**Mr. Daniel Zontar** Fraunhofer Institute for Production Technology, Germany
FF4	17:10-17:30 (20')	Stochastic Physics-based Model Updating Using Lamb Waves for Fatigue Crack Detection in Riveted Lap Joints	**Prof. Wongon Kim** Seoul National University, Korea
FF5	17:30-17:50 (20')	NO_2 Gas Monitoring in Factory Using Low Power Consumption Gas Sensing System based on Colorimetric Gas Sensor	**Dr. Young-Gyun Kim** Seoul National University, Korea

PRESM 2022 Hybrid Program

[G] Robotic Machining and Next Generation Manufacturing

Introduction Machining using an industrial robot has many difficulties due to its low stiffness. Nevertheless, many researchers have tried to apply the industrial robot to machining application because of its excellent flexibility. In this session, the robotic machining system will be presented how to industrial robot can be applied in machining field.

Organizer Dr. Tae-Gon Kim (Korea Institute of Industrial Technology, Korea)

PT Date, Time 22 July (Friday) 2022, 08:30-11:00 (KST, UTC +09:00)

Details Session Chair : Dr. Tae-Gon Kim & Dr. Jungsoo Nam (Korea Institute of Industrial Technology)

No.	Time	Title	Presenter
FG1	08:30-09:00 (30')	Keynote Speaker Discontinuity Formation and Detection during Friction Stir Welding of Aluminum Alloys	**Prof. Frank Pfefferkorn** University of Wisconsin-Madison, USA
FG2	09:00-09:20 (20')	Deflection Compensation of Robotic Milling with Cutting Force Estimation and Identification Error Reduction	**Prof. Jihyun Lee** University of Calgary, Canada
FG3	09:20-09:40 (20')	Cutting Force, Temperature, Tool Wear and Machined Surface Alteration in Micro-milling of Laser-melting Ti-6Al-4V / Ti Composites	**Prof. Chunliang Kuo** National Taiwan University of Science & Technology, Taiwan
FG4	09:40-10:00 (20')	Pre-compensation of Hole Positioning Error in Robotic Drilling Process	**Dr. Seong Hyeon Kim** Korea Institute of Industrial Technology, Korea
FG5	10:00-10:20 (20')	On Developing Core Technologies of Serial-structure Flexible Machine for Metal Cutting Applications	**Dr. Jongyoup Shim** Korea Institute of Machinery & Materials, Korea
FG6	10:20-10:40 (20')	On-machine, In-process Strobo-stereoscopy for Spatially Resolved 3D Surface Profiling of Rotating Part	**Prof. Chabum Lee** Texas A&M University, USA
FG7	10:40-11:00 (20')	Effect of Fiber-tool Contact Mode on Carbon Fiber Reinforced Plastic Milling Tool Wear	**Dr. Gyuho Kim** Yonsei University, Korea

PRESM 2022 Hybrid Program

[H] Digital Twin for Smart Manufacturing

Introduction Digital twin is one of the emerging key-works for future potential manufacturing system. In this session, the digital twin applications will be introduced for smart manufacturing though the outstanding research groups. The participants in PRESM will be able to have much inspiration about the digital twin application for their own research field.

Organizer Dr. Jungsoo Nam (Korea Institute of Industrial Technology, Korea)

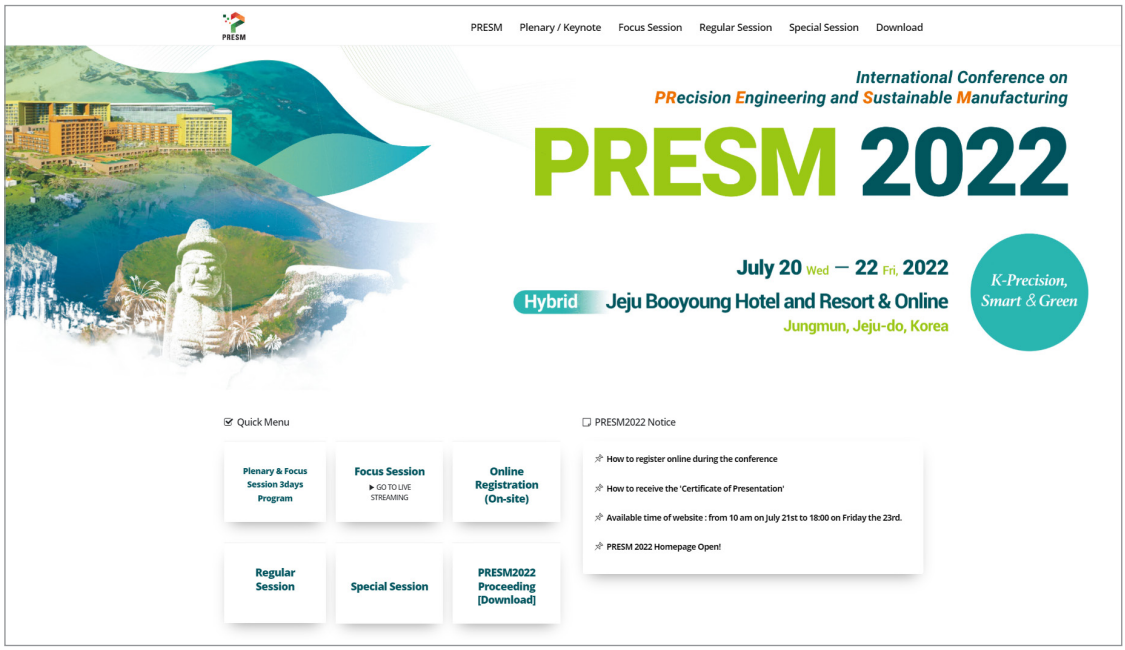
PT Date, Time 22 July (Friday) 2022, 13:50-15:40 (KST, UTC +09:00)

Details Session Chairs : Dr. Tae-Gon Kim & Dr. Jungsoo Nam (Korea Institute of Industrial Technology)

No.	Time	Title	Presenter
FH1	13:50-14:20 (30')	Keynote Speaker Augmented Reality in Human Cyber-Physical Systems toward Intelligent Manufacturing	**Prof. Chih-Hsing Chu** National Tsing Hua University, Taiwan
FH2	14:20-14:40 (20')	Industrial Digital Twin for Smart Manufacturing: A Case Study on Robotic Welding System	**Prof. Sang Won Lee** Sungkyunkwan University, Korea
FH3	14:40-15:00 (20')	Digital Twin Based Process Monitoring Framework and AI-powered Process Planning	**Prof. Martin B.-G. Jun** Purdue University, USA
FH4	15:00-15:20 (20')	Parameter Optimization and Cycle Time Estimation Using CNC Machine Tool Simulation	**Dr. Chan-Young Lee** Korea Institute of Machinery & Materials, Korea
FH5	15:20-15:40 (20')	The Tool Life Simulation based on a Digital Twin Model in the Milling Process	**Dr. Dongmin Kim** Korea Institute of Industrial Technology, Korea

How to participate in PRESM 2022 online conference

1. Go to PRESM 2022 Online Conference website : **http://online.presm.org**



2. Log in with the username (e-mail) and password you registered when you joined in PRESM 2022.

3. Search interested presentations and enjoy.

4. **QnA**: The audience can ask a question by writing a comment below presentation video. The notification email is sent to the presenter so that he or she can answer as soon as possible. The presenters are highly recommended to answer to the question at least one time per day.

5. The proceeding of PRESM [ISSN 2635-7887] is downloadable on the website.

6. **Certificate of participation & receipt**
   (1) Can be printed out on “my page” after the conference finishes. You can find “my page” on top right side of website (http://www.presm.org).
   (2) The receipt of registration can be printed out on “my page” of website.

Downloading, illegal recording, and screen capturing of all presentation materials is strictly prohibited in accordance with relevant laws and research ethics. We ask for your observance of research ethics so that valuable research results can be developed further.

Venue

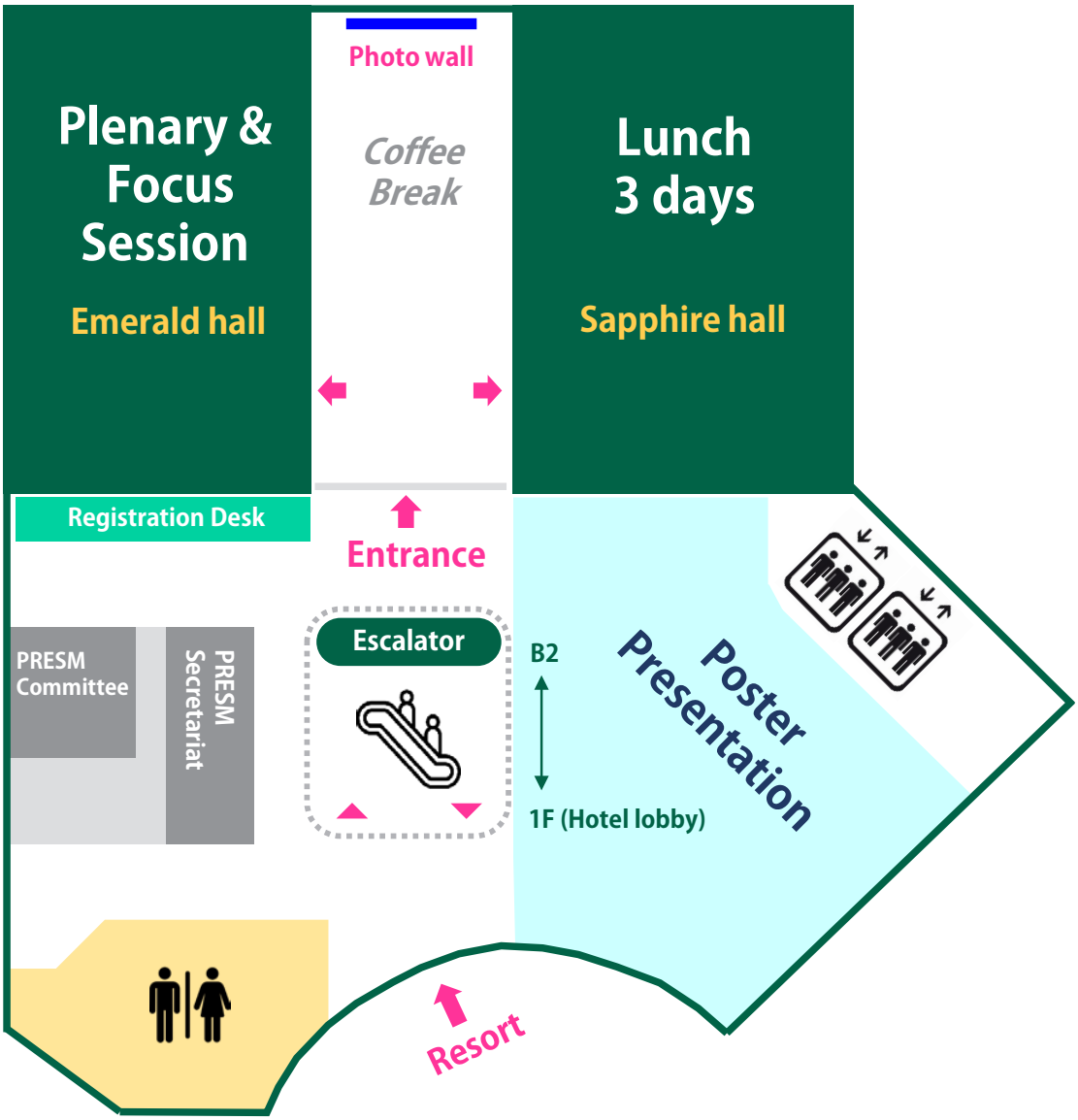
Jeju Booyoung Hotel & Resort

Jeju Booyoung Hotel & Resort is 40 km away from the Jeju International Airport. It takes about 60 mins by airport Limousine Bus or 40-45 mins by taxi.

By Airpot Rimousine Bus

- Fare: KRW 4,500 (in cash or traffic card, you can pay in the bus)
- Routes: Airport ↔ **Jeju International Convention Center (ICC)** ↔ New Gyeongnam Hotel ↔ Seogwipo KAL Hotel
  [Note] At JungMun, the bus will stop by 9 hotels in this area before going to Jeju ICC)
- First departure from the airport: 06:00 am, last departure: 10:50 pm
- First departure from the KAL Hotel: 06:00 am, last departure: 9:40 pm
- Bus schedule: http://bus.jeju.go.kr/schedule/view/600

Floor Plan (Booyoung Hotel & Resort)



Registration

Registration

Category		On-site Registration
Date		June 16(Thu)-July 22(Fri), 2022
Non-Student	On-site	USD 700 / KRW 700,000
	Online	USD 350 / KRW 350,000
Student	On-site	USD 350 / KRW 350,000
	Online	USD 250 / KRW 250,000

*On-site registration desk is located at the B2 floor in Venue.
*Online registration will be possible at the PRESM 2022 website by July 22.

Registration includes

Participation	Presenter	Non-Presenter
On-site	• Access to Plenary & Focus Session • Certificate of presentation • Confirmation of Attendance • PRESM 2022 Proceeding Kit : Official name tag, e-Proceeding USB, & etc. • 3 days Lunch box (July 20-22) • PRESM 2022 e-Proceeding file & e-Program on website	• Access to Plenary & Focus Session • Confirmation of Attendance • PRESM 2022 Proceeding Kit : Official name tag, e-Proceeding USB, & etc. • 3 days Lunch box (July 20-22) • PRESM 2022 e-Proceeding file & e-Program on website
Online	• Access to Plenary & Focus Session on website • Certificate of presentation • Confirmation of Attendance • PRESM 2022 e-Proceeding file & e-Program on website	• Access to Plenary & Focus Session on website • Confirmation of Attendance • PRESM 2022 e-Proceeding file & e-Program on website

*No official nametags are issued to online participants.
*It is strictly restricted to only participants with official nametag to enter the presentation room.

Journal Publication

Selected papers will be published in journals below after passing through peer review.

- International Journal of Precision Engineering and Manufacturing
  SCIE, SCOPUS / Impact Factor 2.041 (2021)
- International Journal of Precision Engineering and Manufacturing-Green Technology
  SCIE, SCOPUS / Impact Factor 4.660 (2021) JCR Q1
- Journal of the Korean Society for Precision Engineering
  SCOPUS

Lunch / Awards & Farewell

Lunch

Date	Time	Place
July 20 (Wed)	12:00-12:50	Sapphire Hall (B2)
July 21 (Thu)	12:00-13:00	Sapphire Hall (B2)
July 22 (Fri)	12:00-13:00	Sapphire Hall (B2)

*Please submit the lunch coupon to staff when you enter the Sapphire Hall (B2).

Awards & Farewell

22 July (Fri), 16:00-17:00

There will be an announcement of the PRESM 2023 conference and closing remarks from the organizing committee in Emerald Hall (B2). And the Best Paper Award and Young Researcher Awards will be announced.