ASME® 2021 ISPS

The 30th ASME Annual Conference on Information Storage and Processing Systems

Program

https://event.asme.org/ISPS

WELCOME ATTENDEES

On behalf of the American Society of Mechanical Engineers (ASME)-Information Storage and Processing Systems (ISPS) Executive Committee, it is our pleasure to welcome you to the 2021 ASME ISPS Conference.

Three decades ago, the first ISPS conference was held in 1991 and this year marks the 30th ISPS conference. Although the main focus of the conference has been information storage and processing systems including magnetic recording and optical recording, in the last 30 years the ISPS conference has continuously expanded its scope to other technology fields such as biomedical equipment, smart sensors / actuators / materials, AI machines imaging and printing equipment based on ultra-precision dynamics and precision control, etc.

Attracting more than 50 high quality technical presentations and papers from both industry and academia for this year's conference, ISPS provides a forum for international researchers from all over the world to share their findings, network with co-researchers, and foster new opportunities for collaboration. One of our key objectives is to attract and support graduate students and researchers in related technical areas and industries. This year, the ISPS conference has especially received many contributions in the fields of machine learning-based intelligent systems and smart factory HW solutions. Data storage, memory and processing provide the critical backbone for such applications, and in future ISPS conferences we expect significant growth in the number of exchanges on information storage device and processing technologies required for such intelligent systems.

Traditionally the ISPS annual conference is held in the state of California, known for its world-renowned universities and trailblazing industrial innovations in science and technology. Due to the threat of COVID-19, we are unfortunately not able to engage with everyone in person for second year in a row. We think it is a necessary step to ensure the safety of all our participants, especially those needed to do foreign travel. The ASME-ISPS team has worked very hard host an online conference again this year, and we think that it is really fortunate that we are able to host the conference with much active participation from your end despite the ongoing pandemic.

This year, the ISPS conference features three keynote speeches. On the first day, we are pleased to present keynote speech by Dr. John W. Dykes, *Managing Principal Technologist at Seagate Technology.* We will commence our second day with a keynote speech by Dr. Kris Schouterden, *Vice President, Development Engineering, HDD R&D at Western Digital*. Lastly, before the short break, Prof. Jia-Yang Juang, *Associate Chair of the Department of Mechanical Engineering at the National Taiwan University* will deliver his keynote address.

On behalf of the ISPS organizing committee, we would like to acknowledge all volunteers who have taken time from their busy schedules to invite speakers, organize tracks and review papers and awards. We would also like to acknowledge the invaluable assistance provided by the ASME staff especially to re-arrange the ISPS conference on an online platform in a short period of time. In addition, we also

would like to thank all participants who have agreed to the new format of attending sessions held at different time zones and will be making valuable effort in preparing and submitting their presentations in advance. Lastly, while the threat of COVID-19 continues, the organizing committee members would like to wish all our conference attendees the best of health. Please stay safe.

Sincerely,

ISPS Conference Chair
Dr. Abhishek Srivastava
Western Digital Corporation, USA

ISPS Conference Co-Chair
Dr. Rahul Rai
Western Digital Corporation, USA

2021 Conference Organizing Committee

Division Chair
Dr. Shaomin Xiong
Western Digital Corporation, USA

Strategic Advisory Committee Chair
Prof. Frank E. Talke
CMRR | University of California, San Diego, USA

Division Vice Chair
Prof. Wanchin Kim
Hanbat National University, Korea

Awards Committee Chair
Dr. Robert Smith
Western Digital Corporation, USA

Program Chair
Dr. M.D. Murthy Peri
Seagate, USA

Immediate Past Division Chair
Dr. Aravind Murthy
Western Digital Corporation, USA

Program Co-Chair
Dr. Tan Trinh
Western Digital Corporation, USA

https://event.asme.org/ISPS

TECHNICAL TRACK ORGANIZERS

Advanced Simulation in Science and Engineering
Dr. Robert Smith, *Western Digital Corporation, USA*
Dr. Rahul Rai, *Western Digital Corporation, USA*

Application of Data and Artificial Intelligence in Mechanical Engineering
Minghui Zheng, *University of Buffalo*
Qian Zhong, *Western Digital Corporation, USA*

Dynamics and Control for Future Technologies
Prof. Kwangseok Oh, *Hankyung National University, Korea*
Prof. Jia-Yang Juang, *NTU, Taiwan*

Flexible Media Handling Machines and Printed electronics, Exposing and Printing Technologies
Prof. Wan-Chin Kim, *Hanbat National University, Korea*
Tan Trinh, *Western Digital Corporation, USA*

Fundamentals on Energy Assisted Magnetic Recording
Dr. Rahul Rai, *Western Digital Corporation, USA*
Haoyuan Mu, *Western Digital Corporation, USA*

Micro/Nano & Biomedical Mechatronic Systems
Prof. Kenji Fukuzawa, *Nagoya University, Japan*
Prof. Frank E. Talke, *CMRR | University of California, San Diego, USA*

Optical Imaging Devices and Opto-mechatronic Systems
Prof. Paul C.-P. Chao, *NCTU, Taiwan*
Dr. M.D. Murthy Peri, *Seagate Corporation, USA*

Smart Materials
Haoyuan Mu, *Western Digital Corporation, USA*
Prof. Jia-Yang Juang, *NTU, Taiwan*

Smart Sensors and Actuators
Prof. James Chang, *National Tsing Hua University, Taiwan*
Prof. Ja Choon Koo, *Sungkyunkwan University, Korea*

Tribology, Dynamics and Servo control of Nano-Micro systems
Prof. Frank E. Talke, *CMRR | University of California, San Diego, USA*
Prof. Jia-Yang Juang, *NTU, Taiwan*

SCHEDULE-AT-A-GLANCE

DAY 1 - WEDNESDAY, JUNE 2, 2021

Meeting Room	18:00 - 18:35 MILITARY 3:00 PM - 3:35 PM PDT 6:00 PM - 6:35 PM EDT	18:40 - 20:00 MILITARY 3:40 PM - 5:00 PM PDT 6:40 PM - 8:00 PM EDT	20:00 - 20:10 MILITARY 5:00 PM - 5:10 PM PDT 8:00 PM - 8:10 PM EDT	20:10 - 20:55 MILITARY 5:10 PM - 5:55 PM PDT 8:10 PM - 8:55 PM EDT	21:00 - 21:55 MILITARY 6:00 PM - 6:55 PM PDT 9:00 PM - 9:55 PM EDT
1	**Welcome from the Organizing Committee**	**Track 1** - Fundamentals on Energy Assisted Magnetic Recording & Tribology | Dynamics and Servo control of Nano-Micro systems	**SHORT BREAK**	**KEYNOTE #1** John W. Dykes, Ph.D.	**TUTORIAL by Dr. Ephiram Suhir**
2		**Track 2 -** Application of Data and Artificial Intelligence in Mechanical Engineering - Part 1			
3		**Track 3** - Smart Sensors and Actuators - Part 1			

DAY 2 - THURSDAY, JUNE 3, 2021

Meeting Room	18:00 - 18:45 MILITARY 3:00 PM - 3:45 PM PDT 6:00 PM - 6:45 PM EDT	18:50 - 20:10 MILITARY 3:50 PM - 5:10 PM PDT 6:50 PM - 8:10 PM EDT	20:15 - 21:00 MILITARY 5:15PM - 6:00 PM PDT 8:15 PM - 9:00 PM EDT	21:00 - 21:10 MILITARY 6:00 PM - 6:10 PM PDT 9:00 PM - 9:10 PM EDT	21:10 - 22:30 MILITARY 6:10 PM - 7:30 PM PDT 9:10 PM - 10:30 PM	22:30 -23:00 MILITARY 7:30 PM - 8:00 PM PDT 10:30 PM - 11:00 PM EDT
1	**KEYNOTE #2** Kris Schouterden, Ph.D.	**Track 4** - Advanced Simulation in Science and Engineering - Part 1	**KEYNOTE #3** Prof. Jia-Yang Juang	**SHORT BREAK**	**Track 7** - Advanced Simulation in Science and Engineering - Part 2 | Application of Data and Artificial Intelligence in Mechanical Engineering - Part 2	**AWARDS & CLOSING CEREMONY**
2		**Track 5 -** Dynamics and Control for Future Technologies - Part 1			**Track 8** - Optical Imaging Devices and Opto-mechatronic Systems | Smart Materials | & Dynamics and Control for Future Technologies	
3		**Track 6** - Smart Sensors and Actuators - Part 2			**Track 9** - Micro/Nano & Biomedical Mechatronic Systems| Flexible Media Handling Machines and Printed electronics, Exposing and Printing Technologies	

DAY 1 – JUNE 2, 2021

6:00 PM - 6:35 PM EDT

Welcome by Thomas Costabile P.E., ASME's Executive Director / CEO ISPS Conference Chair, Dr. Abhishek Srivastava, and ISPS Division Chair, Dr. Shaomin Xiong

6:40 PM - 8:00 PM EDT
Concurrent Technical Track Sessions (TRACKS 1, 2 & 3)

Track 1 - Fundamentals on Energy Assisted Magnetic Recording & Tribology, Dynamics and Servo control of Nano-Micro systems

MODERATOR: *Dr. Rahul Rai, Western Digital Corporation*

62275   Experimental Study of Nanoscale Head-Disk Heat Transfer In Heat-Assisted Magnetic Recording
Qilong Cheng, UC Berkeley

64984   Material Transfer From Media to Head in Heat Assisted Magnetic Recording (HAMR)
Shaomin Xiong, Western Digital Corporation

66171   Computational and Experimental Investigation of Contact Detect Response of a Head-Integrated Thermistor on HAMR vs. PMR Media
Manuel C. Anaya-Dufresne, Seagate Technology

65324   A New Method to Calibrate Protrusion Measurement on a Small Heating Device
Haoyuan Mu, Western Digital Corporation

63202   Control of Head Smear Generated From Dlc Films Using an External Electric Field
Hiroshi Tani, Kansai University

65314   Characterization of Heads Fly Height Modulation Using the Heater Induced Perturbations
Rahul Rai, Western Digital Corporation

65255   Fpga-Based Implementation of Torque Controller for 6-Dof Articulated Robots
Paul C.-P. Chao, National Chiao Tung University

Track 2 - Application of Data and Artificial Intelligence in Mechanical Engineering - Part 1

MODERATOR: *Shaomin Xiong, Western Digital Corporation*

65031   Model of Human Action Recognition Based on 2d Kernel
Victorita Radulescu, University Politehnica of Bucharest

65295   Scratch Detection on Hard Disk Drive Media to Reduce Head Disk Interaction and Prevent Data Loss
Karthik Venkatesh, Western Digital Corporation

65218 A New Approach to Enhance Artificial Intelligence for Robot Picking System Using Auto Picking Point Annotation
Cheng-Han Tsai, Industrial Technology Research Institute

65230 Convolutional Neural Network Design for Improvement of Machining Quality Monitoring
Ting-Yu Chang, National Tsing Hua University

65277 Identification of Factors Affecting Disk Drive's Performance in Data Server by Use of Decision Tree Learning Method
Yi-Ju Liao, National Tsing Hua University

65374 Prediction of Oled Temperature Distribution Based on Neural Network
Paul C.-P Chao, Institute of Electrical and Control Engineering

Track 3 - Smart Sensors and Actuators - Part 1

MODERATOR: *Aravind N. Murthy, Western Digital Corporation*

63672 Electromagnetic Energy Harvester for Transportation Infrastructure Using Vehicle-Tread Force
Shinji Koganezawa, Kansai University

65097 A New Low Power Photoplethysmography Signal Acquisition System For Mental Stress Estimation
Rajeev Kumar Pandey, National Yang Ming Chiao Tung University

65236 Passive Air Leakage Detection Mechanism for a Vacuum Suction Actuator
Seung Ho Lee, Sungkyunkwan University

65239 Modeling of Novel Arc Shaped Sma Actuator
Abdul Manan Khan, Hanbat National University, Daejeon, South Korea

65248 A High-Resolution and Low Offset Delta-Sigma Analog to Digital Converter for Detecting Photoplethysmography Signal
Rajeev Kumar Pandey, National Yang Ming Chiao Tung University

65257 Design of a 2 Dof Shape Memory Alloy Actuator Using Sma Springs
Hussein Ali, Hanbat National University

8:00 PM - 8:10 PM EDT
SHORT BREAK

8:10 PM – 8:55 PM EDT
KEYNOTE #1 - John W. Dykes, Ph.D., Seagate Technology
Lecture Title: *Meeting Datasphere Storage Needs Through HDD Engineering*

9:00 PM – 9:55 PM EDT
TUTORIAL by Dr. Ephiram Suhir, Portland State University
Tutorial Title: *Thermal Stress Failures in Electronic and Photonic Packaging: Prediction and Prevention*

DAY 2 – JUNE 3, 2021

6:00 PM – 6:45 PM EDT

KEYNOTE #2 - Kris Schouterden, Ph.D., Western Digital Corporation
Lecture Title: *HDD2030 - The Passion for Innovation and Invention Continues*

6:50 PM – 8:10 PM EDT
Concurrent Technical Track Sessions (TRACKS 4, 5 & 6)

Track 4 - Advanced Simulation in Science and Engineering - Part 1

MODERATOR: *Robert Smith, Western Digital Corporation*

65036   Modeling 3D Convolution Architecture for Actions Recognition
Bogdan Alexandru Radulescu, University Politehnica of Bucharest

65201   Mineral Oil As an Alternative Cooling Method
John Tobin, Manhattan College

65287   Networking of Digital Twins in the Digital Factory for Single Part Manufacturing Simulation
Johannes Olbort, Technical University of Darmstadt

65300   Concept of a System Architecture for a Simulation Data Management In the Digital Twin
Benjamin Röhm, Technical University of Darmstadt

64975   Optimal Design Based on Deep Learning of Interior Permanent Magnet Synchronous Motor Used in Electric Oil Pump
Soo-Whang Baek, Sangmyung University

65058   Evaluation of Mechanical Reliability of Micro Bump in Semiconductors Through a Shear Test
Yeungjung Cho, Hanyang University

Track 5 - Dynamics and Control for Future Technologies - Part 1

MODERATOR: *Jia-Yang Juang, National Taiwan University*

64988   Thermal Throttling by Model Predictive Control in Flash Memory
Shaomin Xiong, Western Digital Corporation

65202   A 3D Multi-Object Tracking Based on Bounding Box and Depth
Chun-Hao Feng, National Tsing Hua University

65266   Active-Passive Vibration Control for Fans in the Data Server
Han-Sheng Chen, National Tsing Hua University

65385   Development of Algorithms for Performance Index-Based Actuator Fault Detection and Fault-Tolerant Control of Autonomous Vehicle With Adaptive Feedback
Se-Chan Oh, Hankyong National University

65220   Design of a High-Performance Tracking Controller for a Class of Motion Control Systems
Ho Seong Lee, Gyeongsang National University

65283   Gnss Performance Enhancement Using Receiver Raw Measurement in Urban Area
Seongkyun Jeong, Sangmyung University

Track 6 - Smart Sensors and Actuators - Part 2

MODERATOR: *Jen-Yuan (James) Chang, National Tsing Hua University, Taiwan*

65264   A Novel Application of Wiegand Effect for Generating a Reference Signal in Linear Positioning System
Hung-Lin Lien, National Tsing Hua University

65146   Vacuum-Actuated Buckling-Based Fingers
Chih-Wen Ou-Yang, National Taiwan University

65212   Analysis and Design of a Vertical Linear Actuator With Gravity Compensation for Wafer Metrology Application
Kyung-Min Lee, Chungnam National University

65273   Micro Double-Legs Robot Using Electromagnetic Oscillatory Actuator
Quang Hoan Le, Hanbat National University

65328   A High-Speed, Short-Stroke Xy-Stage With Counterbalance Mechanisms for Highly Focused Laser Machining
Joanne Yoon, Graduate School of Convergence Science and Technology, Seoul National University

65351   Detection of Full Phases in a Gait Using Multi-Modal Sensor-Integrated Shoes
Daeho Lee, KAIST

8:15 PM - 9:00 PM EDT

KEYNOTE #3 - Prof. Jia-Yang Juang, National Taiwan University
Lecture Title: *Soft Robotics: Shape Morphing and Locomotion by Controlled Buckling*

9:00 PM - 9:10 PM EDT
SHORT BREAK

9:10 PM – 10:30 PM EDT
Concurrent Technical Track Sessions (TRACKS 7, 8 & 9)

Track 7 - Advanced Simulation in Science and Engineering - Part 2 & Application of Data and Artificial Intelligence in Mechanical Engineering - Part 2

MODERATOR: Dr. M.D. Murthy Peri, Seagate Technology

65232   Calculation of Electromagnetic Forces for EDS Type Maglev Using 3-D Finite Element Model
Seonbin Lim, Yonsei University

65242   A Study on Thermal Management of Fdm Type 3d Printer for Deposition of Bio-Compatible Materials
Sang Wook Lee, Wonkwang University

65262   Multiple Point Loading on Thin Cantilever Rectangular Plate Subjected to Pure Bending
Aniket Anil Hase, National Tsing Hua University

65267   Implementation of Artificial Intelligence in Bending Analysis of Propeller/Fan Blade
Aniket Anil Hase, National Tsing Hua University

Track 8 - Optical Imaging Devices and Opto-mechatronic System, Smart Materials & Dynamics and Control for Future Technologies - Part 2

MODERATOR: Prof. Wanchin Kim, Hanbat National University, Korea

65039   TCN Units, Solution in Recognition of Human Activities
Bogdan Alexandru Radulescu, University Politehnica of Bucharest

65371   Portable Ophthalmic Device for Remote Slit-Lamp Examinations and Visual Acuity Screening
Alex Phan, UC San Diego - CMRR

65131   Transparent Conductive Gzo Patterns Fabricated by Co2 Laser-Assisted Atmospheric Pressure Plasma Jet
Yun Chung Lee, National Taiwan University Department of Mechanical Engineering

65354   Characterization of Electric Fields Generated by Electricidal Coatings for Biofilm-Resistant Catheters
Luke Lindgren, University of California, San Diego

65315   Design of Haptic Interface for Endpoint-Based Robotic Manipulation
Jae Hwan Bong, Sangmyung University

Track 9 - Micro/Nano & Biomedical Mechatronic Systems & Flexible Media Handling Machines and Printed electronics, Exposing and Printing Technologies

MODERATOR: Dr. Tan Trinh, Western Digital Corporation

65185   Experimental and Numerical Investigation of Heat Transfer Through Porcine Heart and Esophageal Tissue
Karcher Morris, UC San Diego

65188   Vision-Based Motion Planning of Cable-Driven Parallel Robots in the Presence of Moving Obstacle Using Sampling-Based Method
*Jiajun Xu, Gachon University*

65367 Design of a 3D Printed Micro-Transmission System for a Detachable Bronchoscope
Matthew Kohanfars, UC San Diego

65383 Transporting Carrier With Droplets Driven by Electrowetting-on-Dielectric Effect
Jian-Zhang He, National Tsing Hua University

65921 Advance Monitoring of Blood Pressure and Respiratory Rate Using De-Noising Auto Encoder
Seung-Ho Park, Gachon University

64689 Individual Drive Cross-Coupled Control System to Compensate for Measurement Error for Roll-to-Roll Contact Pressure Uniformization
Daehyeon Kim, Department of Mechanical Engineering, Chungnam National University

KEYNOTE SPEAKERS
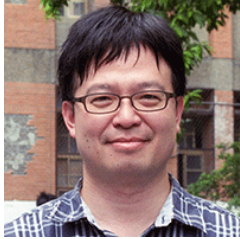
Prof. Jia-Yang Juang
Professor and Associate Chair of the Department of Mechanical Engineering, National Taiwan University

Lecture Title: *Soft Robotics: Shape Morphing and Locomotion by Controlled Buckling*

Biography: Professor Jia-Yang Juang received the B.S. and M.S. degrees from National Taiwan University in 1997 and 1999, respectively, and the Ph.D. degree from University of California, Berkeley in 2006, all in Mechanical Engineering. His PhD study was funded by Computer Mechanics Laboratory (CML) and California State Nanotechnology Fellowship. From 2006 to 2011 he worked as a Research Staff Member and Senior Principal Engineer in Hitachi Global Storage Technologies and Western Digital Corp., respectively, in Silicon Valley, California. He joined the faculty of Department of Mechanical Engineering at National Taiwan University in 2011, and is now a full professor and associate chair. He is a Senior Member of IEEE and a Member of ASME.

Prof. Juang's research interests include thin film materials/atmospheric pressure plasma jet/laser processing, mechanics of biological materials/bioinspired materials, and soft robotics/shape morphing. He holds 16 granted United States patents, one China patent and several pending United States patents. He has published 40 journal papers and 40 papers in international conference proceedings. He is on the editorial board of three journals, and has reviewed manuscripts for 49 journals. He won the Best Paper Award in the 28th and 29th ASME Annual Conferences on Information Storage and Processing Systems (ISPS 2019 and 2020).

Kris Schouterden, Ph.D.
Vice President, Development Engineering, HDD R&D, Western Digital

Lecture Title: *HDD2030 - The Passion for Innovation and Invention Continues*

Biography: After graduate school, Kris joined IBM in 1997 as an engineer doing development in the area of advanced head-disk-interface. His first contact with product development came in 2001 during a 1-year assignment in Fujisawa working on mobile products. After returning to San Jose, Kris took progressively broader roles in the Performance Enterprise development area and subsequently started to cover all HDD products. After another international assignment to Fujisawa between 2011-2014, currently, he is VP of Recording Sub-System product development.

John W. Dykes, Ph.D.
Managing Principal Technologist at Seagate Technology

Lecture Title: *Meeting Datasphere Storage Needs Through HDD Engineering*

Biography: John Dykes is a Managing Principal Technologist with responsibility for Device Physics simulation, experiments and staging in the research division of Seagate Technology. He holds a B.S. degree in Physics from Utah State University along with M.S. and Ph.D. degrees in experimental solid state physics from the University of California-Davis. During his career, John has conducted fundamental research at Lawrence Livermore National Laboratory and the National Institute of Standards and Technology. He has held engineering and management positions at several data storage companies over the past 24 years. John's areas of expertise include device physics and manufacturing, process development, technology assessment and staging, systems engineering, experimental design and data analysis, metrology and product development. He holds 11 patents and has been inducted into the Seagate Inventor's Hall of Fame.

SPECIAL TUTORIAL

Thermal Stress Failures in Electronic and Photonic Packaging: Prediction and Prevention

Dr. Ephraim Suhir
Portland State University, Portland, OR, USA
Technical University, Vienna, Austria; and
ERS Co., 727 Alvina Ct., Los Altos CA 94024, USA

Biography: Ephraim Suhir is on the faculty of the Portland State University, Portland, OR, US; Technical University, Vienna, Austria; and James Cook University, Townsville, Queensland, Australia. He is also CEO of the SBIR ERS Co. in Los Altos, CA, USA. Ephraim is the IEEE, the ASME, the SPIE, and the IMAPS Life Fellow; the APS, the IoP (UK), and the SPE Fellow; and AIAA Associate Fellow; has authored 450+ publications, presented numerous keynote and invited talks worldwide, and received many professional awards, including 1996 Bell Labs DMTS Award (for developing effective methods for predicting the reliability of complex structures used in AT&T and Lucent Technologies products), 2004 ASME Worcester Read Warner Medal Award (for outstanding contributions to the permanent literature of engineering and laying the foundation of a new discipline "Structural Analysis of Electronic Systems"; he is the third "Russian American", after S. Timoshenko and I. Sikorsky, who received this prestigious ASME award), the 2019 IEEE EPS Field award for seminal contributions to mechanical reliability engineering and modeling of electronic and photonic packages and systems and the 2019 IMAPS Lifetime Achievement Award.