2024 the 11th International Conference on Mechanical, Automotive and Materials Engineering

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2024

BANGKOK, THAILAND

December 18-20, 2024

Centara Watergate Pavilion Hotel Bangkok

Address: 567 Rachaprarop Rd., Makkasan, Ratchathewi, Bangkok 10400, Thailand

CENTARA
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Contents

Conference Venue

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โรงแรมเซ็นทารา วอเตอร์เกต พาวิลเลียน กรุงเทพฯ

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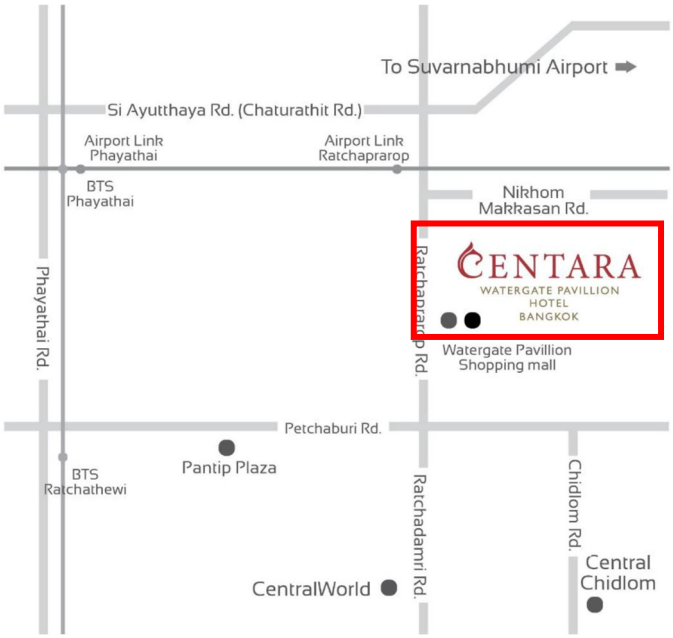

Attendance Guideline

Time Zone

UTC+7

Schedule

- ❑ **December 18: Sign-in and Conference Kits Collection ➔ 9F**
- ❑ **December 19: Keynote & Invited Speeches & Oral Sessions ➔ Pavillion 1 & 2 (9F)**
- ❑ **December 20: One Day Tour**

Language

- Please make presentation and discuss in English.

Oral Presentation

- ➢ Keynote Speech: 40 mins (including Q&A).
- ➢ Invited Speech: 30 mins (including Q&A).
- ➢ Author Presentation: about 13 minutes for presentation and 2 minutes for Q&A.

- Please make sure your presentation is well timed. Please keep in mind that the program is full and that the speaker after you would like their allocated time available to them.
- Each speaker is required to meet her/his session chair in the corresponding session rooms 10 minutes before the session starts and copy the slide file (PPT or PDF) to the conference computer.
- Please note that each session room will be equipped with a LCD projector, screen, point device, microphone, and a laptop with general presentation software such as Microsoft PowerPoint and Adobe Reader. Please make sure that your files are compatible and readable with our operation system by using commonly used fronts and symbols. If you plan to use your own computer, please try the connection and make sure it works before your presentation.
- Videos: If your PowerPoint files contain video clips, please make sure that they are well formatted and connected to the main files.

Poster Presentation

- ➢ Poster size - A0, 841 x 1189 mm, upright/portrait format.
- ➢ Poster to be printed and brought to conference site by presenter self.
- ➢ At least 1 author to stand by the poster during the Poster session, which is not only to present your work, but also to answer questions from the audience.

Reminder

Please attend the conference in formal attire.

Safety Reminder: Secure Valuable Items at All Times.

We remind you to secure your personal belongings at all times.

The conference organizer will not be responsible for the loss or damage to any personal belongings.

Emergency Numbers

Police: 191 Ambulance: 1646 Tourist Police: 1155 Tourist Information Center: 1672

Conference Committees

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Sashindra Kumar Kakoty, Indian Institute of Technology Guwahati, India
Leonardo Gunawan, Institut Teknologi Bandung, Indonesia

Program Outline

Day 1 | December 18, 2024 | Wednesday | UTC+7	
Time	**Activity**
14:00-17:00	Venue: 9F | Sign-in and Conference Kits Collection

Day 2 | December 19, 2024 | Thursday | UTC+7		
Time	**Activity**	
	Venue: Pavillion 2 (9F) Host: Conference Chair - Prof. Nguyen Quang Liem, Vietnam Academy of Science and Technology, Vietnam	
9:30-9:35	 **Opening Remark & Welcome Address** Conference Chair - Prof. John Mo, Royal Melbourne Institute of Technology, Australia	
9:35-10:20	 **Keynote Speech - Prof. Xingjian Jing** City University of Hong Kong, Hong Kong ***Beneficial Nonlinear Design in Engineering: The X-Structure/Mechanism Approach***	
10:20-10:45	**Group Photo & Coffee Break**	
	Host: Conference Chair - Prof. John Mo, Royal Melbourne Institute of Technology, Australia	
10:45-11:30	 **Keynote Speech - Prof. Wan Azmi bin Wan Hamzah** Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), Malaysia ***Recent trends in sustainable development techniques: "Novel Nanolubricant for Air-Conditioning and Refrigeration Systems"***	
11:30-12:00	 **Invited Speech - Assoc. Prof. Suwin Sleesongsom** King Mongkut's Institute of Technology Ladkrabang, Thailand ***DDO to RBDO, challenging of the newcomer***	
12:00-13:30	**Lunch Break**	
	Pavillion 2 (9F)	**Pavillion 1 (9F)**
13:30-15:30	**Sessoin 1** Engineering Materials and Mechanical Performance Analysis	**Session 2** Control Systems and Measurement Analysis in Electronic and Mechanical Engineering
15:45-17:30	**Session 3** Vibration Detection and Stability Analysis in Mechanical Systems	**Poster Session** Control Models and Mechanical Analysis in Digital Machinery and Manufacturing Systems
18:00-20:00	**Dinner Banquet & Award Ceremony @ Pavillion 1**	

Day 3 | December 20, 2024 | Friday | UTC+7	
Time	**Activity**
11:00-22:00	One Day Tour

Conference Chair

Prof. John Mo

Royal Melbourne Institute of Technology, Australia

John P. T. Mo is Professor of Manufacturing Engineering and former Head of Manufacturing and Materials Engineering at RMIT University, Australia, since 2006. He has been an active researcher in manufacturing and complex systems for over 35 years and worked for educational and scientific institutions in Hong Kong and Australia. From 1996, John was a Project Manager and Research Team Leader with Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) for 11 years leading a team of 15 research scientists working on high value industrial projects. A few highlights of the projects that John led in CSIRO and in RMIT include: signal diagnostics for plasma cutting machines, ANZAC ship alliance engineering analysis, optimisation of titanium machining for aerospace industry, critical infrastructure protection modelling and analysis, polycrystalline diamond cutting tools on multi-axes CNC machine, system analysis for support of complex engineering systems, national Electronic Product Code demonstrator (for Australia). John has been academic advisor for a number of educational institutions in the Australasian region on their engineering program development and operations. John obtained his doctorate from Loughborough University, UK and is a Fellow of Institution of Mechanical Engineers (UK) and Institution of Engineers Australia.

Research Interests

- system integration, risk analysis, infrastructure modeling, signal diagnostics, and manufacturing optimization

Conference Chair

Prof. Nguyen Quang Liem

Vietnam Academy of Science and Technology, Vietnam

Nguyen Quang Liem is a Professor of physics. He served as Director of Institute of Materials Science (IMS), Vietnam Academy of Science and Technology (VAST) over the period 2009–2017. He has rich experiences in optoelectronic materials and has published more than 100 papers on international journals, one book and some patents. His research interests are in optoelectronic materials (film and quantum dots/nanocrystals) and devices (luminescent materials for light emitting diode and for biolabeling/sensors, photocatalysts for photo-reactivity and for photoreactor), development of scientific instruments and spectroscopic measuring techniques, especially some related ones like Raman scattering and photoluminescence spectroscopy enhanced with surface plasmon resonance for fast/non-destructive and sensitive analysis/detection of residual pesticides, chemical radicals, characterizations of the ancient art/cultural products. He is the Vice-President of the Vietnam Physical Society (VPS) and a Council Member of the Association of Asia Pacific Physical Societies (AAPPS). He is Editor-in-Chief of Advances Natural Sciences: Nanoscience and Nanotechnology (IOP Publishing), editorial member of Heliyon (Elsevier) and of Journal of Science: Advanced Materials and Devices (Elsevier).

Research Interests

- Optoelectronics, Nanomaterials, Historical ceramics

Keynote Speaker

Prof. Xingjian Jing
City University of Hong Kong, Hong Kong

- **Venue: Pavillion 2**
- **Time: 9:35-10:20, December 19, 2024**

Speech Title: Beneficial Nonlinear Design in Engineering: The X-Structure/Mechanism Approach

Biography: Xingjian Jing received the B.S. degree from Zhejiang University, China, the M.S. degree and PhD degree in Robotics from Shenyang Institute of Automation, Chinese Academy of Sciences in 2001 and 2005, respectively. He also achieved the PhD degree in nonlinear systems and signal processing from University of Sheffield, U.K. in 2008.

He is now a Professor with the Department of Mechanical Engineering, City University of Hong Kong. Before joining in CityU, he was a Research Fellow with the Institute of Sound and Vibration Research, University of Southampton, followed by assistant professor and associate professor with Hong Kong Polytechnic University. His current research interests include: Nonlinear dynamics, Vibration, Control and Robotics, with a series of 200+ publications of 12800+ citations and H-index 59 (in Google Scholar), with a number of patents filed in China and US. He is one of the top 2% highly cited world scientists and a senior IEEE member. He currently serves Associate Editors of Mechanical Systems and Signal Processing, IEEE Transactions on Industrial Electronics, & IEEE Transactions on Systems, Man, Cybernetics -Systems, and served as Technical Editor of IEEE/ASME Trans. on Mechatronics during 2015-2020. He was the lead editor of a special issue on "Exploring nonlinear benefits in engineering" published in Mechanical Systems and Signal Processing during 2017-2018 and is the lead editor of the other special issue on "Next-generation vibration control exploiting nonlinearities" published in MSSP during 2021-2022.

Abstract: Nonlinearity can take an important and critical role in engineering systems and thus cannot be simply ignored in structural design, dynamic response analysis, and parameter selection. A key issue is how to analyze and design potential nonlinearities introduced to or inherent in a system of under study, which is greatly demanded in many practical applications involving vibration control, energy harvesting, sensor systems and robots etc. This talk will present an up-to-date review on a cutting-edge method for manipulation and employment of nonlinearity in engineering systems developed in recent years, named as the X-structure or mechanism approach. The method is inspired from animal leg/limb skeletons and can provide passive low-cost high-efficiency adjustable and beneficial nonlinear stiffness (high static & ultra-low dynamic), nonlinear damping (dependent on resonant frequency and vibration excitation amplitude) and nonlinear inertia (low static & high dynamic) individually or simultaneously. The X-shaped structure or mechanism is a generic and considerably simple structure or mechanism representing a class of beneficial geometric nonlinearity with realizable and flexible linkage mechanism or structural design of different variants or forms (quadrilateral, diamond, polygon, K/Z/S/V-shape, or others) which all share similar geometric nonlinearity and thus similar nonlinear stiffness/damping properties, flexible in design and easy to implement. This talk systematically reviews the research background & motivation, essential bio-inspired ideas, advantages of this novel method, beneficial nonlinear properties in stiffness, damping and inertia, and potential applications, and ends with some remarks and conclusions.

Keynote Speaker

Prof. Wan Azmi bin Wan Hamzah
Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), Malaysia

- **Venue: Pavillion 2**
- **Time: 10:45-11:30, December 19, 2024**

Speech Title: Recent trends in sustainable development techniques: "Novel Nanolubricant for Air-Conditioning and Refrigeration Systems"

Biography: Prof. Dr. Wan Azmi bin Wan Hamzah (W. H. Azmi) is currently a Professor in Mechanical Engineering at the Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA). He received his B. Eng. in Mechanical Engineering from Universiti Teknologi Malaysia (UTM), M. Eng. and Doctor of Philosophy in Mechanical Engineering from Universiti Kebangsaan Malaysia (UKM) and Universiti Malaysia Pahang (UMP), respectively. His research interests are heat transfer, thermo-fluid engineering, automotive, nanotechnology, cooling systems, lubrication, air-conditioning systems, solar systems, tribology, and many more. He specialises in nanoparticle dispersion technology (Nano-Distec), which is mainly used in automotive systems. The research involved the invention of advanced automotive liquids using nanotechnology, namely Nanocoolants, Nanolubricants, and Nanopaints. His excellent research work has been published in over 100 high-impact journals. His works have over 8000 citations with an h-index of 52 in SCOPUS. He was awarded a remarkable total of 100 awards from national and international bodies for the research outcome.

Abstract: Nowadays, air-conditioning and refrigeration systems contribute to high energy demand and consumption worldwide. The endeavour toward efficient air-conditioning and refrigeration systems is vital in effectively utilising energy. One novel technique to encounter this issue is dispersing nanoparticles in the compressor's lubricant, namely nanolubricant. Nanolubricant application in refrigeration systems can enhance the overall performance of the systems by improving the properties of their original base lubricants. The present talk aims to highlight the recent trends in sustainable development techniques by applying nanolubricants in air-conditioning and refrigeration systems. The nanolubricants were primarily prepared using two-step preparation. The stability of nanolubricants was evaluated by qualitative and quantitative methods. Next, the talk will examine the thermo-physical and tribological properties of nanolubricants, evaluate the performance of automotive and residential air-conditioning systems operated with mono and hybrid nanolubricants, and investigate the optimum condition of the system performance using nanolubricant. Stability evaluation showed that all nanolubricants have excellent stability attributes, with limited sedimentation observed. Dynamic viscosity and thermal conductivity of the mono and hybrid nanolubricants increased with volume concentration but decreased with temperature. Promising tribological results were obtained from nanolubricants, significantly reducing the coefficient of friction. Performance improvements were found for almost all tested samples when nanolubricants were applied in the system. Nanolubricants have contributed to the reduction of compressor work, cooling capacity enhancement, and power consumption in the system. In conclusion, nanolubricants can enhance lubricant properties and improve the overall system's performance when operating with green refrigerant. Nevertheless, a full-blown durability run of air-conditioning and refrigeration systems with nanolubricants is recommended for future work. The new generation of nanolubricant technology in air-conditioning and refrigeration systems with smaller components and higher efficiency is anticipated soon.

Invited Speaker

Assoc. Prof. Suwin Sleesongsom
King Mongkut's Institute of Technology Ladkrabang, Thailand

- **Venue: Pavillion 2**
- **Time: 11:30-12:00, December 19, 2024**

Speech Title: DDO to RBDO, challenging of the newcomer

Biography: Assoc. Prof. Suwin Sleesongsom received his Ph.D. in Mechanical Engineering from Khon Kaen University, Khon Kaen, Thailand, in 2012. Currently, he is a lecturer at Department of Aeronautical Engineering, International Academy of Aviation Industry, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand. He has authored numerous articles published in prestigious journals including Knowledge-Based Systems, Structural and Multidisciplinary Optimization, Engineering Optimization and Aerospace. His researches are published more than 40 papers in International Conferences and International Journals, and with higher 500 citations. His primary research focuses on evolutionary optimization, mechanism and machinery, aeroelasticity, aircraft structure design, uncertainty quantification, and reliability-based design optimization. Over the past decade, Assoc. Prof. Suwin Sleesongsom's team focuses on the research, that related to an aircraft structure design. The research title "Surrogate Assisted Reliability Optimization of an Aircraft Wing with Static and Dynamic Aeroelastic Constraint" is received the most cited article award from International Journal of Aeronautical and Space Sciences in 2022. He still working hard on research and extend his work to the field of uncertainty quantification and reliability-based design optimization, which has been published in research papers more than 15 papers in a half decade. Additionally, he works as a reviewer to support many researchers by reviewing more than 100 papers. He works as review editor for Frontiers in Aerospace Engineering Journal and International Conference on Swarm Intelligence (ICSI). His research interests include the multidisciplinary design optimization mechanisms/machine design, the aeroelastic design of aircraft structures, and the reliability-based design optimization.

Abstract: Due to lack of exact knowledge about physical parameters and working environment in engineering design, the optimum design is usually estimated from deterministic analysis starting from the conceptual design stage. In practice, real world engineering system involves uncertainties due to some parameters are finitely measured by observing, especially for the geometrical parameters, material properties, load and so on due to the random in nature, which have enough or lag of information. Changing direction of research works from deterministic design optimization (DDO) to reliability-based design optimization (RBDO), in the past to present, recent updated works can bring the newcomer to this field easier than the previous. Author's works including theory in uncertainty quantification (UQ), RBDO using probabilistic technique or non-probabilistic technique, and reliability-based topology optimization (RBTO) are provided with computer codes for the newcomer studying cutting-edge knowledge in engineering design, including UQ, RBDO, TO, and RBTO, in a simple manner.

Session 1

"Engineering Materials and Mechanical Performance Analysis"

Chair: Prof. Wan Azmi bin Wan Hamzah, Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA), Malaysia

Time: 13:30-15:30, December 19, 2024	Venue: Pavillion 2 (9F)

Notes: The schedule of each presentation is for reference only. Presenters are required to attend the whole session, in case there may be some changes on conference day. Please join in the room 5-10 minutes earlier.

Time: 13:30-13:45	Paper ID: E24-101E	Presenter: Mingyang Li

Title: *Research on the Integrated Instruction of Virtual Simu-lation and Practical Operation of CNC Lathes for En-hanced Quality Productivity*

Authors: Hongwei Fan, Jianliang Huang, Jihua Hu, Yuan Dai, Mingyang Li

From: Sun Yat-sen University, China

Abstract: Practical instruction in CNC lathe operations constitutes a pivotal component of engineering education across ordinary colleges and universities nationwide. With-in the sphere of enhanced quality productivity, the practical teaching of CNC lathes faces unprecedented challenges and opportunities. This article is grounded in the philosophy of talent development through practice-driven innovation, ex-ploring in depth the comprehensive design and reform strategies for the CNC lathe practical teaching system. By integrating Swan CNC simulation software with the practical teaching framework and embracing the advanced CDIO (Con-ceive, Design, Implement, Operate) engineering education philosophy, the aim is to lead the transformation of CNC lathe instruction and guide its evolution toward digitization, informatization, and intelligence. The implementation of this innova-tive pedagogical model will not only significantly enhance students' engineering practice capabilities but also invigorate their innovative thinking and spirit of ex-ploration, thereby providing robust support for the cultivation of high-caliber technical talents that meet the demands of enhanced quality productivity.

Time: 13:45-14:00	Paper ID: E24-113	Presenter: Eki Dwi Juliansyah Putra

Title: *Influence of Carbody Bending Stiffness and Elastically Suspended Under-Chassis Equipment to the Vertical Vibration of the Railway Vehicle Carbody: A Study using A Scaled Model*

Authors: Yunendar Aryo Handoko, Eki Dwi Juliansyah Putra, Leonardo Gunawan

From: Institut Teknologi Bandung, Indonesia

Abstract: This paper outlines the alternative solutions to shift carbody system first bending frequency using an anti-bending bar and elastically suspended equipment under the carbody chassis. The study was conducted through numerical simulation of a scaled rail vehicle model. The model was validated by comparing the natural fre-quency with the experimental setup. According to the results, using the proper dimension of anti-bending bar to increase the carbody bending stiffness could enhance the carbody system first bending frequency without significantly increas-ing the carbody mass. Elastically suspended equipment can also work as a DVA to reduce structural bending vibration, and it will be optimum if the applied equipment natural frequency is slightly below the initial carbody system first bending frequency. The combination of both shifts the carbody system first bend-ing frequency higher.

Time: 14:00-14:15	Paper ID: E24-114	Presenter: Shen Houfa

Title: *Modeling of Secondary Cooling during Continuous Slab Casting based on the Realistic Water Spray Flux*

Authors: Xu Longyun, Dou Yahui, Ran Mou, Shen Houfa

From: Tsinghua University, China

Abstract: Continuous casting is a main process for the crude steel production, while the modeling and simulation serves an effective tool for the integrated computational materials engineering in the metallurgy. In order to predict and control the exit temperature of continuous casting slab, a three-dimensional model for the heat transfer and solidification during continuous casting has been developed based on the realistic roll apron and spray nozzle

arrangement. Both cold and thermal state properties of the nozzle spray on the slab were considered, and the complicated boundary conditions, such as spray cooling, natural convection, thermal radiation as well as roll conduction were involved in the model. By calibrating the caster dependent model factor, the calculated cooling curve and solidification end accorded with the measurements. An example of modifying the process parameters showed that the thick slab temperature was effectively improved, which satisfied the requirement of the continuous casting production with sound quality.

Time: 14:15-14:30	Paper ID: E24-126A	Presenter: Ching An Huang

Title: *Grinding performances of electroplated CBN grinding tools prepared for grinding slot in austenitic stainless steel (AISI 316L) plates*

Authors: Chia Hsuan Shen, Aphichart Rodchanarowan, Yu Zen Chen, Po Liang Lai, Ching An Huang

From: Chang Gung University, Taiwan

Abstract: Electroplated grinding tools with single- and dual-layer cubic boron nitride particles (CBNp) were developed through a three-step process: Ni-undercoating, Ni-CBNp co-electroplating, and Ni-B strengthen-electroplating. These tools, with composite coatings of 150 µm CBNp on a 3 mm AISI 440C rod, were annealed at 500°C, trimmed, and then tested for grinding performance on AISI 316L plates. Grinding forces were measured in three axes using a dynamometer. Optimal performance was achieved with an 80% CBNp coverage, a 120-µm-thick Ni-undercoat, and a chip-removal groove. Tools without chip-removal grooves experienced excessive grinding chip crushing, leading to nano-sized grains. The single-layer CBNp tool with a chip-removal groove achieved a 37% longer maximum ground length compared to its counterpart without the groove. The best performance, with a ground length of 1091 mm, was observed in the dual-layer CBNp tool with a chip-removal groove. Dynamometer readings identified three distinct grinding stages: stable, worn-off, and fracture. In the worn-off stage, tool coating experienced minor cracking and detachment. At the fracture stage, increased Fz force led to taper-grinding of the tool shaft end and eventual fatigue failure, typically occurring below the fixture without visible plastic deformation.

Time: 14:30-14:45	Paper ID: E24-129	Presenter: Asad A Khalid

Title: *Performance of Hybrid Aluminium-Glass/Epoxy Nested Tubes under Lateral Loading*

Authors: Asad A Khalid, Ak Luqman Pg Izudin Abas

From: Universiti Teknologi Brunei, Brunei

Abstract: With the increase in demand for structures that can absorb high energy in auto-motive and aerospace applications, noticeable amount of research was conducted to design reliable, efficient, and light weight energy absorbers. In recent years, nested tubes under lateral loading found to exhibit appreciably higher absorbed energy and increased efficiency of crushing force than single tubes having the same space subjected to lateral loading. In the current research paper, analysis on aluminum, glass and hybrid aluminum-glass/ epoxy combined tubes subjected to lateral loading were carried out. Empty and polyurethane foam filled combined tubes of hexagonal-circular, hexagonal-rectangular, and hexagonal-hexagonal cross-sections were modelled using LS-Dyna finite element software. Outer hex-agonal cross-section tube length and diameter were maintained as 50 mm. Each tube consists of four layers, each layer 1 mm thickness. Effect of tube cross-section, foam filler and material used on lateral force-displacement and efficiency of the crushing force was investigated. Absorbed energy of the combined tubes were determined and discussed. Failure mode of the fractured combined tubes was compared. Results show that the empty and foam filled hexagonal-rectangular combined tubes withstand higher load and absorbed higher energy than the hexagonal-hexagonal followed by hexagonal-circular tubes. Foam filled hexagonal-rectangular nested tubes of aluminum-glass/epoxy absorbed energy higher 5.88% and 20.5% than hexagonal-hexagonal followed by hexagonal-circular nested tubes respectively. The foam filler enhanced deformation stability, lateral load, and absorbed energy of the nested tubes.

Time: 14:45-15:00	Paper ID: E24-116	Presenter: Debajit Das

Title: *Effect of Texturing and Fluid Inertia on Journal Bearing Performance Considering Mass-Conserving Boundary Conditions*

Authors: Debajit Das, Sashindra Kumar Kakoty

From: Indian Institute of Technology Guwahati, India

Abstract: This paper investigates the combined influence of texturing parameters, fluid iner-tia and cavitation in the case of hydrodynamic journal bearings. The mass-conserving – Jakobsson-Floberg-Olson (JFO) boundary

conditions have been applied to account for the cavitation. The modified Reynolds equation has been solved by using the Gauss-Seidel method of successive iteration and the Progres-sive mesh densification method has been used to accelerate the numerical solu-tion. The findings from the study indicate that square texturing gives higher load-carrying capacity and lesser friction coefficients at high modified Reynolds num-bers, whereas spherical texturing gives higher load-carrying capacity and lesser friction variables at low modified Reynolds numbers. Further, higher load-carrying capacity and lesser friction variables are observed at a dimple area densi-ty of 0.15, whereas higher flow is observed at a dimple area density of 0.35.

Time: 15:00-15:15	Paper ID: E24-135	Presenter: A.H. Hamisa

Title: *Assessment of the Stability of Nanolubricants for SiO_2 and TiO_2 Nanoparticles Suspended in Polyol-Ester Lubricant*

Authors: A.H. Hamisa, W.H. Azmi, N.N.M. Zawawi, Taib Mohd Yusof, A.N. Aziah, A.M. Syafiq

From: UCYP University, Malaysia

Abstract: The application of nanolubricant enhanced the performance of the automotive air conditioning (AAC) system. The performance of electrically driven compressors in AAC systems (AAC-EDC) can be greatly enhanced by the stability of nanolubricants. Thus, the stability of TiO_2/POE and SiO_2/POE mono nanolubri-cants at temperatures up to 100 °C and volume concentrations ranging from 0.01% to 0.1% is examined in this study. Using a two-step preparation method, TiO_2 and SiO_2 nanoparticles were dispersed into the Polyol-ester (POE) base lubricant. Two approaches are used in the stability evaluation of the nanolubri-cant: qualitative and quantitative. The qualitative approach uses visual observa-tion. In contrast, the quantitative method is used Ultraviolet-visible (UV–Vis) spectroscopy and zeta potential evaluation. According to the visual observation, SiO_2/POE nanolubricants exhibited the best stability, followed by TiO_2/POE nanolubricants. Meanwhile, from the UV-Vis spectroscopy evaluation, mono TiO_2/POE sustained the concentration ratio by more than 90% with a sedimenta-tion time of up to 30 days. The zeta potential of the TiO_2/POE and SiO_2/POE mono nanolubricants was higher than 60 mV, indicating exceptional stability. It can be stated that the nanolubricants from this study have outstanding stability conditions and can be used further in the application of the AAC-EDC system.

Time: 15:15-15:30	Paper ID: E24-403	Presenter: Anas I. Alburay

Title: *A Comparative Study of Satellite Battery Performance in Space Environment*

Authors: Anas I. Alburayt, Majed A. Alharbi, Mohammed A. Alturky, Omar S. Alhossaini, Yasser H. Alattas

From: King Abdulaziz City for Science and Technology, Saudi Arabia

Abstract: Batteries play vital roles in many space applications. It is one of the main components of the spacecraft subsystem. It can provide the power required to maintain the running life of spacecraft instruments in a space environment. It allows controlling and managing the spacecraft to perform its processing for completing the time required in space. Obtaining a reliable battery for this pur-pose is important to success. For satellite applications, the batteries generate the power for the subsystems to communicate and transmit the data between the sat-ellite and the ground station. They can be used to store the recharging power from the solar panel and use it during the required times to make the power run all the time. Therefore, examining the power capability of the satellite is essential to ensure its functional efficiency during the long working period. To study the ef-fect of the space environment on the satellite batteries temperatures, the current work presents comparison results for the satellite batteries in three different working situations namely, nominal, hot and cold cases. The cases of hot and cold are considered severe and are chosen to represent the worst cases. One solar day is the simulation time that is enough to capture all significant power budget events. A finite element modelling (FEMAP) is used in the analysis. The numer-ical predicted results are compared with existing lab tests and with real values during orbital operations (Ground station). Predicted results show that the mini-mum and maximum average temperature of the batteries during nominal orbital operation is 15.80 °C and 19.40 °C, respectively. The lab results show that the minimum and maximum battery temperatures range between 10 °C and 30 °C. The predicted and real orbital operation temperatures are within an acceptable range when they compared with the lab results.

Session Group Photo | Best Presentation will be awarded during Dinner Banquet

Session 2

"Control Systems and Measurement Analysis in Electronic and Mechanical Engineering"

Chair: Prof. Nguyen Quang Liem, Vietnam Academy of Science and Technology, Vietnam

Time: 13:30-15:30, December 19, 2024	Venue: Pavillion 1 (9F)

Notes: The schedule of each presentation is for reference only. Presenters are required to attend the whole session, in case there may be some changes on conference day. Please join in the room 5-10 minutes earlier.

Time: 13:30-13:45	Paper ID: E24-104A	Presenter: Yu Aizawa

Title: *Research on lensless cameras for measurement*

Authors: Yu Aizawa, Ryoshu Furutani, Miyu Ozaki

From: Tokyo Denki University, Japan

Abstract: Lensless cameras are cameras that have no lens in their optical system. In conventional cameras, light from the subject is focused by the lens and recorded on the sensor. In contrast, a lensess camera incorporates a mask with a specific pattern in the optical system, and light passes through the mask and is recorded on the sensor. As light is not concentrated, the resulting image is blurred, so the subject's image is restored by computer processing using the mask pattern information. Most current measuring instruments have a structure with a lens inside the optical system. Measuring instruments using cameras also use lenses similarly and are dependent on the lens optics. In addition, although various mask patterns have been developed for lens-less cameras, there is a certain degree of difficulty in constructing camera systems. Therefore, in this study, a lensless camera for measurement was developed by utilizing the lensless camera's lensless structure, dividing the sensor and mask to create multiple viewpoints and applying the stereo method. In addition, a mask using OHP film with randomly arranged dots was easily manufactured. Two experiments were conducted using the lensless camera: the first was an experiment to evaluate the performance of the mask and lensless camera system using printed paper as a subject; the second was an experiment to evaluate the measurement function using several screws of different diameters as subjects. The lensless camera system fabricated base on the results of these experiments was evaluated and considered.

Time: 13:45-14:00	Paper ID: E24-405	Presenter: Tassei Uematsu

Title: *Path Generation Using Deep Reinforcement Learning for Model Predictive Control of Automatic Driving*

Authors: Tassei Uematsu and Tomoaki Hashimoto

From: Osaka Institute of Technology, Japan

Abstract: This study focuses on autonomous driving technology and proposes an optimal path design method to reduce the risk of traffic accidents. The auton-omous driving system is divided into three layers: "perception," "decision-mak-ing," and "control," each layer requires a distinct task. In previous studies, control methods using Model Predictive Control (MPC) have been proposed for the con-trol layer of the system design. On the one hand, this study aims to introduce deep reinforcement learning into the decision-making layer of the system design. The objective of this study is to propose a path generation method using deep rein-forcement learning for the MPC method applied to the automatic driving system. The effectiveness of the proposed method is verified by numerical simulation.

Time: 14:00-14:15	Paper ID: E24-105A	Presenter: Shoi Yamashita

Title: *Research on calibration method of articulated arm coordinate measuring machine by deep learning*

Authors: Shoi Yamashita, Ryoshu Furutani, Miyu Ozaki

From: Tokyo Denki University, Japan

Abstract: A co-ordinate measuring machine (hereinafter referred to as "CMM") is a measuring machine that maneuvers a probe at the tip of the measuring machine and contacts the object to be measured, converting its shape into coordinates in three-dimensional space to obtain the shape of the object to be measured. CMMs can be broadly divided into two types: Cartesian Coordinate Measuring Machines and Articulated Coordinate Measuring Machines. A Cartesian coordinate measuring machine (hereinafter referred to as "C-CMM") is a measuring

machine that moves its arm along the mutually orthogonal X-, Y-, and Z-axes and measures by contact. They have high measurement accuracy and are widely used in production. An articulated coordinate measuring machine (hereinafter referred to as "A-CMM") is a measuring machine that consists of multiple rotating joints and measures by the angles of the joints and the length of the arms. The A-CMM can freely approach the workpiece from any direction by bending the arm as desired, and thus can flexibly measure complicated shapes that are difficult to measure with the C-CMM. However, the A-CMM has not yet achieved the same level of accuracy as the C-CMM. This is because the length of each arm and the range of motion of each joint of the A-CMM are rarely as designed. Therefore, in this study, we performed appropriate calibration of A-CMMs using deep learning. We evaluate the learning of the coordinates measured by C-CMM using the angles of seven joints measured by A-CMM, and verify whether the learning is correct or not by determining the errors. In order to judge whether the training is properly performed, the errors are calculated in three patterns: "Data to update neural network weights", "Measured tip center of 7 pillars for each of the 8 pillars in the artifact", and "For each of the eight bars in the artifact, the center of the tip of the one remaining bar that was removed was measured to confirm the versatility of the results".

Time: 14:15-14:30	Paper ID: E24-407	Presenter: Taisuke Iwabuchi

Title: *Nonlinear Model Predictive Control for Landing Guidance of Reusable Rocket with Manipulation of Gimbal Angles and Aerodynamic Coefficients*

Authors: Taisuke Iwabuchi and Tomoaki Hashimoto

From: Osaka Institute of Technology, Japan

Abstract: The development of reusable rockets has attracted much attention to save the space mission cost. This study proposes a design method of control sys-tem for automatic landing of rockets based on nonlinear model predictive control. The system model considered here consists of the 6 degree of freedom motion, nonlinearity of dynamics, variation of fuel mass, and manipulation of gimbal an-gles and aerodynamic coefficients. The objective of this paper is to propose a control system design method based on model predictive control for automatic landing of reusable rockets with considering the variation of fuel mass and the manipulation of gimbal angles and aerodynamic coefficients. The effectiveness of the proposed method is verified by numerical simulations.

Time: 14:30-14:45	Paper ID: E24-108	Presenter: Itsuki Matsumura

Title: *The Extraction Method of Profile Based on Two Linear Stage Movement*

Authors: Itsuki Matsumura, Ryoshu Furutani, Miyu Ozaki

From: Tokyo Denki University, Japan

Abstract: Generally, profile measuring machines measure the contour profile of a work-piece by means of a displacement sensor moving on a moving stage axis and its sensor output. However, this method assumes that the movement of the stage on which the displacement sensor is mounted is known in advance or is linear. However, this assumption is not always correct. The movement axis error of a linear stage has a significant impact on the measurement. One approach to solving this problem is profile separation, and typical measurement methods are the in-version method and the multipoint method. However, each method has its own problems. In the inversion method, the workpiece is measured once, then inverted 180 degrees and measured again, and profile separation is performed based on the relationship between the two measurements. This method requires the incor-poration of a mechanism for inversion in the measurement device, which makes the entire device larger, and causes rotational errors during the inversion opera-tion. The multi-point method calculates the profile error of the moving stage axis by measuring with multiple displacement sensors. The problem with this method is that it is prone to profile errors at the zero-point due to the use of multiple dis-placement sensors. In this paper, we propose a measurement method that uses two independent linear stages and only one displacement sensor. In this method, the displacement sensor and the workpiece to be measured are placed on two in-dependent linear stages, and the displacement of the displacement sensor is meas-ured and calculated.

Time: 14:45-15:00	Paper ID: E24-402A	Presenter: Nutchanon Suvittawat

Title: *Cost Optimization of Airport Passenger Facility's Capacity connecting with High-Speed Rail*

Authors: Nutchanon Suvittawat, Christian Kurniawan, Nuno Antunes Ribeiro and Soh De Wen

From: Singapore University of Technology and Design, Singapore

Abstract: When discussing optimization in high-speed rail or airport manage-ment, most research focuses on the scheduling of train or airplane arrivals and departures to streamline passenger flow, minimize associated costs, and enhance passenger satisfaction. Various approaches exist to tackle this problem, including the use of mathematical

models to elucidate the variables and parameters in-volved in facility management. A commonly employed model in this context is the Poisson process. The Poisson process is a stochastic model that predicts the statistical probability of event arrivals based on the Poisson distribution. This distribution posits that at low arrival rates, the probability of fewer events occur-ring is higher, but as the arrival rate increases, the distribution pattern gradually resembles a normal distribution. This indicates that the highest probability of event occurrence is at the mean arrival rate, with symmetrical probabilities for occurrences above and below the mean. This study proposes the application of the Poisson process to simultaneously manage both high-speed rail and airport operations. A notable megaproject in Thailand aims to connect three international airports via high-speed rail, with train stations integrated into airport facilities. This shared space necessitates consideration of both train and airplane arrival and departure rates, including potential delays, to appropriately size the passenger facilities. An undersized facility could lead to passenger discomfort and damage the airport's reputation, while an oversized facility would result in unnecessary construction and maintenance costs. Therefore, optimization is essential to deter-mine the optimal facility capacity, balancing train and airplane schedules using the Poisson process. The proposed mathematical model considers the passenger facility for only one section: Departure zone. The zone is further segmented into three areas: normal (primary usage), spare (overflow usage), and emergency (contingency usage). Four cost categories are considered: Holding cost (for pas-sengers within the facility), Maintenance cost (irrespective of passenger pres-ence), Penalty cost (incurred when passengers are moved from normal to other areas), and Construction cost (Initial investment). The optimal capacities for the normal and spare areas are derived using an optimization method. This research illustrates the potential of employing the Poisson process to design passenger fa-cilities for combined train and airplane usage, achieving optimal space allocation with minimized costs. The concept can be extended to design and optimize any facility dependent on event probability following the Poisson process and distri-bution.

Time: 15:00-15:15	Paper ID: E24-106	Presenter: Keito Nagata

Title: *Study on a simplified length measurement method using an optical frequency comb modulated in the radio frequency domain with a lock-in amplifier*

Authors: Keito Nagata, Ryoshu Furutani, Miyu Ozaki

From: Tokyo Denki University, Japan

Abstract: The optical frequency of an optical frequency comb can be expressed as a fre-quency in the microwave band and is called the scale of light. Applications such as distance measurement and gas concentration temperature measurement using an optical frequency comb have been developed. However, optical comb devices are expensive laser transmitters, and it is difficult to conduct research using com-mercially available products. In this study, distance was measured using an inex-pensive optical comb. The laser emitted from the optical frequency comb was split into two optical paths by a half mirror and entered a detector, and the phase difference caused by the difference in the two optical paths was measured. After moving one of the detectors to change the optical path length, the phase difference was measured again. The difference between the two-phase differences was cal-culated, and the travel distance of the detector was calculated from this value. To measure the phase difference, a preamplifier, a double-balanced mixer, a frequen-cy doubler, and a lock-in amplifier were used. Since the frequency used in the measurement was too high to be locked in was difficult, a double-balanced mixer and a frequency doubler were used to beat down the electrical signal and measure the phase difference. In addition, to perform stable measurements, a signal was generated from the lock-in amplifier and the phase difference with that signal was measured, simplifying the lock-in and measurement.

Time: 15:15-15:30	Paper ID: E24-121	Presenter: Zhihui Liu

Title: *Improvements in calibration methods for NiCr-NiSi thin-film thermocouples*

Authors: Zhihui Liu, Yingyu Chen, Haochen Wang, Zixi Wang

From: Tsinghua University, China

Abstract: Thin-film thermocouples are widely used in microelectronics, precision instrumentation, and aerospace because of their fast response, small size, and light weight. However, accurate temperature measurement cannot be separated from accurate calibration. This paper systematically studies the calibration method of NiCr-NiSi thin-film thermocouples, discusses the main factors affecting the calibration accuracy, and proposes specific measures to optimize the calibration process. Through experimental verification, the optimized calibration method significantly improves the measurement accuracy and stability of the thin-film thermocouple.

Session Group Photo | Best Presentation will be awarded during Dinner Banquet

Session 3

"Vibration Detection and Stability Analysis in Mechanical Systems"

Chair: Dr. Yunendar Aryo Handoko, Institut Teknologi Bandung, Indonesia

Time: 15:45-17:30, December 19, 2024	Venue: Pavillion 2 (9F)

Notes: The schedule of each presentation is for reference only. Presenters are required to attend the whole session, in case there may be some changes on conference day. Please join in the room 5-10 minutes earlier.

Time: 15:45-16:00	Paper ID: E24-115	Presenter: Dhanjita Medhi

Title: *Variable-Pitch Vertical-Axis Turbine Evaluation Using NACA 4- and 5-digit Airfoils*

Authors: Dhanjita Medhi, Atul Kumar Soti

From: Indian Institute of Technology Guwahati, India

Abstract: The vertical-axis wind turbine (VAWT) has been the focus of several recent studies to improve its aerodynamic performance, with the basis on renewable energy sources. For improving the performance, the present work uses variable-pitch bladed VAWT with two distinct blade profiles. A 2-D numerical work has been conducted on a 3-bladed variable-pitch vertical-axis turbine by using NACA 0021 and NACA 23021 blade profiles. The computational work uses unsteady Reynolds Average Navier-Stokes equation (URANS) and SST k-ω turbulence model for simulating the flow around turbine. For all simulations, a sinusoidal pitching with an amplitude of 10° has been utilized in order to accommodate the variable-pitch mechanism. The moment and power coefficient values are computed for different tip speed ratios (TSR) and results are compared for both the profiles. Vorticity contours are displayed in the paper to see the impact on effectiveness.

Time: 16:00-16:15	Paper ID: E24-102	Presenter: Supasit Suerungruang

Title: *Associations between the Accident Parameters and Motorcyclist Injuries using Multibody Simulation and Decision Tree Analysis*

Authors: Supasit Suerungruang, Nachol Chaiyaratana, Julaluk Carmai

From: The Sirindhon international Thai-German Graduate School of Engineering (TGGS), Thailand

Abstract: Thailand has the highest rate of motorcycle fatalities globally, with motorcycles involved in 74.4% of fatal accidents. Different crash scenarios result in varying kinematic and injury responses in motorcyclists. A comprehensive understanding of the relationship between motorcycle accident parameters and motorcyclist injuries is crucial for developing effective countermeasures and vehicle safety solu-tions. This study examines the association between various accident parameters and the severity of motorcyclist injuries in motorcycle-vehicle collisions. Com-mon crash scenarios were categorized into ten distinct scenarios and two configu-rations based on 228 Thailand accident reports. Key accident parameters, includ-ing impact speed, angle, and point of impact, were identified and analyzed. Multi-body dynamics simulation was employed to reconstruct motorcycle accidents and define parameter boundaries. These models were then used to generate possible accident cases based on real-world accident scenarios. In total, 1,011 impact con-ditions were simulated to estimate head injury criteria and chest acceleration. The C4.5 decision tree was employed to analyze the association between the accident parameters and motorcyclist injury. The results show sufficient predictive abili-ties. Impact angle was the most influential factor in predicting head and chest in-juries. In the motorcycle impacting car configuration, motorcycle speed and the opponent vehicle's impact point affected predictions of head and chest injuries, while opponent vehicle speed was influential for predicting chest injuries. In the car impacting motorcycle configuration, opponent vehicle speed and the motorcy-cle's impact point affected predictions of head and chest injuries, while opponent vehicle impact point was influential for predicting head injuries.

Time: 16:15-16:30	Paper ID: E24-118	Presenter: Peibo Mao

Title: *Vibration Analysis of Mechanical System Under the Combined Action of Road Load and Impact Load*

Authors: Peibo Mao, Jianli Ge

From: Nanjing University of Science and Technology, China

Abstract: To investigate the impact laws of different factors on the vibrations of mechanical systems under road surface loads and impact loads, a multi-body dynamics model of the mechanical system was established. The road surface was modeled using white noise generation methods, and simulations were conducted under different road surface conditions to obtain the impact laws of various grades of road sur-faces on the mechanical system. A vertical stabilizer based on a three-ring control system was developed to analyze the vibration characteristics of the mechanical system in both scenarios—with and without the stabilizer. The simulation results indicated that the amplitude of system vibrations increased with the roughness of the road surface. Without stabilizers, when the road grade changes from D to E and F, the maximum pitch angle of the pitching part increases by 8.22% and 121.59% respectively. Additionally, the vertical stabilizer effectively enhanced the stability of the mechanical system; compared to the mechanical system without the stabilizer, the maximum pitch angle was reduced by 77.77%, and the fluctua-tion range of the pitch angle decreased by 71.68%.

Time: 16:30-16:45	Paper ID: E24-124	Presenter: Suman Swaraj Mishra

Title: *Investigation of Fluid-Structure Interaction Using Spectral Element Solver*

Authors: Suman Swaraj Mishra, Atul Kumar Soti

From: Indian Institute of Technology Guwahati, India

Abstract: The present work focuses on using and applying spectral element methods for investigating flow characteristics. Most numerical studies for analyzing fluid flow characteristics were carried out using the three traditional lower-order methods: finite difference, finite volume, and finite element method. The main demerits of these methods are computational cost and accuracy. The spectral element method is an extension of the finite element method which uses higher-order polynomials like the spectral methods, thus having a higher-order accuracy with less computa-tional time and complex geometry handling capacity. A comparison of the in-house solver with commercially available software has been done. A numerical simulation of flow past a stationary and sinusoidally oscillating square cylinder at Re = 100 and 150 was conducted and compared with previous studies to check the correctness of the solver. The main objective is to develop an efficient solver to simulate flow-induced vibration problems.

Time: 16:45-17:00	Paper ID: E24-406A	Presenter: Minami Morita

Title: *Model Predictive Control Using State Estimation Based on Unscented Kalman Filter for Stabilization of Underwater Vehicle Dynamics*

Authors: Minami Morita and Tomoaki Hashimoto

From: Osaka Institute of Technology, Japan

Abstract: This study focuses on the design problem of control systems for stabi-lization of nonlinear dynamics of underwater vehicles. Model predictive control (MPC) is a well-established control method in which the current control input is obtained by solving an optimal control problem. However, MPC method is inap-plicable to systems whose all state variables are not exactly known. In general, it is usual that the state variables of systems are measured through output sensors. Thus, only limited parts of them can be used for designing control inputs. The objective of this study is to establish a control method for stabilization of under-water vehicle dynamics by means of incorporating a state estimation method into the MPC method.

Time: 17:00-17:15	Paper ID: E24-109	Presenter: Abhijit Pal

Title: *Power Harnessing from Flow-induced Vibration of Five Cylinders in Sinusoidal Arrangement at Re = 150*

Authors: Abhijit Pal, Atul K. Soti

From: Indian Institute of Technology Guwahati, India

Abstract: Flow-induced Vibration (FIV) involves stable or unstable motion of the body due to two-way coupling of body motion and fluid flow. Five cylinders are ar-ranged at a sinusoidal formation and they can move as an unit while elastically mounted. Five cylinders are of equal diameter. The Reynolds number of the flow is fixed at 150. The horizontal and vertical spacing from the center of the cylinder to the next cylinder are 4.0 and 3.0. The amplitude of vibration increases as the damping of the system reduces. Highest amplitude shifted to higher reduced ve-locity with increasing damping. The power can be harvested through the motion of the body. Maximum average power is shifted to lower reduced velocity. Max-imum extracted power is observed to be 1.5 and 3 times than the tandem cylinder and single cylinder power output.

Time: 17:15-17:30	Paper ID: E24-133	Presenter: Suwin Sleesongsom

Title: *Four-Bar Path Synthesis for Variable Camber Wing Using Two Steps Approach*

Authors: Spencer Troy P.Cortez, Suwin Sleesongsom

From: King Mongkut's Institute of Technology Ladkrabang, Thailand

Abstract: The variable camber wing (VCW) mechanism synthesis is a present research aim. The variable camber wing is a main track for development of morphing aircraft from the past to the present due to it seems the high lift device in a traditional modern aircraft, but the separate flow due to its slot can be suppressed with the continuous shape changing. With structural-based camber change, the mechanism design requires a new technique in synthesizing the variable camber mechanism, which expects to adapt its' trailing edge. The deflection angle causes the VCW to generate an additional lift to the main body wing. The two-step approach is used in designing the new VCW mechanism which is crucial when it starts with aero-dynamic analysis at different deflected angles and follow with VCW mechanism synthesis. The mechanism synthesis expects to minimize the error between actual mechanism motion and target trailing edge points. The task of this research is to include design constraints to have the possibility of the four-bar mechanism to work well, and be able to work and be placed inside of the trailing edge. The op-timizers are selected to tackle the problem is a variation of teaching learning-based optimization. The results show the proposed method with two-step approach which can synthesize the variable camber wing mechanism and also meet with the design targets.

Session Group Photo | Best Presentation will be awarded during Dinner Banquet

Poster Session

"Control Models and Mechanical Analysis in Digital Machinery and Manufacturing Systems"

Time: 15:30-16:00, December 19, 2024	Venue: Pavillion 1 (9F)

P01	**(E24-110)** *Development of Conductive Heating Technology for Hot Stamping Process* Jeongsik Lim, Gyeongbuk Technopark, Korea
P02	**(E24-127)** *Research and Standardization Application of Energy Consumption Management for Light-duty Commercial Vehicles in China* Liu Zhichao, China Automotive Technology and Research Center Co., Ltd., China
P03	**(E24-132)** *Closed-form solutions for various pressurized holes in anisotropic elastic plates* Van Thuong Nguyen, VNU University of Engineering and Technology, Vietnam
P04	**(E24-139)** *hDriver: A Human-like Driver Model Capable of Style-Retaining and Self-learning for Better Speed Control* Xiangguang Ma, Wenzhou University, China
P05	**(E24-404E)** *Thermal, Metallurgical and Mechanical Determinants of Laminar Nickel/Aluminum Dissimilar Alloys during Laser-material Interaction Part // : Aluminum-based Alloy* Zhiguo Gao, Anyang Institute of Technology, China
P06	**(E24-130)** *Mathematical Modeling of Thermodynamic Behavior in a V-Shaped Thermal-Lag Engine* Duc-Thuan Phung, VNU University of Engineering and Technology, Vietnam
P07	**(E24-409)** *Mechanical Performance Simulation of Ti/Ti Bolted Joints under Hydraulic Dynamic Loading with Tension-torsion-shear Coupling Loads* Yifan Gao, Civil Aviation Flight University of China, China
P08	**(E24-134)** *Application of Artificial Neural Network in Evaluating the Performance of Savonius Vertical-Axis Wind Turbines* Minh Banh Duc, Vietnam National University, Vietnam
P09	**(E24-112A)** *Hot Stamping Process for Forming of Ultra-high Strength Steel using Focused Infra-red Light* Taehoon Kim, Altec. Co., Ltd., Republic of Korea
P10	**(E24-122)** *Distributed Drive Electric Vehicle Multi-Motor Speed Synchronization Control Based on Midrange Deviation Coupling Control* Changlin Zhu, Army Engineering University of PLA, China
P11	**(E24-138A)** *Development of a Halogen Lamp Heating-Based Localized Heating System for Reducing Defects in Cold Press Forming* Kyung Hwan Seo, Altec. Co., Ltd., Republic of Korea

One Day Tour

❑ Time: 11:00-22:00, December 20, 2024

❑ Itinerary:

- **11:00:** Pick-up from Centara Watergate Pavilion Hotel Bangkok
- **12:00:** Arrive at Erawan Shrine
- **13:00:** Arrive at The Grand Palace, Wat Phra Kaew
- **14:30:** Take boat to Wat Arun
- **17:30:** Arrive at Asiatique the Riverfront (free time)
- **19:30:** Have Seafood Buffet Dinner on Royal Galaxy Cruise
- **22:00:** Back to Centara Watergate Pavilion Hotel Bangkok

❑ Fee: 100USD

❑ What's Included

- ✓ English speaking tour guide
- ✓ Entrance fees to attractions
- ✓ Starting from conference hotel and return
- ✓ Transportation fees
- ✓ Sea Food Buffet Dinner

❑ Minimum Number of Tourist Required: 8 (Otherwise the one-day tour will be cancelled)

❑ Notice

- ✧ Please note that you are required to wear proper attire (no bare shoulder bare knees or strapless-heel shoes). Shoes must be removed before entering all temple buildings.
- ✧ Please be sure to bring your valid passport with you.
- ✧ Please abide by the laws formulated by the government of the Thailand, and those who violate them will bear the consequences.
- ✧ The scenic spots, meals and other arrangements in this tour shall be subject to the arrangement of the tour guide.
- ✧ **Lunch is not included.** Tourists are requested to arrive at Centara Watergate Pavilion Hotel Bangkok at least 10 minutes in advance. (The bus leaves at 11:00.)

❑ Highlights for the Tour

The Grand Palace

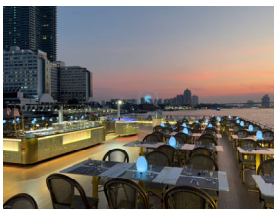
Wat Phra Kaew

Wat Arun

Asiatique the Riverfront

Royal Galaxy Cruise

Seafood Dinner



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