UNIVERSITI MALAYSIA PERLIS

ICADME 2023 gtEST 2023 congress

Conference Booklet

ICADME 2023

8th International Conference on Applications & Design in Mechanical Engineering

4 - 5 September 2023

Organized by:

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Faculty of Mechanical Engineering Technology

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INTERNATIONAL AND NATIONAL ADVISORY PANELS

PROGRAMME TENTATIVE (Day 1)

4th September 2023, Monday

0800 - 0830	**Registration** **Venue: Registration Counter, WTC, Kuala Lumpur**
0830 - 1030	**Keynote Address**: *"Design for Sustainability and Design for Circularity - The Roles of Biopolymer Composites"* (Prof. Ir. Dr. Mohd Sapuan Salit, UPM) Venue: PAHANG Room, WTC, Kuala Lumpur With vast experience and extensive research in the field of composite materials, **Prof. Ir. Dr. Mohd Sapuan Salit** keynote speech will explore the potential of biopolymer composites as a sustainable alternative to traditional materials in a circular economy. His talk will offer attendees valuable insights into the latest advancements in this field, along with practical strategies for effectively integrating biopolymer composites into sustainable design practices.
1030 - 1300	**Opening Ceremony** **Venue: Tun Dr Ismail Hall, WTC, Kuala Lumpur** - Arrival of Invited Guests - Arrival of YBhg. Prof. Dato' Ts. Dr. Zaliman Bin Sauli, Vice Chancellor of UniMAP - Arrival of YBhg. Tan Sri Dato' Sri Sufri Bin Hj. Mhd Zin, Chairman of the Board of Directors of UniMAP - Arrival of Invited Dignitaries - Arrival of YBrs. Prof. Dr. Azlinda Binti Azman,Director General of Higher Education - Negaraku & WAWASANKU Anthems - Welcome Address by YBhg. Prof. Dato Ts. Dr. Zaliman Bin Sauli, Vice Chancellor of UniMAP - Opening Address by YBrs. Prof. Dr. Azlinda Binti Azman, Director General of Higher Education - Launching Ceremony of the Global Trends in Engineering & Science Technology Congress - Presentation of Tokens of Appreciation - Signing of the Memorandum of Understanding (MoU) & Memorandum of Agreement (MoA) - Photography Session - Lunch Reception
1300 - 1400	**Prayer and Afternoon Break**
1400	**Parallel Session 2: ICADME 2023 (Physical)** **Venue: PAHANG Room, WTC, Kuala Lumpur**
1500	**Parallel Session 2: ICADME 2023 (Virtual)** **Venue : Google Meet platform**
1800	**End of Conference**

PROGRAMME TENTATIVE (Day 2)

5th September 2023, Tuesday

0800 - 0900	**Registration** **Venue: Registration Counter, WTC, Kuala Lumpur**
0900 - 1200	**Parallel Session 3: ICADME 2023 (Virtual)** **Venue : Google Meet platform**
1200 - 1300	**Lunch Break** **Venue : Google Meet platform**
1300	**End of Conference**

KEYNOTE SPEAKER

"Design for Sustainability: The Roles of Biopolymer Composites"

Prof. Ir. Dr. Mohd Sapuan Salit
Universiti Putra Malaysia (UPM)

Mohd Sapuan Salit is Professor of composite materials, Department of Mechanical & Manufacturing Engineering, Universiti Putra Malaysia, and Head of Advanced Engineering Materials & Composite Research Centre, UPM. He earned BEng in Mechanical Engineering, University of Newcastle, Australia, MSc in Engineering Design, Loughborough University, UK and PhD in Material Engineering, De Montfort University, UK. He is a Professional Engineer, and Fellow of Society of Automotive Engineers, Academy of Science Malaysia, International Society for Development and Sustainability, Plastic & Rubber Institute Malaysia, Malaysian Scientific Association and Institute of Material Malaysia. He is a Founding Chairman and Honorary Member of Society of Sugar Palm Development & Industry, Malaysia. He was appointed World Class Visiting Professor, Andalas University Indonesia. He is Editor in Chief of Journal of Natural Fibre Polymer Composites, co-editor-in-chief of Functional Composites and Structures, Associate Editor-in-Chief, Defence Technology, Elsevier, and editorial board of 30 journals. He has produced over 2000 publications including 900 journal papers, 60 books, and 220 chapters in book. He has delivered 60 plenary and keynote lectures, and 150 invited lectures. He organized 31 journal special issues as guest editor, reviewed 1500 journal papers. He successfully supervised 98 PhD and 75 MSc students. He received ISESCO Science Award, Khwarizimi International Award, Kuala Lumpur Royal Rotary Gold Medal Research Award, National Book Award, Citation of Excellence Award, Emerald, UK, Malaysia's Research Star Award, Publons Peer Review Award, USA, Professor of Eminence Award, Aligarh Muslim University, India and Top Research Scientists' Malaysia Award. He received SAE Subir Chowdhury Medal of Quality Leadership, Anugerah Tokoh Pekerja UPM, Anugerah Khas Akademia Putra, UPM, International Society of Bionic Engineering Outstanding Contribution Award, China, Ikon Akademia 2022, Ministry of Higher Education Malaysia, The World Academy of Sciences (TWAS) Award in Engineering Sciences, Materials Science Leader Award by Research.com and IET Malaysia Leadership Award.

Prof. Ir. Dr. Mohd Sapuan Salit has been selected as the keynote speaker for ICADME 2023, where he will deliver a speech entitled "Design for sustainability: The roles of biopolymer composites". Design for sustainability is based on the combination of product innovation and sustainability. United Nations Environment Program (UNEP) Design for sustainability rules of thumb emphasised, among others, on the importance of using cleaner materials, renewable materials, recyclable materials, and materials with positive social impact in the design process. Biocomposites fulfilled all these rules. Understanding the underlying concept of product innovation can help implementing design for sustainability project. Idea generation phase of design refers to the creative component of product development process. In this phase, various concepts were generated, put forward and used to generate new solutions, using different techniques. In this research, different techniques were used to generate design concepts for biocomposite products such as TRIZ, biomimetics, mindmapping and morphology chart. Biocomposites are emerging materials mainly obtained from plants; where their resources are renewable, recyclable, clean, able to generate local income, low cost, light weight and safe to use in addition to comparable specific strength and stiffness to selected traditional materials. Conceptual design of different products developed from biocomposites is presented including in car components, traditional tooth brush, bicycle and safety helmets, food packaging, motorcycle components, and furniture. In addition, the biocomposite materials used in such applications are described in terms of materials (fibre and matrix selection process, fabrication techniques, life cycle assessment, and performance. Advantages and disadvantages of biocomposites in such applications are also presented. Innovation in design also helped in improving the mechanical performance of biocomposites such as through sandwich structures, nanoscale materials, additive manufacturing, lamination technology, hybridization and blends, and the incorporation of design features such as ribbing, and bosses. Industrial application of biocomposites is discussed for commercial scaled sustainable production.

With his vast experience and extensive research in the field of composite materials, Prof. Ir. Dr. Mohd Sapuan Salit keynote speech will explore the potential of biopolymer composites as a sustainable alternative to traditional materials in a circular economy. His talk will offer attendees valuable insights into the latest advancements in this field, along with practical strategies for effectively integrating biopolymer composites into sustainable design practices.

TECHNICAL SESSIONS SCHEDULE

SESSION 2 (Physical)

Date: 4th September 2023

Time: 1400 – 1700

Venue: PAHANG Room, WTC, Kuala Lumpur

NO.	Time	ID	TITLE	PRESENTER
2-1	1400	1	Correlation Study on the Effect of Sintering Mechanism with the Properties of Geopolymer-Based Ceramic	Nur Bahijah Mustapa
2-2	1415	2	Biodegradation and swelling behaviour of cellulose-based plastic incorporation of pennisetum purpureum, chitosan and gelatine	Tuan Nurain Tuan Rohadi
2-3	1430	4	A Fully Explicit Lattice Spring Elastoplastic Solid Model for Fluid Structure Interaction Applications	Ng Khai Ching
2-4	1445	6	Design and Fabrication of Test Rig for Static Pushing and Pulling Experiments	Muhammad Nadzirul Izzat
2-5	1500	7	Countermeasures against Polygonal Deformation of Borehole in Reaming Process	Takahiro Ryu
2-6	1515	11	Finite Element Modelling of Serrated Chip Formation During Turning AZ31 Magnesium Alloy	Muhammad Syamil Zakaria
2-7	1530	14	Investigation of Dynamic Viscosity and Calorific Value of Algae Biodiesel Blend with n-Butanol Additive	Noor Hafiz Noordin
2-8	1545	19	An Effect Various Factor on Dental Implant to Develop Success Rate of Dental Implant: A Review	Nurul Najwa Mansor
2-9	1600	22	A Study on The Significance Of Exhaust Manifold's Bending Angle To The Brake Torque Of 115cc SI Engine	Rishan Murali
2-10	1615	27	Maximum Spreading Diameter of A Water Droplet after Impact on A Hot Surface beyond Leidenfrost Temperature	Mohd Zaidul Fikry Juhar
2-11	1630	31	Thermal Characteristics of Malaysian Khaya senegalensis Wood Fuel Pellets: Densification-induced Changes at Different Feedstock Moisture Levels	Ras Izzati Ismail
2-12	1645	18	Drill Bit Design and Its Effect on Temperature Distribution and Osteonecrosis During Implant Site Preparation: An Experimental Approach	Nur Saifullah Kamarrudin

TECHNICAL SESSIONS SCHEDULE

SESSION 2 (Virtual)

Date: 4th September 2023

Time: 1500 – 1715

Venue: Google Meet platform

NO.	Time	ID	TITLE	PRESENTER
2V-1	1500	10	Design and Fabrication of A Wrist Splint for Burn Patient Rehabilitation using 3D Printing Technologies	Mohd Shahneel Saharudin
2V-2	1515	35	Parametric Study on Producing Fused Deposition Modelling Filament Made of Recovered Carbon Black Reinforced Acrylonitrile Butadiene Styrene Plastics	Norshah Aizad Shuaib
2V-3	1530	3	An Innovative Approach for Natural Gas Liquefaction Using a Mixed-Multi-Component-Refrigerant	Noor Hanif Ismail
2V-4	1545	28	Mechanical Behaviour of Paediatric Femur Bone: A Brief Review of 3-Point Bending and Compression Loading Scenarios	Salem Anes Salem Bafadhi
2V-5	1600	37	Flow Fluctuation during Flow Boiling of Binary Mixtures in High Aspect Ratio Microchannel	Arif Widyatama
2V-6	1615	21	Quantifying the Impact of Drilling Parameters on Temperature Elevation within Bone during the Process of Implant Site Preparation	Nur Saifullah Kamarrudin
2V-7	1630	12	Performance Characterisation of Thermal Energy Storage containing a Phase Change Material (PCM) Sphere with Fins: Simulation-Based Analysis	Muhammad Syahir Ahmad Fouzi
2V-8	1645	20	Numerical Investigation of Immersion Cooling Performance for Lithium-ion Polymer (LiPo) Battery: Effects of Dielectric Fluids and Flow Velocity	Ahmad Akmal Zaed
2V-9	1700	30	Numerical Investigation of Bulb Quantity and Distance Configurations to Optimize Temperature Distribution within a Temporary Cylinder Chicken Coop (TCCC) for 1–2-Week-Old Broiler Chicks in Rainy Season	M A Ghazali

TECHNICAL SESSIONS SCHEDULE

SESSION 3 (Virtual)

Date: 5th September 2023

Time: 0900 – 1200

Venue: Google Meet platform

NO.	Time	ID	TITLE	PRESENTER
3-1	0900	5	Pre- and Postoperative Assessment of Bone with Osteogenesis Imperfecta Using Finite Element Analysis: A Review	Khairul Salleh Basaruddin
3-2	0915	13	Development of Variable-Line Balancing Chart by Risk Assessment Using Monte Carlo Simulation	Mohd Shihabudin Ismail
3-3	0930	15	Correlative Investigation on Dielectric-Mechanical-Morphological Characteristic for Kenaf-Glass-Hybrid Fibers Reinforced Epoxy Composite	Siti Mariah Mohd Yasin
3-4	0945	16	Development of New Formulation for Soft Material in Paste Extrusion-based 3D Printer	Shah Fenner Khan
3-5	1000	17	Microwave Dielectric Analysis of Adhesive Debonding in a Hybrid Bio-Composite Kenaf/Glass Overlap Joint at 90° Orientation	Mohd Afendi Rojan
3-6	1015	24	Lightweight Design of Knee-Ankle-Foot Orthotic Devices using Voronoi patterns for Additive Manufacturing	Shah Fenner Khan
3-7	1030	25	Influence of Dissimilar Plate Thickness on Temperature during Friction Stir Welding between AA5083 and AA6061 Aluminium Alloy Grades	Wan Mohd Syafiq Wan Sulong
3-8	1045	29	Efficiency Analysis of a Passive Daylighting System Based on Northern Malaysia's Climate	Mohd Sani Mohamad Hashim
3-9	1100	32	Conceptual Design of Frosty Express: A Portable Cold Storage Box for Door-to-door Delivery Service of Frozen Food in Malaysia	Wee Choon Tan
3-10	1115	33	K-means Algorithm Based on Flower Pollination Algorithm and Calinski-Harabasz Index	Lim Eng Aik
3-11	1130	34	Acoustical Simulation and Analysis on Motorcycle Silencer	Wei Hong Tan
3-12	1145	36	Conceptual Design of a Staircase Climbing Smart Wheelchair	Vil Cherd Teoh

LIST OF ABSTRACTS

SESSION 2 (Physical)

Authors: Nur Bahijah Mustapa, Romisuhani Ahmad, Mohd Mustafa Albakri Abdullah, Wan Mastura Mastura Wan Wan Ibrahim

ID 1: Correlation Study on the Effect of Sintering Mechanism with the Properties of Geopolymer-Based Ceramic

Abstract: Nepheline geopolymer-based ceramics are emerging as a promising alternative to traditional ceramics due to their eco-friendly production and sustainable nature. Therefore, this study aims to comprehensively investigate the relationship between mechanical behaviour and sintering mechanisms in the production of kaolin geopolymer-based nepheline ceramics. Sodium hydroxide and sodium silicate were mixed to act as the alkaline activator to facilitate the geopolymerization process. The experimental analysis involved varying the sintering temperature within the range of 200°C to 1200°C. The findings from the correlation study highlight that the flexural strength and densification process is in linear relation with R^2 of 0.9369, whilst the water absorption and volumetric shrinkage exhibited an inversely linear relationship with the R^2 value of 0.8733. The maximum flexural strength of 78.92 MPa and density of 2.56 g/cm^3 were achieved when sintered at 1200°C. Meanwhile, the water absorption decreases with the increase of volumetric shrinkage, which might relate to the densification process of the geopolymer-based nepheline ceramic. The outcome of this research contributes a deeper understanding of the interplay between mechanical behaviour and sintering mechanism, enabling the design of superior sintered materials.

Authors: Tuan Nurain Tuan Rohadi, Mohd Ridzuan Mohd Jamir, Mohd Shukry Abdul Majid, Normahira Mamat, Haja Syed Hussain, Yeo Yi Xuan

ID 2: Biodegradation and swelling behaviour of cellulose-based plastic incorporation of pennisetum purpureum, chitosan and gelatine

Abstract: This paper reports on the biodegradation and swelling behaviour of cellulose-based plastic incorporation of Pennisetum purpureum (PS), chitosan and gelatine. Cellulose-based plastic (CP) was obtained from chitosan and gelatin; and from the cortex (CPS), pith (PPS), and whole (WPS) of Pennisetum purpureum (PS). The films were prepared by solution casting with untreated, 4, 8, 12, 16, and 20% alkali-treated cellulose of CPS, PPS, and WPS. The ASTM D5988-method was used to conduct the CP biodegradation tests. The swelling behaviour test was performed to measure the swelling percentage for each CP samples in aqueous solution with different pH values. The results reveal that the biodegradation of untreated CPS (60.30%), untreated WPS (49.74%), and untreated PPS (CP) showed the biggest relative weight reduction. CP added with the 8, and 16% alkali-treated cellulose of CPS, and PPS continues swelling in the solution of pH 7 throughout 24 hours of analysis. Increasing the cellulose loading accelerated the biodegradation rate of the bioplastic films. The results also suggest that the CP with the incorporated cortex (CPS) of Pennisetum purpureum (PS), is the most water-resistant in neutral followed by acid and alkali.

Authors: Wei Chian Low, Khai Ching Ng, Ng Hoon Kiat
ID 4: A Fully Explicit Lattice Spring Elastoplastic Solid Model for Fluid Structure Interaction Applications

Abstract: The Fluid Structure Interaction (FSI) solver based on mesh-less methods developed at University of Nottingham Malaysia has been proven to be successful in solving hydroelastic problems involving elastic body. In this paper, the possibility of modelling elastocplastic material behaviour using mesh-less method is further explored. Elastoplastic material bahaviour is essential for modelling ductile fracture in a wide range of engineering problems. The use of a type of nonlocal lattice spring model (LSM) based on fully explicit integration scheme in modelling elastoplastic material behaviour is presented in this work. Specifically, the return mapping algorithm is incorporated in the solid solver for modelling J2 plasticity. The effect of time step size and particle spacing on the accuracy of the solver are investigated by checking the predicted strain against theoretical solution. It is found out that the strain results obtained by varying the time step size are somewhat consistent with the theoretical solution. The predicted strain also converges to the theoretical result as the particle spacing is refined.

Authors: Muhammad Nadzirul Izzat Mahadzir, Isa Halim, Muhammad Zaimi Zainal Abidin, Zulkeflee Abdullah, Radin Zaid Radin Umar, Husna Rahman, Mohd Shahir Kasim
ID 6: Design and Fabrication of Test Rig for Static Pushing and Pulling Experiments

Abstract: Muscular strength data associated with pushing and pulling forces are crucial for ergonomists to design tasks and equipment in manual materials handling. Usually, ergonomists measure pushing and pulling forces using a force gauge. Subjects participating in the pushing and pulling experiments need to grip and hold the force gauge. Additional weight from the force gauge can affect the muscular strength of the subjects, which impacts the validity and reliability of the pushing and pulling data. However, research on the design and fabrication of test rigs for facilitating pushing and pulling experiments seems to be scarce. This study aimed to design and fabricate a test rig to facilitate ergonomists and subjects in performing symmetric two-handed static pushing and pulling experiments. To develop the test rig, the researchers performed a maximum force measurement, a computeraided design model, materials selection, a finite element analysis, a functionality test, and a reliability test. Seven subjects with a body mass of more than 120 kg participated in the validation of the developed test rig. Key findings of this study showed that the test rig could sustain the pushing and pulling forces up to 900 N, representing almost double the muscular strength of the subjects. This study concluded that the developed test rig was sturdy and helpful for facilitating ergonomists in quantifying the magnitude of pushing and pulling forces.

Authors: Takahiro Ryu, Takashi Nakae, Kenichiro Matsuzaki, Yudai Matsumoto, Keizo Tsukamoto, Naoyuki Hirata
ID 7: Countermeasures against polygonal deformation of borehole in reaming process

Abstract: Reaming is a processing method for widening pilot holes such as drill holes and press holes to obtain a highly accurate finish. However, in machining using a regular-pitch reamer, polygonal deformation of the borehole occurs. This deformation is also called a spiral mark because the polygonal shape twists in the feed direction. Although several papers have dealt with vibration phenomena during reaming, countermeasures to date have not been sufficient. In previous studies, the authors considered polygonal deformation of a machined hole during reaming as a self-excited

vibration caused by a time delay and clarified its mechanism. In the present study, we theoretically and experimentally investigated the suppression of polygonal deformation by optimizing the angular arrangement of the cutting edges of irregular-pitch reamers for an 8-flute reamer. In addition, we suggested a new evaluation standard to reduce the calculation load and to evaluate the optimum angular arrangement of the irregular-pitch cutting edges of reamers with other numbers of flutes.

Authors: Muhammad Syamil Zakaria, Mazli Mustapha, Azwan Iskandar Azmi, M.A.M. Nawi, Azlan Ahmad

ID 11: Finite Element Modelling of Serrated Chip Formation During Turning AZ31 Magnesium Alloy

Abstract: Machining metal alloys such as AZ31 magnesium alloy involve thermomechanical behavior between workmaterial and cutting tools. The interaction between workmaterial and cutting tools has affected the chip formation in metal cutting and cutting performance. This paper developed a finite element model (FEM) by using Abaqus software to simulate the chip formation in cutting AZ31 magnesium alloy under dry condition. The study revealed that serrated chips were formed in dry condition. Chip segmentation increased proportionally with cutting speed as generated heat concentrated in a narrow zone, promoting the formation of an adiabatic shear band.

Authors: Noor Hafiz Noordin, Hazim Sharudin, Ab Aziz Mohd Yusof, Haszeme Abu Kasim, Nor Ezzety Mohammad Nizam

ID 14: Investigation of Dynamic Viscosity and Calorific Value of Algae Biodiesel Blend with n-Butanol Additive

Abstract: The transport sector primarily utilizes diesel fuel, which is a prominent energy source for various industries and applications. However, due to population growth, the increasing demand for diesel fuel leads to its depletion. This topic attracts many researchers looking for a solution through fuel alternatives, including the fuel properties of algae oil and its compatibility with diesel engines when combined with diesel fuel. To further understand the related topic, the study aims to explore the fuel properties, focusing on the viscosity and calorific value of Biodiesel Algae oil (BD) with n-butanol (nB). The Alge oil was prepared on the lab scale before blending to produce 4 different mixtures of Biodiesel. The results indicate that the blend 93BD7nB, which contained 93% of Algae biodiesel and 7% of n-butanol, obtained 0.168 Pa/s, which is in the required range in the standard limit ASTM D6751 whereas the calorific values for all samples above the standard limit EN 14214 indicate a good efficiency. In conclusion, this fuel blend exhibits promising potential for future utilization in diesel engine operations and provides an alternative solution for energy depletion.

Authors: Wan Muhamad Amrizam Wan Mohd Azmi, Nurul Najwa Mansor, Mohd Sabri Hussin

ID 19: An effect various factor on dental implant to develop success rate of dental implant: A review

Abstract: The dental inserts utilized by dental specialists during implantation ought to be suitably embedded into the patient jawbone to further develop the achievement pace of implantation. Subsequently, different boundaries assume a crucial part in the implantation strategy. Most of the time, dental specialists utilize the endorsed boundaries for embed calculation, for example, length of string, number of strings, distance across of string, material of embed and stacking condition esteems that are intended for patient. If mistaken one of these boundaries are applied, it influences the essential strength, osseointegration and consequently decreases the achievement pace of

implantation. This survey article centers around itemized data about the few factors that influence the calculation of embed models. The different boundaries like embed calculation, surgery, and the patient's bone quality should be considered to stay away from embed disappointment. A definite comprehension of different boundaries assists with laying out the significance of the embed calculation during dental convention. By understanding the most reasonable embed math will be utilized by dental specialists, it would assist the dental specialist with settling on a more unambiguous embed calculation model, rather than utilizing a general and normal embed mode. This can help in decreasing the quantity of embed disappointments. Notwithstanding, further examination is essential which joins these boundaries to get right embed math to the right persistent.

Authors: R Murali, A B Shahriman, Z M Razlan, M A Rojan, A I Azizul, M F H Rani, M R M Jamir, S Sunan, M H A Ali, G Ramasamy, M H N Hisham

ID 22: A Study on The Significance Of Exhaust Manifold's Bending Angle To The Brake Torque Of 115cc SI Engine

Abstract: The exhaust manifold is a crucial component of the exhaust system in any SI engine, responsible for efficiently expelling combustion products. However, when the exhaust manifold's design is suboptimal, it leads to negative consequences for the engine's performance due to the presence of backpressure. Backpressure refers to the difference between maximum exhaust pressure and atmospheric pressure. An increase in backpressure decreases the overall performance and fuel efficiency of an SI engine. This study aimed to investigate the bending angle characteristics of the exhaust manifold and the brake torque of the 115cc SI engine using 1D engine analysis. The relationship between the exhaust manifold's bending angle characteristics and the brake torque was analysed using Analysis of Variance (ANOVA) with a p-value of less than 0.05, while the validation with experimental data showed a maximum error of 6.62. In the previous research, it was noted that a lower bending angle leads to better performance. However, the current results indicate that out of the three bending angles considered, having one of them yields the most substantial enhancement in brake torque. The optimized bending angle configuration obtained from the analysis increased the mean brake torque by 0.011 Nm (0.14%). Consequently, this study enhances the average brake torque through the optimal bending angle characteristics of the exhaust manifold. The study's objective aligns with Sustainable Development Goal (SDG) 9: Industry, Innovation, and Infrastructure, as the improved performance achieved through an optimal exhaust manifold design configuration is expected to promote domestic technology development.

Authors: Muhammad Sofwan Bin Mohamad, Mohd Zaidul Fikry Bin Juhar, Suhaimi Illias, Nasrul Amri Mohd Amin, Suhaila Hussain, Mohd Hanafi bin Ani

ID 27: Maximum spreading diameter of a water droplet after impact on a hot surface beyond Leidenfrost temperature

Abstract: The impact of liquid droplets on heated surfaces are relevance across a range of applications. The maximum spreading diameter of water droplet during impact on hot surface was experimentally studied. The surface was made of aluminium. The diameter and height of the aluminium block was 70.0 mm and 30.0 mm, respectively. During experiment, the test surface was heated beyond Leidenfrost temperature. A high-speed video camera was used to capture the droplet images from the first impact until the droplet reached maximum spreading condition. The frame rate was set to be 2,000 fps. Distilled water was used as the test liquid. The impact height was set to be

about 65.0 mm. From the high-speed images analysis, the droplet diameter was found to be approximately 4.5 mm. The measured droplet maximum spreading diameters were found to have a good agreement with theoretical calculation.

Authors: Ras Izzati Ismail, Khor Chu Yee, Alina Mohamed

ID 31: Thermal Characteristics of Malaysian Khaya senegalensis Wood Fuel Pellets: Densification-induced Changes at Different Feedstock Moisture Levels

Abstract: This study investigates the thermal behaviour of Malaysian Khaya senegalensis wood energy pellets, examining the effects of densification at different feedstock moisture levels. Densified wood pellets are promising renewable energy sources, but the impact of densification on thermal characteristics, considering various moisture contents, is underexplored. The main objective is to quantify the thermal characteristics, which involved proximate analysis such as energy pellets' ash content, fixed carbon, volatile matter, and calorific value. In this research, Malaysian Khaya senegalensis wood was converted into pellets through a densification process, spanning from of 4-20% feedstock moisture levels. The manufactured pellets were then subjected to various tests to characterize the thermal properties. Results reveal compelling insights on the relationships between densification, moisture content, and thermal properties. Densification significantly influenced thermal attributes, with effects tied to initial moisture content. Increasing moisture levels led to distinct thermal responses, reflecting interactions between densification-induced changes in moisture and thermal responses. These findings aid Khaya senegalensis wood pellet densification optimization for improved thermal performance. Understanding densification's impact on thermal behaviour under varying moisture conditions enhances pellet efficiency as sustainable energy sources. This research contributes to biomass pellet knowledge for renewable energy applications, advancing efficient and eco-friendly energy solutions.

Authors: Md Ashequl Islam, Nur Saifullah bin Kamarrudin, Ruslizam bin Daud, Ishak bin Ibrahim, Zuradzman Mohamad Razlan, M. F. H. Rani

ID 18: Drill Bit Design and Its Effect on Temperature Distribution and Osteonecrosis During Implant Site Preparation: An Experimental Approach

Abstract: In this study, the drilling parameters will be evaluated to obtain optimal parameters in minimizing the impact of drilling damage on synthetic bone blocks. The effect of damage observed in the study is osteonecrosis that occurs in the drill hole for implant site preparation, where a smaller value is desired. The drilling parameters are optimized using the Taguchi method with two control factors: the feed rate and spindle speed; each parameter is designed in five levels. This experiment was then carried out on four different designs of drill bits, i.e., Twist (118°and 135°), spherical, and conical drill bits. While experimental planning uses L25 orthogonal arrays, the "smaller is better" approach is used as a standard analysis. The main findings of this research are 118° point angle twist drill bit is the ideal type of drill bit for bone drilling, as it produces less heat than other types of drill bits. The optimal range of feed rate and drilling speed for bone drilling is 40-60 mm/rev and 1000-1400 RPM, respectively. Combining these parameters helps to minimize heat generation during implant site preparation drilling.

SESSION 2 (Virtual)

Authors: Connor Cann, Mohd Shahneel Saharudin
ID 10: Design and fabrication of a wrist splint for burn patient rehabilitation using 3D printing technologies

Abstract: Severe and common injuries involving burns to the hands and wrists can often lead to permanent loss of motion. The issue is exacerbated by the delicate nature of tendons and muscles in the hands, along with the formation of scar tissue. While rehabilitation exercises can help improve the range of motion, early-stage recovery requires additional tension on the affected areas. To address this concern, a novel project was initiated, aiming to develop a specialized splint for later-stage rehabilitation. This innovative splint allows users to carry out their daily tasks while wearing it, constantly applying a beneficial load on the wrist, hand, and digits to enhance range of motion. The development of the splint involved leveraging Fused Deposition Modelling (FDM) 3D printing and medically safe materials for the initial prototype. Finite Element Analysis (FEA) was employed to analyze the design. The process underwent iterative design improvements and parameter adjustments, ultimately resulting in the final prototype. The FEA analysis confirmed the strength and durability of the PLA components, while the TPU digit resistance bands were evaluated using a hyper-elastic model. As a result, the final design effectively applies tension to the digits without compromising day-to-day tasks' usability and wearer's comfort. Future iterations of the splint could focus on enhancing fastening methods, reducing brace movement during usage, creating various sizes to accommodate different arm/hand dimensions, and optimizing mass-manufacturing processes.

Authors: M F Saad, N A Shuaib, C C Fooi, C R Quan, M H J A Hadi, U F M Ali, A F Osman
ID 35: Parametric study on producing Fused Deposition Modelling filament made of recovered carbon black reinforced Acrylonitrile Butadiene Styrene plastics

Abstract: Additive manufacturing is a process that makes three-dimensional object layer by layer. There are many different types of 3D printer and the most commonly used is Fused Deposition Modeling (FDM). There is a need for a new material for Acrylonitrile Butadiene Styrene (ABS) FDM filament to improve filament strength and reduce the usage of plastics. From literature, there are limited studies available on making 3D printer filament reinforced by recycled carbon black. The limitation hinders the potential of using this material in new applications. In this study, recycled carbon black powder (rCB) was added as a filler reinforcement to enhance the properties of ABS. Parameters considered in this study were percentage of filler weight loading and filler size. Tests and characterisation used in this study were tensile test, thickness test, surface roughness test, scanning electron microscopy, density test and water absorption test. There were improvements in mechanical properties such as tensile test and elasticity of the filament compared to the pure ABS plastic. The higher filler percentage can improve the elasticity of filament and lower filler percentage can improve the strength of the filament. The findings could help in improving marketability status and commercialisation potential of rCB reinforced ABS filament for FDM applications.

Authors: N H Ismail, M N Omar, M S A Ishak, N Z Yahaya, K A A Khalid, M F M Ab Halim
ID 3: An Innovative Approach for Natural Gas Liquefaction Using a Mixed-Multi-Component-Refrigerant

Abstract: The natural gas liquefaction is the most expensive and energy-intensive phase in the natural gas-to-liquefied natural gas-to-natural gas chain. In addition, this region has the biggest development potential. As a result, numerous LNG production methods have been developed and are deployed at export facilities around the world. The goal of this study is to describe and assess an innovative approach for mixed-refrigerant (MR) LNG method. The authors have dubbed this technique the MR-X approach. The MR-X process was developed based on the globally proven liquefaction technology C3MR and its large-scale successor AP-XTM (which offers many benefits and flexibility), but with a novel precooling phase construct. In pre-cooling and liquefaction phases, the refrigerant is a combination of methane, nitrogen, propane, ethane, butane, and isobutane. The paper investigates the creation of the MR-X technology, as well as its modelling, energy, and exergy investigations.

Authors: Salem Anes Salem Bafadhl, Muhamad Safwan Muhamad Azmi, Fauziah Mat, Mohd Sani Mohamad Hashim, Abdul Halim Ismail, Siti Marhainis Othman, Mohd Nasir Ayob

ID 28: Mechanical Behaviour of Paediatric Femur Bone: A Brief Review of 3-Point Bending and Compression Loading Scenarios

Abstract: The femur bone plays a critical role in providing structural support and facilitating locomotion in the human body. While the mechanical properties of the adult femur have been extensively investigated, understanding the behaviour of the paediatric femur bone remains an area of significant interest. This review paper critically compares studies that utilize Finite Element Analysis (FEA) and Experimental Analysis (EA) to investigate the mechanical response of the femur bone under 3-point bending and compression loading scenarios. The scope includes human, murine, and porcine models, focusing on fracture patterns and mechanical properties unique to pediatric populations. The review provides valuable insights into the mechanisms leading to femur bone fractures, guiding the development of age-specific orthopaedic treatments and improving clinical outcomes for pediatric patients with femur injuries. This comprehensive analysis contributes significantly to the field of paediatric orthopaedics, advancing the understanding of bone mechanics and fracture management. Continued research in this area holds the potential to further enhance healthcare and treatment options for bone-related conditions.

Authors: Arif Widyatama, Mandi Venter, Muhammad Sofwan Bin Mohamad, Jacob Dirker, Daniel Orejon, Khellil Sefiane

ID 37: Flow Fluctuation during Flow Boiling of Binary Mixtures in High Aspect Ratio Microchannel

Abstract: Flow boiling performance is affected by several factors, such as channel characteristics and working fluid types. It is found that there is still limited study that discusses the use of binary mixtures combined with high aspect ratio microchannels. The aim of this study is to investigate the flow fluctuation during flow boiling of binary mixtures in rectangular microchannels. Here, a 6 mm width and 0.3 mm depth rectangular channel was utilised, and it represents a hydraulic diameter of 571 µm and an aspect ratio of 20. In the present works, a mass flux of 10 kg m^{-2} s^{-1} was used, and the heat flux ranged from 15.2 and 21.0 kW m^{-2}. The image processing technique was applied to track the bubble tail movement. In addition, the thermal camera was utilised to gather the wall temperature distribution of the channel. The preliminary results show that the use of binary mixtures influences the vapour fraction in the channel and the flow fluctuation characteristics. Some differences are observed in terms of wall temperature characteristics. However, the rapid increase of wall

temperature is found in the outlet region for high flux cases under all liquid types which suggests the dominance of dry out event.

Authors: Md Ashequl Islam, Nur Saifullah bin Kamarrudin, Ruslizam bin Daud, Ishak bin Ibrahim, Shahriman bin Abu Bakar, Siti Noor Fazliah Mohd Noor

ID 21: Quantifying the Impact of Drilling Parameters on Temperature Elevation within Bone during the Process of Implant Site Preparation

Abstract: This in vitro study examined how tool rotational speed (s), feed rate (f), tool diameter (d), drill tip angle, and their interactions affect bone drilling temperature. The thermal qualities of drilling can cause thermal bone damage, especially at temperatures above 47℃. Thermal properties are also important for post-surgery recovery. Despite multiple studies on bone drilling temperature, the exact effect of tool rotational speed, feed rate, and diameter on temperature response remains unknown. Drilling studies were performed on bovine femoral shaft cortical bone specimens. A parametric study was performed to estimate bone temperature at 800–2000 rpm, 20– 40 mm/min feed rates, and 2–4 mm drill diameters. The drills have 118° and 135° tips. A predictive statistical model using response surface methodology (RSM) estimated bone drilling temperature escalation. The study used ANOVA with a 95% confidence level ($\alpha = 0.05$) to examine how drilling factors (rotation speed, feed rate, and drill diameter) affect observed temperature rise. Rotating speed accounted for 59.74% of temperature increases in the study. However, drill diameter somewhat affected 16.21% of the differences. In comparison, feed rate only affected temperature rise by 10.04% of the results. The above findings help explain bone drilling input settings, advancing thermal damage mitigation approaches.

Authors: Muhammad Syahir Ahmad Fouzi, Nasrul Amri Mohd Amin, Muhammad Sofwan Mohamad, Anas Hakimi Anas Hafidz, Nursyazwani Abdul Aziz, Mohd Shukry Abdul Majid, Izzuddin Zaman

ID 12: Performance Characterisation of Thermal Energy Storage containing a Phase Change Material (PCM) Sphere with Fins: Simulation-Based Analysis

Abstract: This paper presents the outcomes of a simulation study aimed at investigating the thermal performance of modified phase change material (PCM) structures within a sphere with integrated fins. The escalating global warming crisis and its associated weather anomalies necessitate urgent measures to mitigate its impacts. Numerous research endeavours have been undertaken to address this issue, including the utilization of thermal energy storage systems (TES) augmented with PCM. PCM can be incorporated into building walls to counteract rising temperatures. However, inadequate heat transfer caused by poor thermal conductivity has been a persistent challenge in these systems. The addition of high conductivity fins has found to improve the overall performance of TES. Yet, this study proposes the addition of low conductivity fins to study for the effect of shape factor to its performance. The research evaluates the phase change of 2-fins and 4-fins with varying thicknesses within the PCM structure. A comprehensive simulation framework is employed to analyse the thermal behaviour of the PCM-enhanced sphere without considering ambient temperature nor PCM properties, but fin dimensions and configurations. The simulation results reveal that the inclusion of fins significantly improves heat transfer within the system by cutting a minimum of 20% in phase change time and could promote the phase change process to happen earlier by a maximum of 38% in starting time. By optimizing the fin configuration and thickness, the overall thermal conductivity of the PCM-based TES can be enhanced. These findings contribute to the development of efficient

thermal energy storage systems, offering potential solutions to combat global warming and promote sustainable thermal management.

Authors: A Z A Akmal, M F H Rani, W K Yinn, M I Ardani, Z M Razlan, A B Shahriman, K Kamarudin, M S A Kadir, R Murali, S Sunan

ID 20: Numerical Investigation of Immersion Cooling Performance for Lithium-ion Polymer (LiPo) Battery: Effects of Dielectric Fluids and Flow Velocity

Abstract: This study investigates the enhancement of immersion cooling performance for a single 14.6 Ah lithium-ion polymer (LiPo) battery cell by using air, palm oil, and engineered fluid (3M Novec 7000) as dielectric fluids. The research aims to observe the temperature distribution and rate of heat transfer on the battery cell at a 3C discharge rate, while varying the fluid velocity flow (0 mm/s, 1 mm/s, and 50 mm/s) and fluid types. Computational fluid dynamics (CFD) simulations were performed using ANSYS Fluent software, with heat generation from the LiPo battery simulated using the Newman, Tiedmann, Gu, and Kim (NTGK) semi-empirical electrochemical model. Results revealed that palm oil demonstrated the optimum cooling effect, reducing peak temperature to safe operating temperature region by 62.4% within 1020 seconds. Fluid flow velocity strongly influenced temperature distribution and heat transfer rates, with 50 mm/s resulting in a more uniform temperature distribution compared to 1 mm/s and 0 mm/s. The rate of heat transfer was highest at 1 mm/s and intermediate at 50 mm/s. Considering the abundance of palm oil in Malaysia, utilizing it as the dielectric fluid with a 50 mm/s flow velocity yields the best cooling effect for the 14.6 Ah LiPo battery at a 3C discharge rate.

Authors: M A Ghazali, Muhammad Faiz Hilmi Rani, M N H Mat, Zuradzman Mohamad Razlan, Shahriman Abu Bakar, Y Gautier, M N Afnan Uda, M S A Kadir, Rishan Murali, S Sunan

ID 30: Numerical Investigation of Bulb Quantity and Distance Configurations to Optimize Temperature Distribution within a Temporary Cylinder Chicken Coop (TCCC) for 1–2-Week-Old Broiler Chicks in Rainy Season

Abstract: Rising production costs, combined with the unpredictable conditions during the critical early stages of chick growth, can disrupt the chicken supply chain. Broiler chicken shortages often result from inadequate environmental control, triggering cold stress and hindering optimal growth. In this context, this study centres on optimizing temperature conditions for 1–2-week-old broiler chicks housed within a temporary cylinder chicken coop (TCCC) during the rainy season. The aim is to ensure optimal thermal comfort, targeting a temperature range of 33–35℃. To achieve this, ANSYS and SolidWorks software were employed to conduct a comprehensive simulation of the TCCC and Philips 150 W infrared industrial lamp. The simulation was meticulously calibrated to replicate the climatic conditions of Kerteh, Terengganu, Malaysia, where temperatures can plummet to 23.8℃, accompanied by an air velocity 0.9 m/s. Through an in-depth investigation involving nine (9) case studies, the impacts of various bulb configurations (5, 10, and 15 bulbs) and distances between the bulbs and the TCCC surface (25 cm, 35 cm, and 45 cm) on temperature distribution were carefully assessed. Notably, an increase in bulb quantity was observed to elevate the temperature, whereas shorter distances led to uneven heat dispersion. Conversely, greater distances were found to correspond with a decrease in average temperature, while simultaneously enhancing the distribution of surface temperatures. These observed effects significantly contribute to the thermal comfort of broiler chicks. Among the case studies explored, the configuration of 10 bulbs and a 45 cm distance emerged as the optimal choice based on conditions prevalent during Kerteh's rainy season. These

findings not only enhance the thermal comfort of broiler chicken, but also hold potential to address Malaysia's growing demand for poultry meat.

SESSION 3 (Virtual)

Authors: Wanna Soh Bua Chai, Khairul Salleh Basaruddin, Mohd Hanafi Mat Som, Fauziah Mat, Muhamad Khairul Ali Hassan, Shafriza Nisha Basah
ID 5: Pre- and Postoperative Assessment of Bone with Osteogenesis Imperfecta Using Finite Element Analysis: A Review

Abstract: This paper presents a review of finite element analysis (FEA) studies on pre- and postoperative assessment of osteogenesis imperfecta (OI)-affected bones. The biomechanical design of the intramedullary (IM) rods and its challenges are also discussed in this paper. The biomechanical modelling approach through FEA allows a deeper understanding and assessment of the occurrence of fractures in OI patients, thus can provide more effective methods to evaluate surgical intervention options. Several studies have addressed the stability of the IM rods to support the fractured bones by varying the length of the rod. In addition, different types of rod materials are also compared. It was found that the interface between the discontinuity of bone fragments after fracture and the rod used to align the bone is important to prevent rod migration. Finally, the paper discusses potential future research to investigate the interfaces between IM rods and bone fragments.

Authors: Mohd Shihabudin Bin Ismail, Mohamad Shaiful Ashrul Bin Ishak, Nor Zaiazmin Yahaya, Muhammad Iqbal Muhammad Hussain, Mohd Adzrie Radzali
ID 13: Development of Variable-Line Balancing Chart by Risk Assessment Using Monte Carlo Simulation

Abstract: Line Balancing Chart is one of the most used lean tools for determining cycle time (CT) and lead time (LT) in the production line processes flow, from raw material input until finished product output. However, for traditional Line Balancing Chart, only the average (mean) CT and LT are considered which causing inconsistent performance of the actual production line throughput rate (productivity). In this study, Variable- Line Balancing Chart (V-LBC) is introduced by considering the dynamic CT and LT in a form of (Minimum, Most Likely (mean), Maximum) for each process involved in the production line. The risk assessment for Value-added (VAA) and non-value added (NVAA) events in the flow are also considered for this V-LBC. A Monte Carlo simulation by using @Risk software is utilized to simulate each process CT distribution capability. As a result, each process in the V-LBC could be represented in horizontal and vertical time variables that involve a variable CT (VAA and NVAA) and risk assessment using Risk Assessment- Failure Mode and Effect Analysis (RA-FMEA) approach. The actual root cause led to the process variation also could be identified more accurately from the V-LBC. Hence the correct action could be taken in order to reduce the variation which indirectly increase the production line productivity.

Authors: Siti Mariah Mohd Yasin, Mohd Afendi Bin Rojan, Nur Saifullah bin Kamarrudin, Mariam Binti Majid, Cheng Ee Meng
ID 15: Correlative Investigation on Dielectric-Mechanical-Morphological Characteristic for Kenaf-Glass-Hybrid Fibers Reinforced Epoxy Composite

Abstract: In recent years, there are many applications where synthetic fibers and natural fibers are used as reinforcing materials in composites, such as the automotive and aerospace industries, the medical industry, and the construction industry. While these hybrid fibers effectively enhance

mechanical and electrical properties, research into electrical characteristics remains inadequate and is an ongoing endeavor. In this work, synthetic woven glass fibers and natural woven kenaf fibers were used to fabricate composite materials by vacuum infusion technique. The dielectric properties of three different substrates, glass fibers, kenaf fibers and glass/kenaf fibers reinforced epoxy composites were investigated at 0° orientation. The ENA Network Analyzer was used to measure dielectric properties in a wide microwave frequency range. The substrates were singlejoint overlapped with an adhesive and then mechanically tested. The shear strength of the joint as a function of strain, was tested using a Shimadzu universal testing machine. Visual inspections were performed to determine the failure modes of the composites. The dielectric constant and loss factor of the glass fiber composite were the highest, while the kenaf fiber composite had the lowest value. When a small amount of glass fibers is incorporated into kenaf fibers, which is called a hybrid composite, the polarization increases and the mechanical strength also increases compared to the kenaf fiber composite. Scanning electron microscopy (SEM) of the fractured tensile tests was performed to understand the nature of the interfaces between glass, kenaf and matrix. The kenaf/matrix interface was heterogeneous but exhibited voids, resulting in low dielectric properties and mechanical strength. The heterogeneity of the hybrid composite was greater than that of the kenaf fiber composite due to the hydrophobicity of the glass fibers. These results show that the composites exhibit a correlation between the dielectric properties, tensile strength, and the morphological nature of the interfaces.

Authors: Shah Fenner Khan Mohamad Khan, Liyana Tajul, Muhammad Mirza Bin Baharudin
ID 16: Development of new formulation for soft material in paste extrusion-based 3D Printer

Abstract: Fused Deposition Modelling is a form of additive manufacturing where solid filament is heated into molten state and deposited onto a heating platform to create three-dimensional objects layer-by-layer. Since heating and cooling processes are involved in Fused Deposition Modelling (FDM), this restricts the use of thermoplastic polymers such Room Temperature Vulcanizing (RTV) silicones and gels. Others concern are with the right rheological properties for extrusion and the ability to provide desired mechanical qualities upon quick solidification. To develop a suitable silicone printing technology, it is crucial to understand the silicone polymerization mechanism in terms of its rheological and mechanical characteristics. Due to the numerous factors that can influence silicone paste mixtures, this study utilized the Taguchi method to design experiments, optimize factors, and predict properties, thereby avoiding extensive and resource-intensive experimental work. The study specifically considered the factors of curing method, mass ratio of silicone thinner, and fumed-silica in the silicone paste formulation. Among the 9 samples generated through the Taguchi method, only one sample demonstrated favourable results in terms of mechanical properties and the curing process, with a mixture ratio of base silicone, silicone thinner, and fumed-silica at 15g.

Authors: Siti Mariah Mohd Yasin, Mohd Afendi Rojan, Nur Saifullah Kamarrudin, W.M. Syafiq, Mariam Majid, Cheng Ee Meng
ID 17: Microwave Dielectric Analysis of Adhesive Debonding in a Hybrid Bio-Composite Kenaf/Glass Overlap Joint at 90° Orientation

Abstract: The use of composite materials is widespread in the aerospace, automotive, and marine industries, especially when it is made from synthetic or natural fibres. Hybridization of natural fibres with synthetic fibres is a method to improve mechanical properties instead of using natural fibres alone. In this study, natural kenaf fibres and synthetic fibres were used as a reinforcing agent with

epoxy resin as the matrix, fabricated using vacuum infusion technique. This research focuses more on single lap joint adhesive bonding, which has been mixed with fine and coarse sodium chloride (NaCl) as defect. The relationship between dielectric properties and mechanical properties has been evaluated in zero defect, medium defect, and large defect conditions. In addition, the characteristics of layering glass fibre on top and bottom of kenaf fibre will be evaluated. Moreover, little attention has been paid to microwave non-destructive testing (MNDT) to demonstrate the dielectric properties for composite bonding. The study focuses on the dielectric properties of the composite plate in a range of frequencies from 1kHz to 1MHz. The substrate joining were characterized for dielectric properties using MNDT, while the mechanical properties were measured by a tensile testing machine. The correlation between these properties were analysed and discussed. The results show that when glass fibre was added to kenaf fibre, the strength of composites increased by approximately 40.7% to 68.978 MPa with a tensile modulus of 2.582 MPa for GKGFs specimens. The results show that when dielectric properties increase, mechanical properties decrease. The effect of defects in the single lap joint increased the dielectric constant and loss factor while the strength of specimen was reduced.

Authors: Shah Fenner Khan Mohamad Khan, Liyana Tajul, Muhammad Afifi Bin Zaidan
ID 24: Lightweight design of Knee-Ankle-Foot Orthotic Devices using Voronoi patterns for Additive Manufacturing

Abstract: Traditionally fabricated knee-ankle-foot orthosis (KAFO) device that is used to aid in the mobility user is uncomfortable. Problems such as weight and enclosure in almost all the part of the leg make it strenuous and humid for the user to wear for a long time. Furthermore, in the traditional production method, it can take up to a week to fabricate. The aim of this study is to redesign the knee-ankle-foot-orthosis by using the application of topology optimization in order to reduce the material used on the product and to make it lightweight. The parameters of the KAFO were determined by using indirect method; similar to traditional method. The modelling and analysis of the KAFO is completed by using CAD and CAE software. Optimization of the product is performed by redesigning the shape and applying topology optimization function. It is able to reduce the maximum stress of the product by 22.56% and the volume by 4.33%. Application of the Voronoi pattern further reduces the mass of the KAFO and produces more organic looks to the product. SLS Lisa Pro 3D printer is used to produce the KAFO in a period of less than a week. This prove to be a viable alternative for producing customized KAFO.

Authors: W. M. Syafiq, M. Afendi, N. A. Nabila
ID 25: Influence of dissimilar plate thickness on temperature during friction stir welding between AA5083 and AA6061 aluminium alloy grades

Abstract: This paper investigates the influence of dissimilar plate thickness on the temperature profile of AA5083 and AA6061 aluminium alloy. Plates of dissimilar aluminium alloy grades are welded in a butt joint configuration by using a milling machine and a custom FSW tool made of H13 tool. Datalogger and type K thermocouples embedded in the workpieces at different distances from the weld line are used to collect the temperature data during the experiment. One thermocouple is placed at each side of the advancing side and retreating side at equally distance from the center line except for Joint 1, 2 and 3. The results show the range of temperature measurement during the experiment is between 300°C and 600°C. FSW process between similar plate thickness produces the highest value of peak temperature and better surface appearance than dissimilar plate thickness.

The thermocouples located near the weld line contributed the higher temperature since the heat source comes from the rotating tool. Besides, higher temperatures were recorded at 5 mm thickness of AA6061 aluminium alloy plate located on the advancing side than the retreating side.

Authors: Mohd Sani Mohamad Hashim, Muhammad Amin Zulkifli Din, Abdul Halim Ismail, Mohd Hafif Basha, Nasrul Amri Mohd Amin, Ng Yi Fei, Muhamad Safwan Muhamad Azmi, Nur Saifullah bin Kamarrudin, Siti Marhainis Othman

ID 29: Efficiency Analysis of a Passive Daylighting System Based on Northern Malaysia's Climate

Abstract: Daylighting design strategy is important in order to have adequate lighting source in a room and necessary to decrease energy consumption for artificial lighting. Passive daylighting system utilizes daylight by collecting, reflecting and diffusing the natural light throughout a given area. The purpose for this paper is to compare and analyse an optimum light pipe system design that can scatter daylight into a room based on three case studies. Lighting analysis was conducted using Autodesk 3ds Max Design software throughout the project based on the actual geographical parameters of Universiti Malaysia Perlis, Malaysia and also using the real sun azimuth on working hours. The results were compared according to the respective designs in order to observe the maximum internal illuminance and the average internal illuminance. The results show that the straight geometry with low aspect ratio produces the highest interior light intensity among other light pipe systems and the average internal illuminance values in the room was able to reach the minimum requirement of a small room which is 200 – 500 lux.

Authors: Tan Wee Choon, Lim Eng Aik, Teoh Thean Hin, Ch'ng Zhen Hao, Muhammad Adam Hakimie Mohd Kasim, Muhammad Azam Azra Ismail, Muhammad Mirza Baharudin, Tan Poh Choon

ID 32: Conceptual Design of Frosty Express: A Portable Cold Storage Box for Door-to-door Delivery Service of Frozen Food in Malaysia

Abstract: The conceptual design of the portable active cold storage box, known as Frosty Express, is meticulously crafted. This innovation targets Malaysia's burgeoning frozen food delivery sector, which has witnessed exponential growth during and after the movement control order. Market analysis revealed existing cold storage solutions to be either prohibitively expensive for door-to-door frozen food delivery or limited in coverage due to passive cooling methods. The Frosty Express design journey encompassed need identification, benchmarking, translation of customer requisites into engineering characteristics, and optimal conceptual design selection. A market survey involving 63 respondents was instrumental in delineating customer requirements, which were subsequently transformed into engineering parameters. Through morphological analysis, four distinct conceptual designs were generated. Employing the Pugh chart, Conceptual Design 1 emerged as the most superior among the proposed designs.

Authors: Lim Eng Aik, Wee Choon Tan, Mohd Syafarudy Abu

ID 33: K-means Algorithm Based on Flower Pollination Algorithm and Calinski-Harabasz Index

Abstract: Aiming at the problems that the Flower Pollination (FP) algorithm is easy to fall into the local optimum, the searchability is weak, and the k-means algorithm is easily affected by the selection of the initial clustering centre, a k-means algorithm based on the FP algorithm is proposed. Six benchmark functions test the improved FP algorithm. The effectiveness of the kmeans algorithm

based on the improved FP algorithm was tested and verified with UCI machine learning and artificial datasets. The verification results showed that the improved FP algorithm improved based on ensuring a faster convergence speed. Compared with other algorithms, the performance of this algorithm has been significantly improved in all aspects.

Authors: Tan Wei Hong, Pratheban Ganesh, Chan Choon Kit, Teoh Choe Yung
ID 34: Acoustical Simulation and Analysis on Motorcycle Silencer

Abstract: The silencer, typically situated at the rear end of a motorcycle, is a vital component of the exhaust system responsible for dissipating the noise generated by the engine's combustion. An ongoing concern related to silencers is the escalating issue of noise pollution. Thus, the design of an effective motorcycle silencer is crucial to maximize noise transmission loss (TL) and minimize emitted exhaust noise. This study presents the development and validation of a simulation-based validation model for motorcycle silencers. The model includes a basic expansion chamber silencer, with TL results compared against theoretical data from prior research. Upon validation of the acoustical simulation, a 3D silencer model based on the HONDA EX5 silencer's original dimensions was created. Additionally, nine modified 3D silencer models were formulated, incorporating variations in silencer shape, perforation hole diameter, absorptive material thickness, and number of perforation tubes. These models were simulated to obtain their TL values and analysed to ascertain optimal performance. The successful validation of the acoustical simulation model, characterized by a promising correlation coefficient of 0.97, marks a significant achievement. The study highlights substantial performance enhancements in the modified 3D silencer models. Notably, a 10mm diameter of perforation holes yielded a 7.6% increase in silencer TL, an oval-shaped silencer exhibited a 10.8% increase, a silencer 2 with a 30mm absorptive material thickness demonstrated a 14.2% increase, and a silencer equipped with double perforation tubes achieved an 11.2% increase in TL. Moreover, this configuration outperformed the original 3D silencer model in terms of TL results. The findings suggest that these parameters can be strategically implemented in motorcycle silencers, contributing to the creation of a sustainable transportation system in Malaysia.

Authors: Vil Cherd Teoh, Nor Hazadura Hamzah
ID 36: Conceptual Design of a Staircase Climbing Smart Wheelchair

Abstract: Wheelchair is the chair with wheels which help those who are facing difficulties in walking due to disability or illness. Nowadays, wheelchair is a very common and important assistive device to promote and enhance the mobility of disables. However, lack of proper facility such as an incline slope poses great problem to the accessibility of wheelchair user. This paper focuses on the conceptual design of a smart wheelchair equipped with assisted staircase climbing. A total of 4 conceptual design is produced. The Pugh selection chart and weighted decision matrix is used and it is found that the conceptual concept 4 has the best design. A 3D detailed modelling of the concept 4 is developed for future testing and analysis of the design prior to fabrication.

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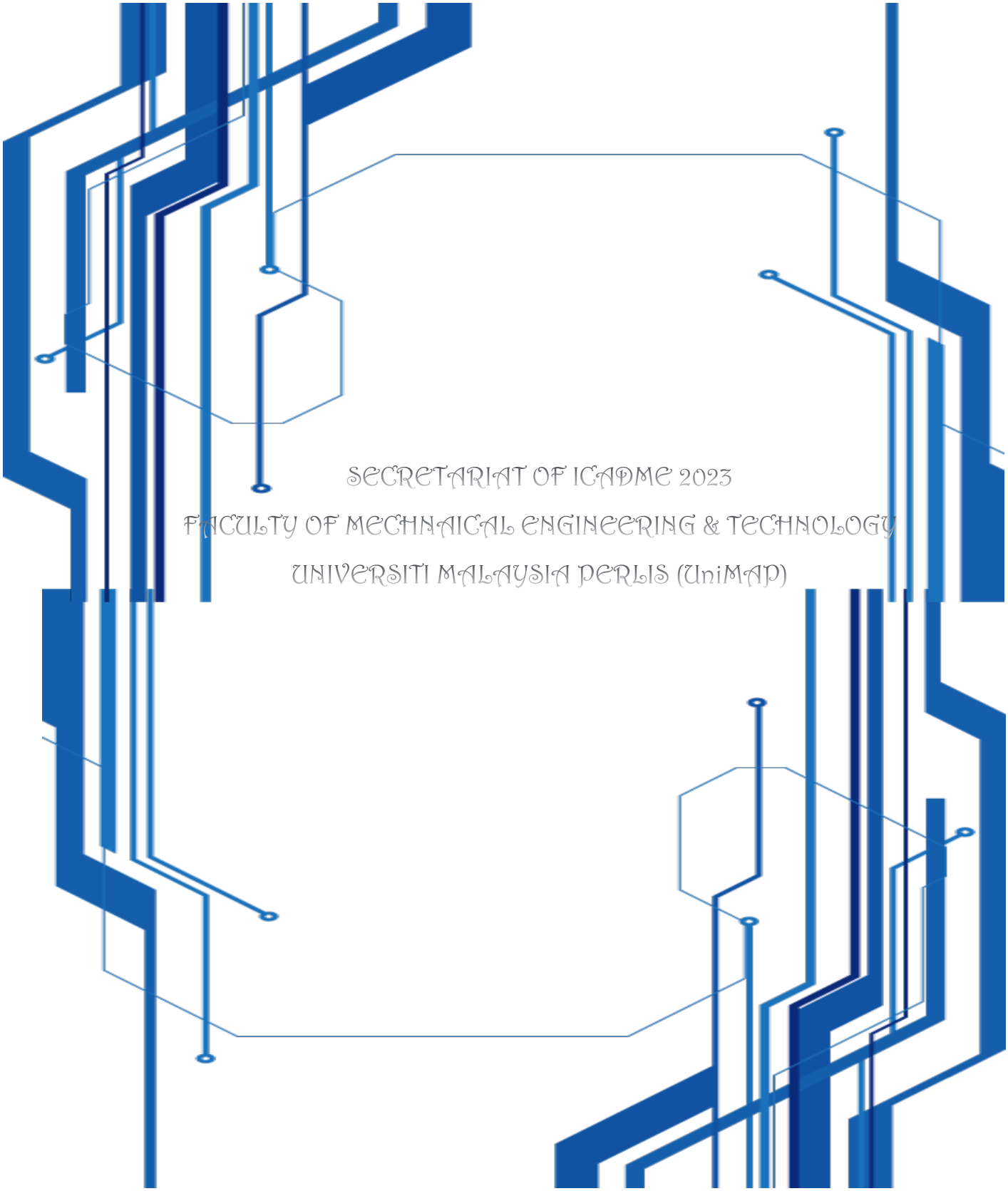
THANK YOU.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