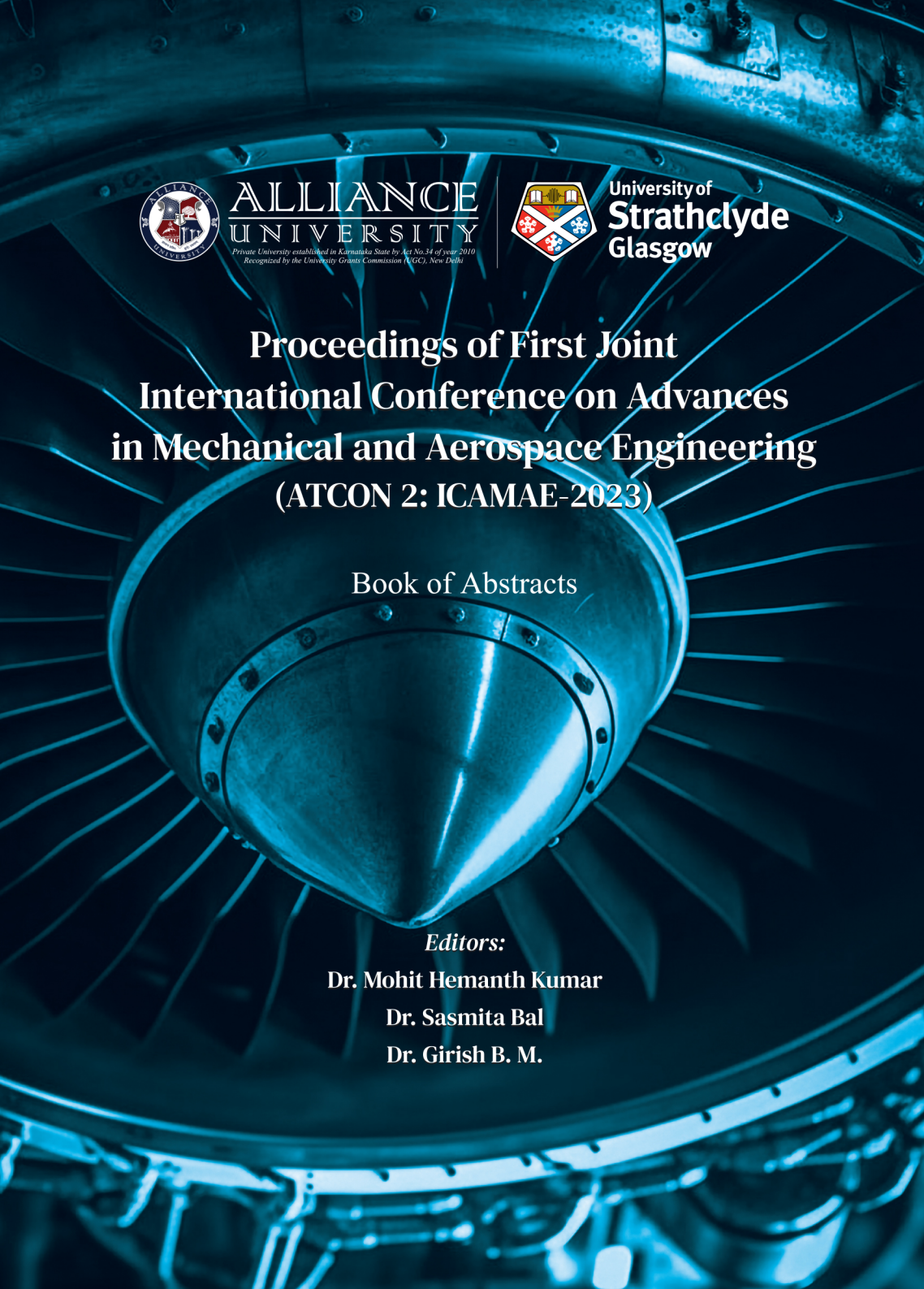

ALLIANCE UNIVERSITY

Private University established in Karnataka State by Act No.34 of year 2010
Recognized by the University Grants Commission (UGC), New Delhi

University of Strathclyde Glasgow

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Book of Abstracts

Editors:

Dr. Mohit Hemanth Kumar

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Dr. Girish B. M.

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BOOK OF ABSTRACTS

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Conference Date: 28 & 30, November 2023

Editors: Dr. Mohit Hemanth Kumar
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ALLIANCE UNIVERSITY

Alliance reimagines the idea of the university by creating a community that leads the charge against the complex challenges of the 21st century. The university conceives research to be the essence of all teaching and learning practices. A unity between research and teaching is promoted to extend the frontiers of knowledge in order to solve real world problems at the local, national, and global scale. For this purpose, the university seeks to be the nerve centre of interaction between the industry, the government, the civil society, and the community at large. In times when technological and social change is transforming the very idea of employability, the university embraces the increasing diversity of specializations while retaining the impulse to unify all knowledge.

ALLIANCE COLLEGE OF ENGINEERING AND DESIGN

Alliance College of Engineering and Design is a prestigious educational institution at the forefront of world real-time research activities. With a commitment to engineering and design education excellence, the college has carved a niche by fostering an environment that encourages innovation, creativity, and cutting-edge research. The institution recognizes that research is vital in pushing the boundaries of knowledge and technology. Therefore, it provides ample opportunities for students and faculty members to engage in meaningful research. The collaboration with industry professionals and research organizations further enhances the research ecosystem at the college. By encouraging collaboration across various fields, the institution promotes a holistic approach to problem-solving and encourages students to think beyond traditional boundaries. The Mechanical Engineering Department at Alliance College of Engineering and Design, Alliance University provides a

supportive and collaborative research environment for faculty members and students. Through research projects, publications, and collaborations with industry and research organizations, the department contributes to the advancement of mechanical engineering knowledge, fosters innovation, and prepares students to become skilled professionals in the field. Our research have yielded remarkable projects that span across diverse domains, from developing cutting-edge energy generation to lightweight structures that revolutionize efficiency of world real time applications.

UNIVERSITY OF STRATHCLYDE, UNITED KINGDOM

The University of Strathclyde is respected as one the leading international technological universities in Europe and its technologies combine the creation and development of solutions for industry and society. Strathclyde is a multi-award-winning university. We are the only University to have won the Times Higher Education University of the Year award twice (2012 and 2019). Over the years, Strathclyde has been recognised across a variety of categories at the Times Higher Education awards.

Our Faculty of Engineering is a leading international centre for engineering research, which boasts multi-million pound investments by Research Councils, Government and companies, and it is at the forefront of engineering research.

Mechanical & Aerospace Engineering is one of the largest departments of its type in the UK and it is by far the largest in Scotland. It has the highest independently assessed standing in

its discipline in Scotland for both teaching and research. Our mission is to advance knowledge and commerce in mechanical and aerospace engineering. Our research is carried out in award-winning and internationally recognised research centres in energy, aerospace, fluids and materials. The Department hosts a broad range of advanced research equipment including a £3 million investment in a state of the art advanced materials research laboratory which delivers a step change in multi-disciplinary experimental research capability. Our research programmes have delivered projects from marine turbines for clean energy to lightweight material for efficient transportation.

COLLABORATION BETWEEN ALLIANCE UNIVERSITY AND UNIVERSITY OF STRATHCLYDE

Alliance University and the University of Strathclyde have entered into a dynamic partnership that extends across research, student exchange programs, and faculty collaborations. The two prestigious universities have come together to enrich research endeavours, leveraging their collective expertise to tackle complex challenges and push the boundaries of knowledge in various fields for the betterment of society at large. This collaborative approach enhances the quality and impact of the research output, thereby creating a robust academic ecosystem, which leverages excellence, innovation, and cross-cultural exchange.

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MESSAGE FROM THE PRO-CHANCELLOR

In an era defined by rapid technological evolution and global collaboration, forums such as the First Joint International Conference on Advances in Mechanical and Aerospace Engineering adopts a hybrid format, facilitating a seamless participation of attendees worldwide through both in-person and virtual channels. We are overwhelmed by the kind of positive response we have received from around the world. Our submissions span over 25 countries including Austria, Thailand, the Netherlands, the United States, China, Oman, Nigeria, and more. The accepted manuscripts have the potential for publication in journals indexed in SCI, Scopus, and WoS during the second and third quarters.

This conference plays a pivotal role in shaping the discourse surrounding mechanical and aerospace engineering. The challenges and opportunities before us are immense, and it is only through collaborative efforts and knowledge exchange that we can hope to overcome them.

Alliance University has always been committed to fostering an environment that nurtures innovation, research, and academic excellence. This conference stands as a testament to our unwavering dedication to the pursuit of knowledge and the advancement of these critical fields. It provides a platform for scholars, researchers, and industry experts from around the world to converge, share insights, and chart the course for the future of mechanical and aerospace engineering.

The importance of this conference extends beyond the academic realm. It serves as a bridge between theory and practice, academia and industry, and individual aspirations and collective progress. Our aim is not only to facilitate the exchange of ideas but also to catalyze collaborative efforts that lead to real-world solutions and advancements.

As the Pro- Chancellor of Alliance University, I am proud of the strides we have made in establishing ourselves as a hub for cutting-edge research and academic excellence. This conference marks another significant step in our journey, and we are eager to contribute to and learn from the vibrant mosaic of insights that will be shared during these deliberations.

I encourage all participants to actively engage in the sessions, forge new connections, and contribute to the rich tapestry of knowledge that will undoubtedly emerge from this gathering. Let us leverage this unique opportunity to not only discuss the latest advancements but to collectively shape the trajectory of mechanical and aerospace engineering on a global scale.

Warm Regards,
Mr. Abhay G. Chebbi
Pro Chancellor
Alliance University

MESSAGE FROM PRO-VICE CHANCELLOR (ACADEMIC AFFAIRS)

Honorable guests, colleagues and students – a very warm welcome to Alliance University!

It is my honor to address this august gathering on the inaugural day of the First Joint International Conference on Advances in Mechanical and Aerospace Engineering.

I would like to extend my heartfelt appreciation to our esteemed partners – University of Strathclyde – for collaborating with us to organize this conference focusing on technologies that will shape the future across industries globally.

The conference comes at an important juncture when sustainability and energy efficiency have become the defining paradigms for technological advancement and innovation. Over the next three days, leading experts will convene to discuss pathbreaking research in materials, design, fluids, thermal and aerospace engineering among other sub-domains.

I am confident the conference will lead to an exchange of ideas and perspectives between academics and industry professionals from India, UK and other parts of the world. Our faculty and students will also immensely benefit from interacting with global thought leaders in mechanical and aerospace engineering.

Friends, Alliance University strives to provide platforms for the generation and transfer of cutting-edge knowledge via events like this conference. We believe quality research and its application for societal good must be the raison d'être for any globally reputed institution.

I wish everyone a very productive and memorable conference ahead!

Regards
Dr. B. Priestly Shan
Pro-Vice Chancellor (Academic Affairs)
Alliance University

MESSAGE FROM DEAN, ACED

It is my honor to welcome you all to the First Joint International Conference on Advances in Mechanical and Aerospace Engineering hosted by Alliance University in collaboration with the prestigious University of Strathclyde, Glasgow.

As the Dean of Alliance College of Engineering and Design, it brings me immense pride that our institution is hosting such a renowned gathering of global experts and researchers. The field of mechanical and aerospace engineering is advancing rapidly, playing a pivotal role in building sustainable societies. This conference intends to facilitate the exchange of groundbreaking research, ideas and innovations to tackle complex real-world problems.

Over the next three days, leading academics from India, UK and around the world will come together on one platform. With over 115 research papers and presentations spread across five

broad themes, the conference promises engaging discussions. Participants also have the opportunity to network, forge partnerships and get inspired.

I would like to extend my gratitude to all those who have put their valuable effort into making this event a grand success, especially my co-organizers from University of Strathclyde. Finally, my best wishes to all delegates for a productive conference ahead and a memorable stay in Bengaluru.

Let the collaborations and conversations begin!

Regards
Dr. Reeba Korah
Professor & Interim Dean,
Alliance College of Engineering & Design,
Alliance University

HOD'S MESSAGE

Greetings and warm welcome to all delegates of the First Joint International Conference on Advances in Mechanical and Aerospace Engineering (ICAMAE 2023)!

As the Head of Department of Mechanical Engineering at Alliance College of Engineering and Design, it gives me great pleasure to be involved as a convener in this prestigious collaboration between Alliance University, India and University of Strathclyde, UK. Our aim is to create a platform to discuss latest innovations, trends, and findings to expand the horizons of knowledge and breakthroughs in mechanical and aerospace engineering. Through keynotes, paper presentations and lively discussions, this conference brings together top researchers, academics, and industry professionals in the field. It will explore diverse topics spanning materials science, production, design, fluids, thermal and aerospace engineering. I am especially pleased about the product exhibition featuring pathbreaking innovations with real-world applications in these areas.

Participants can expect deep insights, meaningful exchange of ideas and exploring avenues for joint efforts. Select papers will be published to increase visibility while the most impactful research will be recognised through awards. We hope ICAMAE 2023 will shape future roadmaps, mainstream green technologies, leverage cross-border synergies towards deploying mechanical and aerospace engineering effectively to solve pressing global challenges.

My heartfelt appreciation for all the hard work put in by every contributor and organiser behind the scenes. Looking forward to vibrant technical deliberations and forging lasting partnerships at this conference.

Dr. Girish B M
Professor and Head
Organizing Chair ICAMAE 2023

MESSAGE FROM THE CONFERENCE ORGANIZING CHAIR

Dear colleagues and friends,

A warm welcome to the First Joint International Conference on Advances in Mechanical and Aerospace Engineering – ICAMAE 2023.

ICAMAE 2023 will be a significant international forum for sharing recent developments and original findings in the fields of Mechanical and Aerospace Engineering.

The ICAMAE 2023 programme features exciting keynote talks and a wide range of high quality presentations on pertinent areas such as advanced materials, sustainable manufacturing, aerodynamics, structural dynamics, and many more.

I am proud and honoured to stress that ICAMAE 2023 is a major output of the growing collaboration between two prominent universities, Alliance University, India and the University of Strathclyde, United Kingdom.

This is a vibrant partnership that extends across research, student exchange programs and faculty collaborations. Alliance University and the University of Strathclyde have joined forces with the aim of augmenting research endeavours and leveraging their collective expertise to generate new knowledge and tackle current industrial and societal challenges.

The University of Strathclyde is the only higher education institution in Scotland founded during the Enlightenment. The essence of the Enlightenment movement, crystallised in its motto, 'Dare to Know', is reflected in Strathclyde's founding mission as "the place of useful learning".

Today, the University of Strathclyde is a leading international technological university which is socially progressive. We deliver high-quality education, world-leading research and cutting-edge innovation for the benefit of students, staff, our community and wider society.

I feel our core strengths are appropriately reflected by the diverse themes of ICAMAE 2023, whilst its successful delivery will further strengthen the relationship between our esteemed institutions.

Best wishes,

A I Toumpis

Dr Athanasios Toumpis,
CEng MIMechE FHEA
Strathclyde Chancellor's Fellow
Department of Mechanical & Aerospace Engineering
University of Strathclyde


CONVENOR'S MESSAGE

Greetings and a warm welcome to the First Joint International Conference on Advances in Mechanical and Aerospace Engineering (ICAMAE 2023)!

As conveners of this distinguished conference, a collaborative effort between Alliance University, India, and the University of Strathclyde, UK, we are thrilled to provide a platform for the exchange of cutting-edge advancements, innovations, and research findings in the realms of mechanical and aerospace engineering. ICAMAE 2023 is set to bring together prominent researchers, academics, industry experts, and professionals. Through keynote speeches, paper presentations, and dynamic discussions, the conference will delve into diverse topics including materials science, production engineering, design engineering, fluids and thermal engineering, and aerospace engineering. A noteworthy feature is the product exhibition, showcasing groundbreaking innovations in these fields.

Participants can anticipate gaining fresh insights, exchanging ideas, and fostering collaborations. Selected papers will find publication in esteemed journals, enhancing visibility, while impactful research will be acknowledged through awards. This conference aims to identify trends and future directions, explore cutting-edge technologies, and promote sustainable solutions and international partnerships. Our collective efforts at ICAMAE 2023 will advance the application of mechanical and aerospace engineering to address real-world challenges. Our sincere gratitude extends to all contributors and organizers who have diligently worked behind the scenes, ensuring the success of this event. With anticipation, we look forward to an intellectually stimulating conference, fostering lasting networks.

Let the interactions and ideations commence!

Best Wishes
Dr. Mohit Hemanth Kumar
& Dr. Sasmita Bal
Convenor-ICAMAE 2023

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Track 1

Material

Article ID: ICAMAE-2023-1-1

MATERIAL SUBSTITUTION & SELECTION FOR CARBON FIBRE FILAMENT WINDING IN NGV COMPONENTS

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ABSTRACT

Material selection is crucial for design constraints and functional characteristics of any components, equipment and system. The proper selection of materials used for manufacturing a component can enhance its operational performance. This paper aims to select the most appropriate constituent materials and processing to be used for carbon fibre filament winding of the components of Natural Gas Vehicle (NGV) like nozzle and cylindrical parts. Six samples of carbon filament fibre, readily available in Malaysia, were considered. The various analytical and empirical methods were used to create a good combination of desired properties of samples to evaluate the best among them. Property design chart and performance index were used to establish the weighted material indices for filling gaps in the materials property charts and finding materials

performing better than monolithic materials. The desired properties of samples should correlate with the functional objectives and constraints in designing NGV components. It was found that TORAYCA M55J was recommendable for cylindrical tube vessels and nozzles of NGV. At the same time, TORAYCA T1100G was preferable for manufacturing nozzles in the perspective of design constraints and requirements.

Keyword: Activity-based costing, Material-attribution, Material-indices, Property chart, Performance index, Quality function deployment

Article ID: ICAMAE-2023-1-2

UPCYCLING DISCARDED FLOWERS INTO ACTIVATED CARBON PARTICLES FOR SUPERCAPACITORS

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ABSTRACT

Activated carbon has become increasingly popular in recent years due to its wide range of applications, including air and water purification, waste treatment, and chemical decontamination. This paper presents a comprehensive study on the preparation of activated carbon from marigold and jasmine flowers. The study aims to explore the potential of these flowers as a cost-effective alternative to traditional sources of raw materials for the production of activated carbon. The paper first details the collection and pretreatment of marigold and jasmine flowers, followed by the analysis of the powdered samples generated. The resulting activated carbons were characterised using various techniques, such as Fourier transform infrared

spectroscopy and scanning electron microscopy. The results of this study demonstrate that marigold and jasmine flowers can be partially converted into activated carbon with a high surface area, well-developed porous structure, and high adsorption capacity for various pollutants. This research offers a promising approach to producing cost-effective and sustainable activated carbon materials.

Keywords - Activated carbon, Biowaste, FTIR, Porous carbon, Green synthesis, Renewable resources, SEM, Simple process, Superconductors.

Article ID: ICAMAE-2023-1-3

PROPERTIES AND PERFORMANCE OF NATURAL FIBRE REINFORCED EPOXY HYBRID BAMBOO COMPOSITES

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ABSTRACT

Natural fibres are being used to balance the environment. Comparatively low costs as well as low energy consumption add to their benefits. The emphasis is on enhancing the properties of the composite with the use of nano- filler materials with natural fibres. The composite was made by hand–layup technique. The epoxy, hardener, bi-directional bamboo mat and nano SiO_2have been used as the filler material. After making the hybrid composites (HC) we gave it six different designations because we have taken bamboo layer with nano silica in two different patterns. Nano SiO_2filler material (NSFM) with three different wt. % were used. NSFM is used with 0,2 and 4 wt. %. The six types of

samples of composites were designated as A, B, C, D, E and F. The mechanical tests of all composites were conducted. Based on the obtained mechanical properties field emission scanning electron microscope (FESEM), x-ray diffraction (XRD) and thermo-gravimetric analysis (TGA) were performed. From the FESEM image we can see that for sample F silica nano particle forms clusters. In the natural composite mixture, as the use of filler material increased, the properties shown an increase up to certain limit followed by the decrease in properties with further increase in the filler material. The addition of nano particles beyond 3 wt.% has shown reduction in tensile strength, flexural strength, impact strength and hardness properties at 4 wt. % silica (SiO_2). A detailed description of TGA test was presented here. The thermal decomposition temperature of a natural fibre hybrid composite can be determined by its thermal degradation behaviour. The thermal properties of the two-layer natural bamboo fibre with 2 wt.% nano SiO_2 composites (sample-B) was excellent when compared to other five hybrid composites investigated in this study. The amorphous peak located at $20.8^{o}(2\theta)$ in the XRD pattern. This study will help us to obtain a new class of composites which may be used as an alternate to the existing composites made-up of synthetic fibres. The detailed investigation will also help us to understand the mechanical behaviour of the fabricated composites before using it for actual application.

Keywords: Bamboo fibre, Composite materials, FESEM, Hybrid composites, Thermo-gravimetric analysis, XRD.

Article ID: ICAMAE-2023-1-4

STUDIES ON EFFECT OF LAMINATE THICKNESS AND HOLE DIAMETER OF GFRP/EPOXY COMPOSITE SUBJECTED TO OPEN HOLE TENSILE TEST

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ABSTRACT

This paper investigates the effect of laminate thickness and hole diameter on the open hole tensile behaviour of Glass Fiber Reinforced Polymer (GFRP) composite. GFRP composites find extensive application in aerospace due to their high strength-to-weight ratio. However, drilling holes in these composites can lead to structural issues. This study focuses on understanding the influence of laminate thickness and hole diameter on the tensile strength of GFRP composites. The research involves fabricating specimens with varying laminate thickness (5mm, 10mm, 15mm) using vacuum bagging technique. Different hole diameters (6mm, 9mm, 12mm) are drilled in the specimens. Tensile tests are conducted on these specimens, and their failure modes are studied

through Scanning Electron Microscopy (SEM). The results indicate that an increase in laminate thickness leads to a decrease in tensile strength but an improvement in damage tolerance. Larger hole diameters correspond to decreased peak loads, suggesting a critical role of hole size in load-bearing capacity. The study reveals that increasing the number of layers enhances the material's load-bearing capacity, although there is a trade-off with reduced tensile strength. SEM analysis demonstrates failure modes including fracture along hole edges, fiber breakage, delamination, and matrix cracking. The study's findings contribute to understanding the interplay between laminate thickness, hole diameter, and mechanical behaviour of GFRP composites under tensile load, providing valuable insights for material design and aerospace applications.

Keywords GFRP, Epoxy and Hardener, SEM.

Article ID: ICAMAE-2023-1-5

ENHANCING DURABILITY IN GFRP/EPOXY PANELS: A STUDY ON REPAIR TECHNIQUES IN OPEN HOLE TEST

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ABSTRACT

Composite materials, particularly Glass Fiber Reinforced Plastics (GFRP), have become integral in numerous industries, attributed to their unparalleled properties such as corrosion resistance, structural robustness, and thermal resilience. The primary objective of this research is to delve deep into the manufacturing and post-manufacturing processes of GFRP composite panels, with a keen focus on the challenges posed by drilling-induced damages, which have the potential to undermine the material's service life. The Key findings, derived from the Open Hole Tensile Test (ASTM D5766), reveal significant disparities in the mechanical properties of drilled versus undrilled samples. A pivotal aspect of this study is the

exploration of repair methodologies for drilled holes. Through comparative analysis, epoxy and chopped glass fibers offer some restorative benefits, GFRP cloth stands out as the most effective material in bolstering tensile strength. In conclusion, this study not only highlights the vulnerabilities associated with drilling in GFRP composites but also offers simple and effective solutions to counteract these challenges, ensuring the longevity and optimal performance of the material.

Keyword: - GFRP Composite, Vacuum Bagging, ASTM 5766, Open Hole Tensile Test.

Article ID: ICAMAE-2023-1-6

SENSITIVITY STUDIES ON POLYVINYLIDENE FLUORIDE-TRIFLUOROETHYLENE / ZINC OXIDE NANOCOMPOSITES SENSOR

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ABSTRACT

Among flexible polymers, β – phase polyvinylidene fluoride (PVDF) is well known for its excellent piezoelectric properties. To achieve the piezoelectric β-phase, thermomechanical treatment of PVDF films is mandatory. A copolymer of PVDF, polyvinylidene fluoride-trifluoroethylene (PVDF-TrFE) has good flexibility and its piezoelectric β-phase can be easily formed without thermomechanical treatment. However, the piezoelectricity of this copolymer is relatively low. In the present work, nanocomposites containing 10, 30, 50 and 60 wt.% zinc oxide nanoparticles (ZnO) dispersed in a PVDF-TrFE copolymer matrix were developed. The films were investigated for its structural and surface morphological features using X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). Piezoelectric voltage coefficient (g_{33}) values showed that the piezoelectricity is more for PVDF-TrFE/ZnO

nanocomposites than for the PVDF-TrFE copolymer. The voltage response of these nanocomposite sensors to external excitation was also found to be superior compared to PVDF. Incorporation of piezoelectric ZnO nanoparticles to copolymer (PVDF-TrFE) thin films improved the sensitivity of (PVDF-TrFE) by approximately two times. The results obtained from this investigation are used for Structural Health Monitoring (SHM) applications.

Keywords: Poly Vinylidene Fluoride, Copolymer, PVDF-TrFE/ZnO, Structural Health Monitoring, Frequency response.

Article ID: ICAMAE-2023-1-7

EXPERIMENTAL STUDIES ON MICROFIBRIL EXTRACTION AND FABRICATION OF ECOFRIENDLY FIBER REINFORCED COMPOSITES

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ABSTRACT

Burmese Silk Orchid is mainly cultivated in India mainly (Kerala, Karnataka, Tamil Nadu, etc). Traditional medical treatments employ a variety of plant parts. Because of their low density, biodegradability, light weight, and natural abundance, they can be used to make automobile components instead of other fibers like glass or carbon fiber. In this work, cellulose Burmese microfibers are extracted through traditional steam explosion method. The epoxy composites with various proportion of Burmese fiber were fabricated by using press technique and their properties such as

tensile, flexural and impact strength were investigated. The result shown that the mechanical properties of the Burmese reinforced epoxy composites were higher at 40% Vf of fiber reinforcement. It is identified that composites with 40% Vf of fiber has given the highest value of tensile, flexural, impact strength of 80 N/mm2, 101 N/mm2 and 9 J/cm2 respectively. The tensile, elastic modulus and flexural strength values are increased to 80%, 75% and 55% respectively as compared to neat epoxy resin. This developed composite could be an effective alternate for component such as windscreen wiper etc.

Keywords: Static, Epoxy, Burmese Fiber, Hydraulic Press, Wind Blade

Article ID: ICAMAE-2023-1-8

ANALYSIS OF MECHANICAL RESPONSES OF FLY ASH FILLED GFRP COMPOSITE PLATES USING FINITE ELEMENT METHOD

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ABSTRACT

The present research aims to investigate the physical, mechanical, thermal properties as well as the mechanical responses of fly ash filled glass fiber reinforced polymer (GFRP) matrix composites under ambient as well as thermal environment and suggest` their potential engineering application. In order to do so, GFRP composite using five different weight percentage (0, 5, 10, 15 and 20 wt.%) of fly ash is prepared and their mechanical, thermal, and physical properties are evaluated experimentally. Further, a simulation model has been developed using ANSYS Parametric Design Language (APDL) to study the static and free vibration responses in ambient as well as thermal environment.

The experimentally attained elastic properties of these GFRP composites have been utilized in the simulation model for computing the mechanical responses. Firstly, the convergence and validation tests have been performed in ambient and thermal environment for the static as well as modal analysis. Then, various numerical studies have been carried out using different design parameters. From the analysis of results, the composite plates with 10 wt.% fly ash filler are observed to demonstrate superior overall characteristics, as well as static and modal responses.

Keyword: Fly ash, GFRP composite, Characterization, Simulation model, Static analysis, Modal analysis.

Article ID: ICAMAE-2023-1-9

STRESS ANALYSIS OF CARBON FIBER AND GRAPHENE REINFORCED POLYURETHANE POLYMER COMPOSITE

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ABSTRACT

Composite polymers provide a large range of designing and manufacturing. They give freedom to design and manufacture any type of component that is light-in-weight, strong, tough, and complex in shape. In this study two different composites are made computationally using ANSYS software and analyzed on the same. Both are having same matrix i.e., thermoplastic polyurethane but they differ in reinforcement. One has carbon fiber in sheet form which is sandwiched in between the matrix and the other has graphene nano-particles which are embedded

into the TPU with 3 % of weight. Both were tested alike in ANSYS software and found comparable values of total deformation, equivalent elastic strain, principle stress, normal stress, shear stress, strain energy and stress factor. Addition of graphene into the polyurethane matrix heads towards the decrement of total deformation and equivalent elastic strain. And sandwiched orientation of CF in between the PU matrix led to absorbing more strain energy and the stress factor is more favorable towards this composite.

Keyword: ANSYS software, Carbon fiber, Graphene Nanoplatelets, Thermoplastic polyurethane

Article ID: ICAMAE-2023-1-10

CHARACTERIZATION AND CORROSION BEHAVIOR OF AL AND TERNARY AL-ZN-MG ALLOY PRODUCED FROM BEVERAGE CAN SCRAPS IN SEAWATER

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ABSTRACT

Due to the depletion of bauxite ore and the high energy involved in the extraction of aluminium, researchers have resorted to using aluminium from secondary sources for possible application in aerospace and automobiles. In this research, the corrosion of as-cast aluminium metal and as-cast aluminium-zinc-magnesium metal produced from beverage cans was investigated in seawater. The aluminium was melted in a crucible, 6 w% zinc and 2 wt% magnesium were added. The as-cast aluminium metal and the as-cast aluminium-zinc-magnesium metal were cast in a permanent mold. The chemical composition, the phases present and the microstructure of the as-cast aluminium and as-cast

aluminium-zinc-magnesium were investigated with X-ray fluorescence, X-ray diffraction and transition electron microscopy respectively. Corrosion properties of the as-cast aluminium metal and as-cast aluminium-zinc-magnesium metal were obtained using polarization potential in seawater. The optical microscopy study of the as-cast s before and after the corrosion test was recorded. The results show the presence of alpha Al and $MgZn_2$ intermetallic particles in the as-cast aluminium and as-cast aluminium-zinc-magnesium metal respectively. Also, the corrosion properties show that the as-cast Al-Zn-Mg metal has a negative potential as well as a higher current in seawater compared to the as-cast Al. Therefore, the presence of intermetallic particles affect the corrosion behavior of aluminium-zinc-magnesium metal produced from beverage cans.

Keywords: -aluminium, scrap, corrosion, second-phase particles, microstructure

Article ID: ICAMAE-2023-1-11

CHARGE TRANSPORT IN SEMICONDUCTOR HETEROGENEOUS STRUCTURE AT OXIDE INTERFACE BY INSERTING A FUNCTIONAL LAYER

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ABSTRACT

Due to the peculiar physical properties and a wide variety of phenomena in semiconductor nanoelectronics based structure, complex oxide interfaces have arisen as one of the most promising areas of condensed-matter electronics. Magnetization at high Curie temperatures, high-temperature superconductivity, ionic conduction, metal-insulator transitions, and polymorphism are examples of these phenomena. Oxide interfaces between highly correlated electron systems also provide a powerful pathway for manipulating charge, spin, orbital, and lattice degrees of freedom and regulating and enhancing effects through interactions with functional layers. This paper suggests a general method for obtaining non-volatile properties at the

oxide interface by inserting a functional layer into a heterogeneous structure. The LaAlO3-SrTiO3 (LAO / STO) complex oxide has been chosen for this research paper.

Keyword: - Antenna, CNT, Flexible electronics, Fabrics, Wetness, Bending, Nanoelectronics.

Article ID: ICAMAE-2023-1-12

IN-SITU REPAIR OF WORN CARBON STEEL COMPONENTS USING A NOVEL SURFACE ENGINEERING APPROACH.

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ABSTRACT

Metal matrix composite (MMC) deposited on the surface of worn steel alloys has the potential to extend the life of component due to an increase in the hardness and wear resistance of the repair. A novel low-cost surface melting technique has been developed in which an MMC layer is deposited by the Tungsten Inert Gas (TIG) technique. on a AISI316L steel substrate. The consumable filler wire was a 4mm outside diameter and 3mm inside diameter 316L tube which was pre-filled with WC10%Co 101μm powder. The post weld microstructure, chemical composition and elemental distribution of the weld deposit were subsequently characterised, and an assessment of the hardness and wear resistance of the deposited layer was performed. The resultant deposit consisted of hard WC10%Co particles within a soft metal matrix and the hardness

and wear resistance increased nine and five times respectively.

Keywords: metal matrix composite, TIG cladding, tungsten carbide, wear resistance coating.

Article ID: ICAMAE-2023-1-13

NUMERICAL AND EXPERIMENTAL INVESTIGATION OF A HIGH STRENGTH STEEL FOR FRACTURE MECHANICS MATERIAL PROPERTY ASSESSMENT

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ABSTRACT

High strength structural steels such as the S690, S700 and S960 grades are used in the construction of heavy industrial machines, when a high strength to weight ratio is required. This paper investigates a methodology to estimate the fracture mechanics properties of the S700 grade. A tensile test is first conducted to evaluate the linear and non-linear elastic-plastic response of the material. A finite element virtual tensile test model is then used to verify the multilinear kinematic hardening plasticity models. Compact Tension (CT) fracture mechanics finite element models are then developed for three different test specimen sizes: 1T, 0.4T and 0.16T (where specimen thickness T=25mm). The measured non-linear material properties are used in the CT finite element models to calculate the range of force-displacement responses, to

support experimental planning. Additionally, the crack mouth opening displacement (CMOD) is estimated at the load line and built in knife edge on the front face. The J integral is calculated using the ANSYS fracture tool. The numerically estimated force-displacement and CMOD responses in this study will be compared to ASTM E1820 based fracture mechanics experimental results in a future study.

Keywords: fracture mechanics, tensile test, fracture toughness, high strength steels, finite element analysis.

Article ID: ICAMAE-2023-1-14

DESIGN AND OPTIMIZATION OF BIO-INSPIRED LIGHT-WEIGHT COMPOSITE TUBES.

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ABSTRACT

The stalk of the bamboo plant has been in structural use for millennia and is still used today in scaffolding. This plant is favored, due to a fast growing, plentiful, supply and its remarkable weight to stiffness properties. This paper investigates these flexural properties and finds the contribution of the circumferential nodes in suppressing ovalisation of the stalk to be a key factor. The structural devices employed by the bamboo cane are directly transferred to a composite tube structure. Three composite test tubes are designed with different layer orientations. A bending theory is developed which highlights the effects of ovalisation on the failure modes and stresses common in axial bending of the tube. A failure mode analysis is conducted to show the stress limits of the tube under bending. The model shows the prominent failure mode to be circumferential collapse due to ovalisation and how this failure mode can be strengthened by the

introduction of periodic circumferential stiffener rings, which suppress ovalisation and thereby increase the failure stress at which it occurs. The periodic distance between stiffening rings is then optimized in terms of layer orientation and minimization of weight. The analysis provides a better understanding of the effect of circumferential stiffening rings on the bending stresses and failure modes of composite tubes. This knowledge will enhance structural design in the Aerospace, Automotive and Robotics industries.

Keywords: Axial bending; Bamboo plant; Ovalization; Scaffolding

Article ID: ICAMAE-2023-1-15

EFFECT OF DOPING ON THE J-V CHARACTERISTICS OF GA2OX AND TA2OX BASED MEMRISTORS

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ABSTRACT

In this work, we investigate the design of memristive devices with a thorough simulation using the Silvaco TCAD ATLAS simulator. These devices are usually fabricated based on non-stoichiometric transition metal oxides, such as Ta_2O_x and Ga_2O_x. By varying the doping profiles and introducing defects, the resistivity levels of such memristors fluctuate from High Resistive Logic (HRL) to Low Resistive Logic (LRL). Bias voltage scan rate and mobile ion concentration have a strong influence in J-V curves of transition metal oxide-based memristors. This study examines how different parameters affect a transistor's drain-source current (I_{DS}), with a focus on the impact of gate length (L_G). The simulation results indicate the I_{DS} reached a maximum level of 65 mA when L_G is 500 nm. Notably, our results show that L_G plays an incredibly important influence in comparison to other

variables such as doping concentration of the oxygen in Ta_2O_x and Ga_2O_x. The current density significantly increases to 16 mA/ mm^2, when gate width of L_G = 0.2 μm was inserted. In line with findings from the previous literature, this study emphasizes the crucial part that gate length plays an important role in current propagation across the transistor.

Keywords: Gallium Oxide, Memristors, Silvaco TCAD, Tantalum Oxide.

Article ID: ICAMAE-2023-1-16

PROPORTIONAL INTEGRAL DERIVATIVE (PID) CONTROLLER FOR SMART STRUCTURES

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ABSTRACT

The concept of smart structure is progressively becoming realty in this century. Smart structures utilize many sensors and advance technologies, these must be safe in seismic environment. It is reported that India geographically lies in high seismic risk zones and occurrence of seismic activities are very likely to occur. These seismic activities, irrespective of smaller or larger, generate the seismic vibrations. These vibrations at certain frequency may damage the infrastructure. This damage is not only in the form of huge monetary loss but also the precious human lives. Therefore, the seismic vibration control is needed to mitigate these losses. In present interdisciplinary work, a semi-active control mechanism is suggested to mitigate the seismic vibrations. Based on the structural responses, the Proportional Integral Derivative (PID) controller generates the command signal for the actuator. The actuator in this work is the Magneto-rheological damper

which accepts the electrical signal and generates the counter force to mitigate the vibrations. After deploying the PID controller, the structural responses have been measured for a three-story structure under El-Centro time series and compared with the uncontrolled structure. Based on the result and discussion the significant decrease about 70% in structural responses is observed.

Keyword:- Semi-active, Smart structure, PID controller, MR damper, seismic vibration.

Article ID: ICAMAE-2023-1-17

EFFECT OF DEFORMATION ON ELECTRICAL & MECHANICAL PROPERTIES OF SWCNT'S

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ABSTRACT

For more efficient energy distribution system, we need a high efficiency material for charge transport. As a consequence, high-efficiency devices are in demand that may be manufactured using new materials in a more cost-effective and even ecologically friendly manner. Because of their tabular shape, adjustable thermal and electrical properties, ballistic charge transfer method, high current carrying capacity, lack of skin effect, elasticity, strength, and flexibility, CNT-based materials are at the forefront of the race. In present work we combined continuum mechanics methods for studying the effect of strain on Carbon Nano tubes (CNT's), For modelling mechanical and electrical properties in our model we predefined periodic boundary conditions

for CNT generation and for optimization we used the ORCA module. we use first-principle method, further we used the "pseudopotential plane wave method", with the generalized gradient approximation (GGA), and Perdew, Burke Ernzerhof (PBE) correlation.

Keyword: - NEGF, CNT's, Continuum Mechanics Methods

Track 2

Production

Article ID: ICAMAE-2023-2-1

INFLUENCE OF DIFFERENT ARC MODES ON THE MECHANICAL AND CORROSION PROPERTIES OF SS 316L USING WIRE ARC ADDITIVE MANUFACTURING

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ABSTRACT

Gas Metal Arc Welding (GMAW) with different arc modes like Direct Current (DC) and Direct Current Pulsed (DCP) was used to melt stainless steel 316L (SS 316L) wire for thin-wall fabrication. Mechanical properties, including tensile fractography, microhardness, and hot corrosion resistance, are assessed and compared with SS 316L base metal. Bead on Plate (BoP) trials were conducted by varying the process parameters for studying the optimal welding parameter from GMAW. The SS 316L material fabricated using the Wire Arc Additive Manufacturing (WAAM) process exhibits a fine equiaxed grain structure with minimal porosity.

The microhardness analysis demonstrates that the DC pulsed mode material has the highest value at approximately 259.16 Hv. The tensile strength for the DCP walls was recorded as 603 MPa, compared to Base (662 Mpa) and DC (542 Mpa), respectively. The fracture analysis showed that all specimens have the ductile fracture mode under tensile load. The base material proves the most negligible mass changes in the hot corrosion test. When exposed to different salt environments, 5% V2O5 showed the highest corrosive environment in all samples. The resistance of WAAM-deposited stainless steel 316L meets the requirements for various industrial applications.

Keyword: - STAINLESS STEEL 316L, WAAM, MIG WELDING, TENSILE TEST, HOT CORROSION

Article ID: ICAMAE-2023-2-2

EFFECT OF VARYING FILLER PASTE'S MIXING RATIO ON THE TENSILE STRENGTH AND SURFACE DEFORMATION OF AL-64430 DIP BRAZED JOINTS

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ABSTRACT

This study aims to find the effect of varying filler paste ratios on the dip-brazed joints' tensile strength and surface deformation. The filler paste is made by mixing brazing powder (Alumina Handibraze) and DM water in the desired mixing ratios (wt./wt.). Eight different filler ratios (Powder:DM water) were selected, namely 1:5, 1:4, 1:3, 1:2, 1:1, 5:4, 2:1, and 3:1. The specimen with a mixing ratio of 1:5 exhibited unsuccessful bonding, underscoring the necessity of a minimum concentration of joining powder for the formation of a viable joint. Beyond the ratio of 3:1, the paste's viscosity increased to a point where practical application became challenging, thereby imposing an upper limit on the attainable concentration of the joining material. Tensile strength for the specimens was carried out following ASTM D638, where samples broke from

the joint region, indicating joint strength less than the parent aluminium alloy. The results indicated that tensile strength increased with increasing filler paste's concentration till the sample with 5:4 filler paste ratio (31.29 Mpa ultimate stress) and then subsequently slightly dipped. On the contrary, surface deformation, which was carried out using Faro Arm scanner, remained almost constant throughout all the samples, showing no variation with varying filler paste ratios. The reasons behind these were analysed through XRD and microstructural analysis of the joints. Formation of dendrites was observed in all the samples, and voids were detected in samples with lower filler ratio, which resulted in them showing poor tensile strength. SEM analysis was carried out to check the distribution of this Si across the joint, which showed presence of primary and eutectic Si in the joint. XRD detected the presence of Al(Si), α-Al along with the presence of Fe, Mg, and Mn, which reacted with base Al and Si and formed brittle IMCs, which resulted in low ductility of the sample.

Keywords: Dip Brazing, Tensile Strength, Surface Deformation, Al-64430, XRD, SEM

Article ID: ICAMAE-2023-2-3

PARAMETRIC OPTIMIZATION OF FRICTION STIR WELDING FOR ELECTRICAL CONDUCTIVITY OF ALUMINIUM JOINTS USING ANN APPROACH

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ABSTRACT

The present research work investigates the influence of some selected input parameters for Friction Stir Welding (FSW) on the electrical conductivity of AA1350 aluminium butt joints. Rotational speed of tool, Tool Traverse speed (welding speed), and tool tilt angle were opted as input parameters. After experimentation with selected parameters, investigation by ANN is done. Back propagation (BP) algorithm is utilised for developing the net-work. After ANN modelling, optimization of FSW parameters by full factorial method is also investigated. The ANN result outcome and the experiment data was found to be in good agreement. The optimum value of electrical conductivity of welded joints obtained was 52.7 IACS.

Keyword: - Friction Stir Welding, Solid State Welding, Full factorial method, Artificial Neural Network.

Article ID: ICAMAE-2023-2-4

ANALYSIS OF CUTTING PERFORMANCE IN DRY TURNING USING SURFACE TEXTURED TOOLS: QUANTITATIVE ANALYSIS

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ABSTRACT

In this research, the application of surface texturing to improve the tribological performance of a High-Speed Steel (HSS) cutting tool in dry cutting operations is explored. This is achieved by employing a pulsed Nd: YAG Laser to create dimples on the rake face of the HSS tool, which was then used in the dry turning of pure aluminium. Dry cutting experiments using both the textured tool and a conventional, untextured tool, are performed with the resulting data serving as the basis for comparison. The evaluation focused on parameters such as cutting force, chip morphology,

and surface roughness. To glean further insights into the impact and efficiency of surface-textured tools, the Energy Dispersive X-Ray (EDX) analysis is carried out. From the present investigation it is observed that, by the usage of a textured tool, the surface roughness values increase with the increase in feed as well as the cutting speed whereas the cutting forces diminished. About 18-20% reduction in cutting forces and 15% decrease in surface roughness with lower width and thickness of chips are attained by using textured tools in comparison to conventional tools.

Keyword: - Surface textured tool, Dry machining, Surface roughness, Cutting force, EDX analysis.

Article ID: ICAMAE-2023-2-5

BIOCOMPATIBILITY & WEAR EVALUATION OF MG-6ZN-4CU-2CA-1MN ALLOY FOR BIOMEDICAL IMPLANTS

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ABSTRACT

Magnesium (Mg) has emerged as one of the third generation bio materials for regeneration and supports osseointegration that stimulates new bone formation at the site of injury. Its elastic modulus is closer to human bone in comparison to other permanent implants. Despite the advantages, a major concern with pure Mg is its rapid bio-corrosion in presence of body fluids. Hence the In vitro corrosion & wear characteristics of the Mg alloy needs to be studied. In the present work, a novel attempt to develop an Mg alloy with reinforcements of Zinc (Zn), Manganese (Mn) & Calcium (Ca) in appropriate proportions. The mechanical testing results revealed the tensile strength of 0.520 N/mm2 and an elongation break of 1.438 mm. A wear rate of 20μm was observed from the pin-on-disc wear test. The developed

material was analyzed with the metallurgical tests for confirmation. Based on the XRD pattern observed, intermetallic phases of Mg2Zn, Mg2Ca, MgZnCa were confirmed. In vitro degradation behavior and biological performance of the Mg-6Zn-4Cu-2Ca-1Mn alloy was investigated via corrosion and cytotoxicity tests. The cytotoxicity test shows very significant deleterious effects on cancer cells for the proposed alloy, indicating good In vitro cyto-compatibility.

Keyword: - Magnesium alloy, Manganese, Calcium, Characterization, Wear, Bioactivity, Cyto-compatibility.

Article ID: ICAMAE-2023-2-6

PERFORMANCE OF BIO-OIL BASED SPRAY COOLING DURING AISI 316 SS TURNING OPERATION

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ABSTRACT

Atomization based cutting fluids have emerged as one of the ultra-fast cooling techniques but has been rarely investigated as cooling and lubricating media in machining operations. Increased industrial regulations and environmental pollution concerns demand to look for alternative coolants. Non-edible oils are renewable and biodegradable which can be explored to use as coolants in machining operations. The aim of this paper is to evaluate the performance of raw Karanja oil as coolant during turning of AISI 316 SS. Atomized air-Karanja oil is used as coolant during turning AISI 316 SS, using uncoated carbide inserts to analyze the machining performance in terms of heat transfer coefficient. The surface roughness of the machined workpiece was found to be less than the failure criteria in all the environments. Tool wear of less than 0.076 mm was observed. Atomized Karanja oil yielded the

convective HTC of 4.8 x 10^4 $Wm^{-2}K^{-1}$. The novel air-Karanja oil SIC yielded most promising machining performance at optimum parameters. An effective spray penetration between tool-work and chip-tool interfaces was observed and a higher rate of the latent heat removal process; lower cutting temperatures and better lubrication were achieved depicting advantages of atomized cooling as an environment-friendly and cleaner machining technique.

Key Words: Spray Impingement Cooling, Karanja Oil, AISI 316, Turning operation

Article ID: ICAMAE-2023-2-7

SHOT PEEN FORMING OF AL5083 SHEETS AND STUDY THEIR METALLOGRAPHY AND MECHANICAL PROPERTIES

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ABSTRACT

Peen forming is a die less forming process performed at room temperature. During the process, the surface of the work piece is impacted by pressure from small, round steel shot. Every piece of shot impacting the surface acts as a tiny hammer, producing elastic stretching of the upper surface. The impact pressure of the peening shot causes local plastic deformation that manifests itself as a residual compressive stress. The surface force of the residual compressive stress combined with the stretching causes the material to develop a compound, convex curvature on the peened side. In the current project, As Al5083 is a corrosion resistance and non-heat treatable alloy, is chosen to

deform through shot peening. The 0.5mm thickness sheet with length of 150mm and width of 60mm is placed in a Los Angles abrasive machine. 240gms of Steels balls (Six balls each weighing 60gms) were used for imposing impact load to compress the sheets during peening. The process is carried out for 100, 200 and 300 revolutions for 3minutes, 6minutes and 9minutes. The shot peened deformed sheets were tested for area and hardness to study the amount of deformation and strength. As the number of revolutions increases the area of the deformed sheets decreases, the hardness of deformed sheets increases with increase in no. of revolutions. The microstructure through optical microscope reveals the formations fine grains during peening. Highest hardness of 72HRB is found for 300 revolutions sheets during cold working of shot peening. The tensile specimens were prepared according to ASTM E-8 standards the strength increases from 285MPa to 325MPa with increase in no. of revolutions through shot peening.

Keywords: Al5083, shot peening, deformation, mechanical properties.

Article ID: ICAMAE-2023-2-8

STUDY OF MECHANICAL AND TRIBOLOGICAL PROPERTIES ON DIFFERENT ALUMINIUM BASED REINFORCED METAL MATRIX COMPOSITES DEVELOPED BY STIR CASTING TECHNIQUE.

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ABSTRACT

The requirement for aluminium (Al) metal matrix composites is a result of composites with advanced mechanical and wear properties and applications (MMCs).Metal matrix composites (MMCs) made of aluminium (Al) are currently thought to have the greatest strength for use in structural and functional applications. Aerospace, automotive, thermal management, and the military all use composite materials using aluminium matrices. Applications for advantageous properties have increased due to low cost. Al is reinforced with various metallic, non-metallic, and ceramic reinforcements to provide the desired physical and mechanical qualities, such as high hardness, high strength, high stiffness, and high wear, abrasion, and corrosion resistance. Wear plays a significant part in the production of pistons, connecting rods, engine cylinders, disc brakes, and

drum brakes. Here, wear plays a significant influence in how well these components work since excessive wear of the mating components might occasionally result in catastrophic failures. Utilizing specific reinforcement materials like Flyash, Zirconia, Al_2O_3, Graphite and SiC allowed hybrid composites to have improved mechanical, particularly tribological, capabilities. Therefore, a study of aluminium metal matrix composites (MMCs) reinforced with various particles as reinforcements is presented in this paper, with an emphasis on how these reinforcements affect the MMCs' physical, mechanical, and wear behaviour.

Keywords: Metal Matrix Composite, Stir Casting, Aluminium MMC, Mechanical Properties, Wear Properties

Article ID: ICAMAE-2023-2-9

ENHANCING MICRO EDM PERFORMANCE THROUGH MACHINE LEARNING-BASED TOOL WEAR RATE PREDICTION AND OPTIMIZATION

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ABSTRACT

Micro Electrical Discharge Machining (μEDM) is a precision machining technique that uses electrical discharges that are carefully regulated to remove material from workpieces that are electrically conductive. In fields like electronics, medical technology, and micro-optics that call for delicate and complicated microstructures, this approach is widely used. This paper focuses on the crucial topic of tool wear rate in micro EDM, which has an impact on the precision and effectiveness of machining. Few of the parameters results in tool wear, such as decreased dimensional accuracy, poor surface finish, increased tool friction, higher cutting forces, and shorter tool life. To maintain machining precision and increase electrode

life, it is crucial to comprehend and manage tool wear. This paper analyses the mechanisms of tool wear in micro EDM, explores the impact of process factors on wear rate, and emphasises mitigation measures. Through the use of voltage, feed rate, capacitance, and machining time, other metrics experimental results and modelling strategies for estimating tool wear are investigated. By optimizing this strategy manufacturers can improve process conditions, electrode selection, and tooling design to achieve increased precision and efficiency in microscale machining processes by better understanding tool wear in micro EDM. In order to achieve optimal process parameters that minimise tool wear while maintaining machining precision, optimisation algorithms and machine learning were determined.

Keyword: - Machine Learning, naïve bayes classifier, micro edm, tool wear;.

Article ID: ICAMAE-2023-2-10

DISSIMILAR FRICTION STIR WELDING (FSW) OF ALUMINIUM ALLOYS TO COPPER

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ABSTRACT

Friction Stir Welding (FSW) is an innovative technique that offers potential advantages in joining dissimilar materials. Among these, the welding of aluminium and copper holds significant industrial importance, yet presents challenges in achieving defect-free joints. Previous literature indicates that placing copper on the advancing side (AS) promotes effective mixing between aluminium and copper due to the easier flow of the softer material (aluminium). However, diverse tool offset ranges made this impractical for widespread industrial use. Alternatively, researchers reported success in obtaining defect-free joints by placing the softer material (aluminium) on the AS, requiring minimal or no tool offset, though research on this is scant. Additionally, the relationship between the

microstructure of intermetallic compounds (IMCs) and mechanical properties requires further investigation. The current study evaluates the influence of tool rotational (ω) and traverse speeds (υ) on dissimilar AA5083 to copper FSW joint quality when placing aluminium on the AS without introducing tool offsetting. When employing specific combinations of ω/ν ratio, successful weld joints between aluminium and copper were achieved. The weld exhibits an inhomogeneous microstructure, dominated by IMCs Al_2Cu and Al_4Cu_9. Higher tool rotational speeds enhanced the volume fraction of these compounds, elevating the joint's mechanical strength.

Keywords: friction stir welding, dissimilar joining, joint integrity, metallurgy, intermetallic compounds

Article ID: ICAMAE-2023-2-11

A MICROSTRUCTURAL AND MECHANICAL PROPERTY EXAMINATION OF STAINLESS STEEL 15-5PH PRODUCED USING WIRE + ARC ADDITIVE MANUFACTURING

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ABSTRACT

Precipitation hardening (PH) stainless steels, like 15-5PH, have high strength combined with excellent corrosion resistance, making them valuable in critical industries such as defence, aerospace, energy, and maritime. Due to the recent advances in additive manufacturing (AM) technology, components can be rapidly produced at a reduced cost, removing the need for design details requiring welded or bolted connections and permitting greater flexibility in design. Wire + arc additive manufacturing (WAAM) uses widely employed welding techniques, such as cold metal transfer (CMT), to produce fully dense components with mechanical properties similar to that of wrought materials, while also enabling reduction in material wastage and environmental impact. This study investigates the mechanical properties of 15-5PH stainless steel

produced by WAAM. The research compares the as-deposited and direct aged conditions, examining the microstructure, hardness, tensile properties and presents the first published impact resistance data for this material and process combination. The results reveal that WAAM-produced 15-5PH exhibits a minor increase in yield strength and 35% increase in impact energy compared to wrought material after H1150 treatment. However, the microstructural analysis indicates an increased presence of δ-ferrite, leading to embrittlement and a reduction in impact energy in the as-deposited condition.

Keyword: - Wire + arc additive manufacturing**;** Metal additive manufacturing**;** Precipitation hardening stainless steel**;** Additive manufacturing process parameters

Article ID: ICAMAE-2023-2-12

NUMERICAL MODELLING AS A PREDICTIVE TOOL TO REDUCE DEFECTS IN REFILL FRICTION STIR SPOT WELDED JOINTS

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ABSTRACT

This work details the application of a thermally coupled Eulerian-Lagrangian finite element model to study defect formation and material flow during short welding time refill friction stir spot welding processes. Welds of AA2024-T3 aluminium were produced experimentally with a welding time of 0.75 s and compared with the developed numerical model. The model successfully predicted the weld temperature, formation of tunnel defects, and locations of high and low plastic deformation.

Keyword: Refill Friction Stir Spot Welding; friction welding; aluminium alloys; solid-state joining; AA2024-T3

Article ID: ICAMAE-2023-2-13

JOINING DISSIMILAR MATERIALS WITH THE USE OF AN IN-HOUSE BESPOKE ROTARY FRICTION WELDING MACHINE

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ABSTRACT

Rotary friction welding is a widely used variant of friction welding that can manufacture high integrity joints between similar and dissimilar materials with short welding times. However, access to expensive and complex industrial grade friction welding machines is not always possible. This study explores the design process and functionality of a laboratory-scale friction welding setup following the fundamentals of large-scale machinery. The proposed setup is designed to be easily manufactured, employing the use of a calibrated drill press and load cell, thus ensuring welding parameters such as rotational speed and axial load applied are monitored. The decision to investigate rotary friction of welding aluminium bronze Ca104 and austenitic stainless steel AISI316 was taken to explore the limitations of this bespoke friction welding

machine. The workpieces were friction welded at 4 sets of rotational speeds with constant friction and forging pressures applied. The microstructural evolution and mechanical properties of the dissimilar material welds were investigated via scanning electron microscopy and energy dispersive spectroscopy, 4-point bending testing and microhardness measurements. Results displayed a change in the hardness along the weld interface and evidence of metallic diffusion between the dissimilar materials, thus demonstrating the successful application of the small-scale experimental setup.

Keyword: - Joining of metals, rotary friction welding, dissimilar materials novel experimental setup.

Article ID: ICAMAE-2023-2-14

ATTITUDE TOWARDS DIGITAL DEXTERITY-KEY TO DIGITAL EDGE IN MANUFACTURING

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ABSTRACT

Businesses that show digital dexterity excels in profitability and growth, where less-advanced competitors face potential extinction due to apprehension towards use of technology. Digital dexterity refers to the ability to skillfully and effectively use digital tools, technologies, and devices to navigate, interact with, and produce digital content. It encompasses a range of skills, including the ability to use input devices with precision, as well as proficiency in using software applications, navigating digital interfaces, and adapting new technologies. A workforce that possesses digital dexterity is willing to adopt new tools, get past their first uneasiness, and work hard to learn new applications. In this research, we have focused on examining the impact of an individual's perspective affecting the attitude towards using technology in manufacturing units. Data was collected from 100 working professionals

about the usage of technology. Statistical tools were used to determine the outcomes. We have argued that factors like personality traits, perceived curiosity, technological anxiety, and perceived organizational support have impact on the attitude towards using technology in manufacturing units. In doing so, firstly, we conceptualized the theoretical framework using "Technology Acceptance Model to analyze the impact of individual's behavior towards technology", secondly, we studied the previous work done by the researchers, thirdly, we analyzed our data through statistical analysis tool i.e., SPSS software and lastly, we obtained our study's findings. Our result suggests that only personality traits do not have an impact on the outcome variable but other factors like technology anxiety, perceived curiosity, technology anxiety and perceived organizational also have an impact on attitudes to learn new technologies in manufacturing units. Our result suggests not only personality traits have an impact on the outcome but also variables like technology anxiety, perceived curiosity and perceived organizational support also have an impact on attitudes to learn new technologies in manufacturing units.

Keywords: Digital dexterity, TAM, Personality traits, Perceived curiosity, Technological anxiety, Perceived organizational support

Article ID: ICAMAE-2023-2-15

MACHINE BEHAVIOUR

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ABSTRACT

With rapid advancement of applications of Artificial Intelligence (AI) in the development of numerous smart electrical, electronic, mechanical and computer hardware/software systems called as Intelligent Systems (IS), it has become very essential to study scientifically the behaviour of all such systems powered by AI. AI is mediating our economic, political, cultural and social interactions. Every Intelligent System's behaviour is based on some Machine Learning (ML) algorithms designed by the scientists and researchers. Though, these ML algorithms are being designed with good intention and not to harm anyone, but unfortunately working of these systems do not give only positive results as desired rather there are some negative outcomes also and for that reason the scientists and researchers are made responsible. Significant growth in the development of autonomous weapons, for example, is very dangerous. The scholars in the area are raising their concern that if such arms are being used, then

machines will decide who will die and who will live in armed fights. Autonomous Vehicles, Conversational Robots, Machines used for regular household tasks etc. are other examples of such systems. In this research work, I present the scientific analysis of different algorithms used in some intelligent systems so that we shall have the knowledge to minimize harms by controlling their actions. Further, this has been observed that many algorithms used in Artificial Intelligence and Machine Learning applications gave wrong recommendations e.g. Credit Scoring Algorithms, News Ranking Algorithms, ChatGPT, Algorithms Trading Software, Online Pricing Algorithms etc. I conclude that by highlighting the positive and negative outcomes of algorithms a new broad scientific research agenda in the field of Machine Behaviour maybe enforced.

Keyword: - Machine Behaviour, Intelligent Systems, Algorithms, Autonomous Weapons, Autonomous Vehicles, Conversational Robots.

Article ID: ICAMAE-2023-2-16

EBSD OBSERVATIONS OF MICROSTRUCTURAL FEATURES AND MECHANICAL ASSESSMENT OF INCOLOY 800HT AND P91 STAINLESS STEEL DISSIMILAR WELDS

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ABSTRACT

This study looked at the mechanical behavior and microstructure evolution of a dissimilar weld between P91 steel and INCOLOY 800HT utilizing filler wires ER505 and ERNiCrMo-3. To describe the weld microstructure, electron back scattered diffraction (EBSD) investigation was utilized. The production of TiC and TiN precipitates, more frequently with cubic shape, were revealed by the microstructural analysis in either of the two base materials. At the heat affected zone (HAZ) of P91 steel, a large amount of δ-ferrite accumulated as a result of an incomplete evolution of ferrite into austenite. The weld metal showed a fully austenitic structure along with signs of secondary phases rich in Ni ,Cr,and Fe at the inter-dendritic gaps. Some columnar grains revealed a direction that was

parallel to the usual direction relationship, the 001 direction. The grain orientation spread map showed that there were much more misorientation variations within the weld metal grains than there were within the base metals and HAZs. The HAZs' texture intensities were not very high. The austenite grains' orientations were significantly impacted by the anomalous grain development seen in the INCOLOY 800 HAZ. The weldment's tensile strength was unaffected, though. Failure of the tensile specimen from the Incoloy 800HT side showed that this material was weaker than the INCOLOY 800HT one and the weld area. In compared to the parent materials, the impact toughness of the weld decreased due to the presence of brittle phases at the inter-dendritic regions.

Keywords: Incoloy 800HT, P91 steel, Microstructure, grain orientation, mechanical Properties

Article ID: ICAMAE-2023-2-17

A COMPARATIVE ANALYSIS ON MICROSTRUCTURAL AND CORROSION ASPECTS OF AA5083 ALLOY WELD BEADS PROCESSED BY GTAW AND SPINARC-GMAW

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ABSTRACT

In this study, bead-on-plate welding was performed on a sheet of AA5083 alloy using two distinct welding techniques: gas tungsten arc welding and SpinArc-gas metal arc welding. This study compares the microstructural, mechanical, and corrosion characteristics of processed weld beads. The microstructural features of the weld beads were characterized using scanning electron microscope and the corrosion characteristics of weld beads were determined by potentiodynamic polarization method. The corroded specimens were subjected to analysis using a scanning electron microscope in order to identify and capture the various morphologies of corrosion. In addition, a microhardness study was performed on the weld beads across the base metal, heat affected zone, and weld zone. The findings of the study

indicate that the weld bead produced using gas tungsten arc welding exhibited superior corrosion resistance compared to the weld bead generated by SpinArc-gas metal arc welding. This can be attributed to the higher presence of porosities in the latter, which facilitated the development of corrosive pits. The hardness observed in the weld zone of the bead produced through SpinArc-gas metal arc welding was found to be lower compared to the other weld bead due to the presence of porosities.

Keywords Aluminum Alloy; GTAW; SpinArc-GMAW; Microstructure; Hardness; Corrosion.

Article ID: ICAMAE-2023-2-18

AN EXPERIMENTAL INVESTIGATION TO STUDY INFLUENCE OF CONTROL PARAMETERS OF ROTARY EDM ON SURFACE ROUGHNESS OF MONEL USING BRASS ELECTRODE

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ABSTRACT

This experimental study investigates the Electrical Discharge Machining (EDM) of Monel-400 alloy using rotary EDM (REDM). Four key process parameters — Current, Pulse-on-Time, Duty Factor, and Electrode Rotation—are systematically varied to explore their influence on surface roughness (SR). The surface characteristics examined through SEM micrographs reveals complex features such as cracks, globules, and pores. A regression model is developed and validated through analysis of variance (ANOVA), indicates the significance of the examined parameters in predicting SR. Further, SEM analysis were found suitable to better understanding of the influence of process parameters on surface characteristics of machined part. The insights

gained contribute to the optimization of EDM processes for Monel alloy machining, with a focus on controlling surface roughness for suitable industrial applications.

Keywords: Rotary EDM, Monel Alloy, Cryogenic Treatment, Brass Electrode

Article ID: ICAMAE-2023-2-19

NON-LINEAR ANALYSIS OF COLD-WORKED AUSTENITIC STAINLESS-STEEL REINFORCING BAR POST-FIRE MATERIAL RESPONSE

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ABSTRACT

Austenitic stainless steels are a key factor in attaining sustainability, a must for the future. The robustness of this approach is demonstrated by its resistance to corrosion, its capacity to perform in a range of temperatures, its formability, its toughness, and its ease of welding. Stainless steel has proven its durability and low maintenance costs in a wide range of applications, making it an advantageous material over other high-alloy metals. Stainless steel is valuable because of the expensive alloying element (nickel) and the ease with which it can be reused. This paper focuses on finite element analysis of material behavior of cold-worked austenitic stainless steel reinforcement bars against experimental data. A good agreement can be found between the numerical and experimental results. Samples heated to roughly 500 °C retained their strength and flexibility even after cooling down. No significant

alterations were observed. The proof strength (f0.2p) and ultimate tensile strength (fu) of samples within this range both rose by 1-4% and 1-2%, respectively, compared to original samples. At the given temperature, the elongation at maximum force was 10% higher than the original sample. The experimental and numerical results match up, with a maximum discrepancy of 5% for stress and strain.

Keywords: FEA; Austenitic Stainless-Steel Reinforcement Bars; proof strength (f0.2p) ;.ultimate tensile strength (f_u) ;.stress and strain response

Article ID: ICAMAE-2023-2-20

A RECENT REVIEW ON MITIGATION STRATEGIES FOR CONTROL OF AIR POLLUTION

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ABSTRACT

Air pollution is one of the major problems which environment and society were facing at large extent. The objective of the present study is to review the potential sources of air pollution and its mitigation strategies. Emissions, transport dispersion, transformation and emissions were the major sources of air pollution. It was gathered that outdoor and indoor environment gets polluted by different sources of pollution. It was found that due to air pollution has got detrimental effect on human health majorly in terms of respiratory diseases. Different mitigation strategies were discussed for reducing air pollution levels. It was found that by reducing dependency on fossil fuels and increasing walking and bicycles trips will reduce the level of air pollution considerably as well as imparts health benefits.

Keywords: Air Pollution, Mitigation, Sources, Pollutants, Strategies

Track 3

Design Engineering

Article ID: ICAMAE-2023-3-1

SELECTION OF VEHICLE TIRES USING MULTI ATTRIBUTE DECISION MAKING METHODS

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ABSTRACT

Tires in any of the vehicle are basic need as that allows the car to move along the highway. The weight of the vehicle is carried by the tires, which also convey traction and braking forces to the road surface, in addition to absorbing shocks from the road and changing and maintaining motion direction. Therefore, the selection of tires for a vehicle is a very crucial and important task for the safe driving and comfortable driving for the customer. Using multi-criteria decision-making process and a few key and fundamental requirements can help to choose the ideal tire for vehicle, that are five attributes of a vehicle tire viz: price, lifespan, section width, weight and tread depth and seven alternatives that are MRF, Apollo, JK Tyres, CEAT, Michelin, Bridgestone and Good Year. The current research provides the finest strategy for choosing tires for vehicles such as, Analytical Hierarchy Process and Additive Assessment Ratio and the ranking of the tire

brand. Following the selection, JK Tyres is the best tire brand, MRF is the worst tire brand according to Analytical Hierarchy Process, and Apollo is the worst tire brand according to Additive Assessment Ratio. With the aid of the aforementioned various ways, the chosen methods can be used to make the best decisions in the other engineering and management industry sector challenges.

Keyword: - Selection of Vehicle Tires, Additive Assessment Ratio, Analytical Hierarchy Process, etc.

Article ID: ICAMAE-2023-3-2

ADOPTION OF IOT ENABLED INTELLIGENT AGRICULTURAL IRRIGATION SYSTEM.

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ABSTRACT

This project focuses on the adoption of an IoT-enabled intelligent agricultural irrigation system, aiming to enhance plant health and growth through autonomous monitoring and assistance. The system incorporates various sensors and IoT technology to provide real-time data on plant strength and ensure the optimal supply of essential nutrients such as nitrogen, phosphorus, and potassium fertilizers. The system incorporates a sophisticated ensemble of advanced sensors and IoT technologies, orchestrated to deliver real-time, high-resolution data pertaining to key plant physiological parameters. Concurrently, it orchestrates the automated modulation of essential nutrients, including nitrogen, phosphorus, and potassium fertilizers. At the core of this system lies a highly calibrated soil moisture sensor, meticulously engineered for precise, real-time measurement and recording of soil moisture levels. This critical data forms the basis for a closed-

loop control system, enabling the automated release of water at optimal intervals to maintain an ideal soil moisture level. The algorithmic precision ensures a dynamic and responsive irrigation strategy, adapting to evolving soil conditions. Distinguishing itself from conventional systems, this innovative agricultural irrigation platform extends its functionality to user-centric mobile interfaces. Facilitating remote control and monitoring through mobile devices, the system established a paradigm of user-friendly interaction, thereby enhancing its accessibility and usability.

Keyword: - Autonomous, User-Friendly, Hydraulics, Sensor Data and IOT Technology.

Article ID: ICAMAE-2023-3-3

DESIGN AND IMPLEMENTATION OF LOW-POWER HIGH-SPEED 8-BIT KSA USING 6T-HYBRID XOR-CELL FOR IOT-APPLICATIONS

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ABSTRACT

The Adder is an essential component in both Arithmetic-Logic Unit (ALU) processors and DSP processors. The overall power consumption of the adder is dependent on the design of the XOR-logic. Therefore, a new and advanced 6T-Hybrid XOR-logic is proposed, which offers superior features such as full swing voltage, fewer transistor counts, and smaller area compared to the traditional XOR-gate. To enhance the power performance parameter, this novel 6T-Hybrid XOR-gate has been integrated into an 8-bit KSA. The power consumption for 6T-XOR-cell and 8-Bit KSA is reported as 0.967uW,15.897uW and the corresponding delays are 0.0278ns,12.256ns respectively .One advantage of the 6T-Hybrid XOR-cell is lower

internal capacitance due to absence of cross-coupled connections. This results in reduced short-circuit power and increased battery life for devices operated by battery power. The proposed design has been thoroughly tested and verified using the Cadence Virtuoso platform. The experiments were conducted with a supply voltage (Vdd) of 0.8V and a frequency of 1-GHz. Therefore, by the above mentioned results the 8-bit KSA highly suitable for high-speed, low-power consumption portable devices, especially for applications in the field of Internet of Things (IoT).

Keywords: Parallel Prefix Adder(PPA), KSA, Brent-Kung, Ladner-Fischer, Sklansky-Adder,6T-Hybrid XOR-Cell, Arithmetic-Logic Unit (ALU).

Article ID: ICAMAE-2023-3-4

DESIGN OF HIGH-SPEED AREA EFFICIENT 16-BIT KSA IMPLEMENTED BY NOVEL 6T-HYBRID XOR-CELL FOR ALU-PROCESSOR APPLICATIONS

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ABSTRACT

This paper presents a novel 16-bit Kogge Stone Adder(KSA) that utilizes a unique 6T-Hybrid XOR-cell. Compared to conventional XOR-cells, this new implementation offers superior high-speed capabilities and reduces the transistor count from 12T to 6T. As a result, it significantly minimizes power consumption and reduces the required area when compared to existing designs such as Brent Kung, Sklansky adder, and Ladner-Fischer. Moreover, this innovative approach improves the leakage current and short-circuit power through the interconnection nodes and computation stages, which are often high. KSA, typically known for its fastest speed and low fan-out among other designs, can be calculated by log2N. The performance

parameters for XOR-cell power in the proposed 16-bit KSA are measured at 0.967 (uW), and the power consumption for the conventional PPA-designs is reduced by 50%. Additionally, the delay is measured at 0.0278 (ns) for the proposed design, while it is 30.154 (ns) for conventional designs. The simulation results were obtained using the Cadence virtuoso tool with 45 nm technology, a supply voltage (Vdd) of 0.8V, and a frequency of 1GHz. With these exceptional features, the proposed 16-bit KSA implemented by the 6T-Hybrid XOR-Cell proves to be effective in high-speed battery-operated edge-device manufacturing, particularly for IoT-applications.

Keywords: Parallel Prefix Adder(PPA), KSA, Brent-Kung, Han-Carlson, Sklansky,6T- Hybrid XOR-cell, CMOS-Logic,Pull up Network (PUN),Pulldown Network (PDN), Carry- propagate(Pi), Carry-generate(Gi).

Article ID: ICAMAE-2023-3-5

FORENSIC REPORT MANAGEMENT FOR DIGITAL EVIDENCE USING BLOCK CHAIN TECHNOLOGY

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ABSTRACT

Digital evidence is frequently used as a foundation for conclusions in contemporary legal proceedings, including criminal prosecutions and civil cases. However, the security and integrity of digital evidence may be compromised by elements such as data modification, illicit access, or defects in centralised storage. To address these challenges, we propose a decentralised approach for using smart contracts to protect digital evidence. The decentralised architecture relies on blockchain technology and smart contracts to ensure the immutability, transparency, and integrity of digital data. Because the method uses a distributed ledger, which reduces the risk of data loss or manipulation, it does not require a central authority. Using sophisticated technologies, authentication can boost trustworthiness and accountability.

Keyword: Block chain, Forensic report, Digital evidence, Centralized storage

Article ID: ICAMAE-2023-3-6

CYBER THREAT MITIGATION: UNCOVERING PHISHING URLS USING MACHINE LEARNING MODELS

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ABSTRACT

In this research study, we provide a comparative analysis of 12 machine learning models, which are categorized as Standalone models, Ensemble models, and Deep Learning models and then select the best model to develop a framework that automatically detects phishing URLs so that users can safely browse without any delay. We gathered 600,000 URLs as a dataset of phishing and genuine URLs, and extracted 19 elements from the URLs, including Have IP, Have At, URL Length, URL profundity, Non-standard twofold slice, https domain, shortened URL, Dash Count, Has keywords, DNS Record, Comb 5y interest, Blacklisted Domain, Domain age, Domain active, iFrame, Mouse Over, Right click, Web Forwards, and Label. We then trained different AI models on this dataset, including

standalone models like decision Trees, KNN, Logistic Regression and Naive Bayes and ensemble models like Random Forests, XGBoost, AdaBoost and Hard Voting and Deep learning models like ANN, LSTM, GRU and CNN. We evaluated the performance metrics such as accuracy, recall, precision, train time and prediction time on these models. Out of the selected categories of standalone models, ensemble models and deep learning models, we observed that ensemble models appear to have the best overall performance in terms of accuracy and prediction time and among the ensemble models the XGBoost model has the highest accuracy of 95.073% and the lowest prediction time of 0.173 seconds. Moreover, XGBoost produced the lowest number of false positives at 3000 URLs out of 600,000 URLs. Hence, for our proposed phish detection framework, we selected XGBoost as the final model.

Keyword: - XGBoost, Phishing, Confusion Matrix, Prediction.

Article ID: ICAMAE-2023-3-7

NUMERICAL INVESTIGATIONS ON IMMERSION COOLING OF LITHIUM-ION BATTERIES USING DIFFERENT COOLANTS

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ABSTRACT

Due to its increased energy density, longer lifespan, and quick charging capabilities, lithium ion batteries have been increasingly popular in the electric vehicles over the past few years. Because of its high energy density, specific power, and long cycle life, LIB is still the best battery in the market. However, LIB is extremely sensitive to temperature, presenting difficulties with thermal management. This study involves the numerical analysis of 4x4 arrangement of LIB cells with immersion cooling is conducted using three different cooling fluids including water, mineral oil and Al_2O_3/water nanofluid. The modelling is carried out using Solidworks and thermal analysis is carried out in ANSYS Fluent. By varying the operational and geometrical parameters, their effects on thermal performance were studied. The results show that water and nanofluid works better than mineral oil. At higher

discharge rates of 3C and 5C, water and nanofluid limits the average temperature rise of the battery module under 5°C. Varying the flow rates from 10 mLPM to 1 LPM showed that average temperature decreases with increase in flow rate. When changing the inlet temperature of the battery module from 298K to 308K, it resulted in increased cell surface temperature and decreased heat transfer. The study shows that with high flow rate and low inlet temperature the temperature rise is minimal even at higher discharge rate of 5C.

Keywords: - Battery thermal management system, Li-ion battery, Immersion cooling, Discharge C rate, Coolants.

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SAFETY STOCK (INVENTORIES) ESTIMATION IN CPG INDUSTRIES - APPLICATION OF MACHINE LEARNING TECHNIQUES

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ABSTRACT

For any Consumer Packaged Goods (CPG) industries there are 2 kinds of Inventories viz: Cycle Stock and Safety Stock. Cycle Stock is used on a regular basis for their Production of Finished (or Semi-finished) goods. Safety Stock is leveraged during unforeseen events or uncertainty. This paper guides users in terms of balancing Safety Stocks estimation using 3 different kinds of approaches. The first is to Calculate Safety Stocks based on Industry proven Key Performance Indicators KPIs (e.g., Days Coverage and Service Level) and later mentions Prediction of Safety Stocks. Multiple models are simulated for Prediction. But optimal results are obtained from Extreme Gradient Boosting Algorithm. The final model is ensembled for

both Calculated and Predicted parts, based on varied weights. This Safety Stock estimated provided better results for the Organization as compared to the initial frequent Stock Out scenarios.

Keyword: - Safety Stocks, Days Coverage, Service Levels, Extreme Gradient Boosting, Ensemble Model

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DESIGN OPTIMIZATION OF INDEPENDENT SECONDARY LOCK TO AVOID FAILURE IN AUTOMOTIVE CONNECTORS

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ABSTRACT

Automotive connectors are essential elements in modern automobiles, ensuring reliable and secure electrical connections for a variety of systems. Among these connectors, miniature connectors with hinged latches play a crucial role in maintaining electrical continuity. The hinge failures and cracks that can appear on these connectors at the hinged junction, however, may affect their function and raise safety issues. This paper presents a comprehensive design optimization approach for the independent secondary lock (ISL) mechanism in automotive connectors. The primary objectives are to minimize von Mises stress and logarithmic strain, which will ultimately reduce the risk that cracks would occur and the hinge will collapse. The study involves a comprehensive evaluation of various hinge profiles while keeping material, and operational aspects into unchanged. The mechanical behavior of various hinge

configurations is assessed using refined FEA models under accurate loading conditions. The results show that particular hinge profiles exhibit improved stress distribution and strain reduction, significantly reducing the occurrence of crack marks at the hinged joint. Additionally, to ensure the modified hinge profile's improved efficiency in decreasing crack marks, The findings show that cracks has significantly decreased, improving the connections' long-term dependability and durability.

Keywords: Crack Marks, Fea Analysis, Hinge Profile Design, Miniature Connector, Design Optimization.

Article ID: ICAMAE-2023-3-10

NUMERICAL INVESTIGATION ON HYDROPHOBICITY OF THE NON-UNIFORM TRIANGULAR ROUGH SURFACES USING 2D LATTICE BOLTZMANN METHOD

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ABSTRACT

Hydrophobicity analysis is crucial for studying water-repelling properties of molecules, surfaces, and materials. This study investigates the impact of solid-fluid interaction strength on wettability and hydrophobicity of rough surfaces using a two-dimensional (2D) pseudo-potential multiphase lattice Boltzmann method with a D2Q9 model. The study considers the equilibrium state of a water droplet on a flat surface to assess the accuracy of the numerical model and calculate the contact angle. The hydrophobicity of rough surfaces is analyzed using droplets with a radius of 150 lattice units in the 1000x1000 lattice unit domain. The study reveals that increasing the solid-fluid interaction parameter significantly increases the contact area between water droplets and solid walls, resulting in increased hydrophobicity. The

hydrophobicity is measured by measuring the contact angle between the solid and fluid-vapor interface. The study also highlights the impact of average roughness and saturation temperature on surface hydrophobicity.

Keywords: - Hydrophobicity, LBM, Contact angle, Cassie-Baxter state

Article ID: ICAMAE-2023-3-11

TOPOLOGY OPTIMIZATION AND STATIC STRUCTURAL ANALYSIS OF MODIFIED RIGID FLANGE COUPLING USING NX

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ABSTRACT

In recent years, Topology Optimization (TO) application has increased to develop design parts with high-performance while having lower weight than the conventional part. In industry, Siemens NX, one of the most widely used tool for designing purpose, is easy to use, suitable for general engineering and the most demanding CAE expert. This article aims to use NX for topology optimization to reduce the material cost by reducing the mass of the coupling. Article focous on the design of a modified rigid flange coupling in NX and performed Finite Element Analysis (FEA) in NX integrated Simcenter 3D for design validation. Topology Optimization in NX is used to reduce the mass of the coupling by applying the design constraints and load cases. The investigation results show that TO

has reduced the flange's 40-45 % mass. Thus, reducing the material cost to a greater extent.

Keywords: Topology Optimization, Finite Element Analysis, NX, Flange Coupling

Article ID: ICAMAE-2023-3-12

DESIGN AND DEVELOPMENT OF BIDIRECTIONAL CONVERTER BASED EV CHARGING STATION

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ABSTRACT

Electric vehicles are an increasing mode of transportation with sales going up every year globally and prices going down, as we move into the future EV batteries get more and more efficient every day and also increase in capacity with minimal usage of space. Combined with a high potential for using solar power sources through government subsidies, the tendency for using green, eco-friendly technologies is increasing. This project aims to provide a scheme for a futuristic scenario where there are a large number of EV charging stations alongside homes and office buildings

and enough solar panels to supply considerable power to highly populated areas and also the future in which all these power interconnections are quite feasible. By using various power converters, algorithms and control techniques and also taking into consideration the different sources, and loads which can be used as sources too, depending upon the need of the hour an optimal solution to the power demand is realized. Hence this work deals with charging and discharging of an EV from both Solar panel and Power Grid using bidirectional converters and various controlling patterns.

Keywords: Electric Vehicle, Charging station, Power converters Solar Panel, Power Grid, Bidirectional.

Article ID: ICAMAE-2023-3-13

COMPARATIVE ANALYSIS OF LOW POWER SRAM CELLS USING GATED VDD AND MTCMOS TECHNIQUES

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ABSTRACT

In this paper, Gated Vdd and MTCMOS techniques are proposed to get low power from the simulated SRAM cells considering 4T, 5T and 6T circuits based on CMOS logic. In the present time, huge evolutions have been made in the field of electronics embedded with memory technology for organized working. Out of many memory cells, the most popular is MOS based SRAM (Static Random-Access Memory), especially for microprocessor and microcontroller architectures. This paper discusses SRAM circuits and with parameters of power dissipation and delay. In this paper, SRAM cell designs with low power techniques have been analysed for delay and power dissipation. Low power techniques like Gated Vdd and MTCMOS (Multi Threshold CMOS), have been applied to reduce the power consumed by the SRAM cells. These designs

are related to an existing 6T SRAM cell. Results show that thee MTCMOS based SRAM cells represent better choice for reduced power dissipation and delays.

Keywords: SRAM, Power dissipation, Low power techniques, Gated Vdd, MTCMOS.

Article ID: ICAMAE-2023-3-14

SMART CITY-DRIVEN ENHANCEMENT OF BILIRUBINOMETER JM-105 ACCURACY WITH ARTIFICIAL NEURAL NETWORK ERROR CORRECTION

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ABSTRACT

Accurate bilirubin level assessment is essential in the field of healthcare technology for rapid detection and treatment of many medical problems, particularly infant jaundice. The Bilirubinometer JM-105 serves as a popular non-invasive instrument for testing bilirubin levels. However, it is subject to inaccuracies, much like any other medical measurement device, because of aspects including device calibration, environmental circumstances, and changes in skin pigmentation. During the first one to two weeks of life, most neonates, both term and preterm, will have raised levels of unconjugated bilirubin and some degree of jaundice because of increased levels of unconjugated bilirubin with temporarily decreased excretion. If the

unconjugated bilirubin levels are extremely high and the illness is not addressed, it is especially common in premature infants and may result in kernicterus, an irreversible neurologic disorder. Unsafely high levels of unconjugated hyperbilirubinemia are treated with phototherapy. These levels usually appear within the first one to two weeks of life and are based on the day of birth and risk factors. To reduce infant jaundice-related morbidity and death, blue light phototherapy is an essential treatment. The baby can expel the extra bilirubin before it builds up because the blue light absorbs bilirubin, which is subsequently broken down in the blood. Jaundice can be avoided and treated; however, kernicterus is persistent and incurable and leaves the patient permanently disabled. It is possible for severe jaundice to take dangerously high levels before it becomes immediately visible to the naked eye. Jaundice may also not appear for a few days after birth, long after the baby has already left the hospital. Hence, early bilirubin monitoring in newborns at risk is essential to prevent. severe jaundice, which may cause long-term neurological damage, especially in premature babies who are more likely to die from jaundice and become disabled. The tests that are available for assessing bilirubin require painful heel pricking to draw blood. A transcutaneous bilirubin meter is already available that can predict jaundice in a non-invasive way. However, the main problem with the device is accuracy. So, we need to develop an algorithm that

gives the output as bilirubin value measured through blood sample (TSB) when the input given is the value of bilirubin measured from the bilirubin meter (TcB). This study presents an error-correcting technique with sophisticated relationships and patterns from data, with a diversified dataset of bilirubin readings and the related real-world values obtained using gold-standard laboratory techniques. that uses neural networks with artificial intelligence to improve the precision of bilirubin level readings obtained with the JM-105 Bilirubinometer. The proposed strategy highlights the value bilirubinometer[JM-105] compared with the standard test results, which found a standard deviation of 3.1622. So, the potential of sophisticated technologies to revolutionize healthcare services, providing accurate diagnosis, while contributing positively to the good health of urban populations by bridging the disparities between healthcare technology and smart cities.

Keywords: - Artificial Neural Networks (ANNs), Bilirubinometer JM-105, Error correction

Article ID: ICAMAE-2023-3-15

INTELLIGENT AUTONOMIC COMPUTING: ACHIEVING SELF-OPTIMIZATION THROUGH AUTONOMOUS LEARNING

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ABSTRACT

Mechanical engineering has focused on autonomic computing, a paradigm inspired by the human autonomic nervous system. This is a general overview of how self-management, self-optimization, and adaptability are made possible for mechanical systems by applying the principles of autonomic computing by carefully arranging and orienting them in accordance with the task requirements. Mechanical systems play a significant role in the handling of items in the working environment. The functions of algorithms in autonomic computing, including control theory, machine learning, and predictive analytic algorithms, are explored in this study. Mechanical systems can make well-informed decisions based on real-time data thanks to these

enhanced dynamic resource allocation algorithms, which support their decision-making processes. With the least amount of human intervention possible, these ideas enable mechanical systems to autonomously organize themselves, improve their efficiency, and adapt to changing conditions. By producing the best outcomes, this increased involvement in manufacturing, industrial robots, smart factories, and even construction machinery. Several important measures, including fulfillment rates, cycle times, inventory turnover ratios, and other measurements of supplier and retailer loadings, can be found here.

Keywords: Autonomous Computing, Autonomous Learning Algorithm, Self-Optimization, Resource Allocation.

Article ID: ICAMAE-2023-3-16

QUANTUM ML ALGORITHM FOR OPTIMIZING DIGITAL DATA USING ENHANCED QUANTUM CLASSIFIER TECHNIQUES IN LEARNING METHODS

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ABSTRACT

With the massive collection of data and the usage of various predictive modelling techniques for images, the need for machine learning came into existence. Dealing with extremely large scales of data, and the need to solve complex problems which trace back to the origin, the need for implementation of quantum techniques became essential. Quantum theory accesses the power of computing at atomic levels and as a current trend, combines with machine learning which helps in speeding up the process and getting very high levels of accuracy. Quantum digital image processing helps in analysing the images better, reducing noise and distortion factors, this gives a multi-point view of the image and generates better classification results. Image processing usually deals with all the features

on an image, and utilizes image matrices to extract and compare information, this usually results in a loss/ lossless, when images are compressed, transformed, and when noise reduction techniques are applied to the images. A typical image lattice gives far fewer details about the image, while analysing it with a quantum system, helps achieve high accuracy for classification and regression tasks. The Representation of classifying Images done in our paper using an Enhanced Quantum optimized CNN help in handling digital imaging data in a better way and also obtaining a multidimensional view of the data. Another Quantum Algorithm named Deutsch algorithm is used to solve specific problems in images and to transform digital data effectively by exhibiting Parallelism and Interference features. Using such techniques grayscale or even color images has been processed in Quantum circuit via IBM Qiskit or in Google Cirq which will be simulated in Real Quantum Computer. The goal is to analyse digital images and make a less intensive model that requires minimal training and gives out extremely good results for classification, and other highly intensive tasks for large images like annotation.

Keyword: - Machine Learning, Quantum CNN, Deutsch Algorithm, Quantum Classifier Circuit.

Article ID: ICAMAE-2023-3-17

NAVIGATING PRACTICAL UNCERTAINTIES IN ASSEMBLY SEQUENCE PLANNING: A PERSPECTIVE ON INDUSTRY 4.0 CHALLENGES

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ABSTRACT

The existing approaches employed in assembly sequence planning (ASP) struggle with a lack of adequate consideration for predicates, resulting in suboptimal solutions. Hence, the study investigates the effects of assembly predicates on the optimality and practical feasibility of robotic assembly sequence planning (RASP). In recent decades, assembly processes have become significant to industrial organizations. The primary objective of this study is to elucidate the obstacles that arise while transferring academic research on ASP to its practical implementation in

industrial settings. This is mainly owing to their need for more consideration of assembly uncertainties. This study examines the impact of assembly predicates on optimal and practical feasibility within the context of Robotic ASP. The study highlights the significance of developing predicates encompassing several aspects, such as feasibility with the combination of multiple directions, jigs, and fixtures for enhancing stability, tool feasibility, and more. The paper provides an overview of potential research opportunities for developing predicates within the framework of Robotic ASP, supported with appropriate examples. By efficiently addressing these issues, the field can enhance the integration of theoretical developments and industrial implementation.

Keywords: - Assembly task planning, tool-integrated assembly attributes, assembly automation, robotic assembly, hybrid class topper optimization algorithm

Article ID: ICAMAE-2023-3-18

ACCELEROMETER-BASED ON-BODY SENSOR FOR ALZHEIMER'S PATIENT MONITORING

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ABSTRACT

The most frequent cause of dementia, Alzheimer's disease, is a major public health issue with far-reaching effects on both people and society as a whole. With an incidence of just 1%, this disease is thought to have 10–30% prevalence in people over 65. This article considers the types in Alzheimer's disease and its available conventional prototypes to track the patient location, medicine remainder to both care taker & patient using the internet technology. In the proposed monitoring system a triaxial accelerometer sensor is configured to measure the downward acceleration of patient. Accelerometer sensor measure acceleration of an object & converts it into an electrical response used for the purpose of human motion analysis, motion vibration detection. Its output is in units of gravity-

measures the object direction relative to ground act as tilt sensor. The sensor manufactured using semiconductor technology; maintain high sensitivity, small in size and its performance greatly improved, due in part to advances in MEMS technology, further patient assistance is controlled by Blynk app.

Keyword: - Early-onset, Late-onset, Familial, patient monitoring, fall detection alert.

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LOW POWER HIGH SPEED MULTIPLY ACCUMULATE UNIT USING PARTIAL PRODUCT REDUCTION PROCESS

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ABSTRACT

The Multiply- Accumulation Unit (MAC) unit of low power and high speed, it accompanies dadda multiplier in its design due to its low delay compared to Wallace multiplier. Dadda multiplier is a main element for Partial Product Reduction (PPR) process to be successful in reducing the critical path delays in MAC unit, main reason for this is Dadda Multiplier that higher significance bits are not accumulated or added until PPR process of other operand begins. A clear observation on design and working of Conventional MAC results, that carry propagations contribute to delay, which is one among the trade-off's during addition process after operands are multiplied. To overcome the path delays seen in Conventional MAC unit, a partial product reduction (PPR) process is used by integrating part of additions. Pipelining architecture is incorporated in the

presented design because of its increased functionality throughput, it accumulates results in registers between logic blocks and send the results that are accumulated in a sequential order. In arithmetic pipeline, operation is broken down into sub-operations and intermediate results are stored in registers and passed on to further stage. In fast multiplier we have 3 stages first one is Partial Product Matrix (PPM), consider we are designing a 4-bit matrix then a matrix of maximum height 4 is formed. In second step the matrix is reduced which is named as Partial Product Reduction (PPR) Process where combination of half adders and full adders are i.e., combinational circuits are used to reduce it to a height of 2 (reduced to two rows). In step three the reduced two rows are added using adders called as final addition. A small size adder is implemented in design to compensate the overflow of bits. The introduced architecture for MAC unit using Dadda Multiplier reduces delay thus can be used in DSP application and real-time applications for faster computational results. This work involves architecture simulation results of power consumption and circuit area under same timing constraints compared with other architecture results.

Keywords: Multiply accumulation Unit, Partial Product Reduction, FPGA, VLSI, Dadda Multiplier.

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THE ROLE OF ARTIFICIAL INTELLIGENCE AND DEEP NETWORKS IN HEALTH CARE

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ABSTRACT

The goal of artificial intelligence, specifically machine learning, is to reduce the time and effort of humans by understanding and to learn intellectual and complex tasks using the data available. AI systems have successfully performed many tasks that need expertise at a large scale. The branch of artificial neural networks and deep learning is at the predominant and progressing phase, in many sectors, that have never been seen. The health sector is one domain that gets benefitted at a large scale. Many recent deep architectures have made analyses, diagnoses, classifications, and predicting of diseases, providing us at least human-level performance. This paper provide a detailed review and comments on the neural and deep neural models in the health sector by considering the complex neurodevelopmental disorder of autism.

Keyword: - Artificial Intelligence, Machine Learning, Algorithms, Autism, Neural Networks, CNN, Loss, Detection, Translation, Evaluation.

Article ID: ICAMAE-2023-3-21

A MODEL FOR OPTIMISING AUTOMOBILE DESIGN BASED ON ANALYSIS OF CONSUMER PREFERENCES

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ABSTRACT

This study examines consumer preferences for some of the contemporary features available for automobiles. The objective of the study is to identify the best combination of the features that can satisfy both customer preferences and manufacturer market share optimisation. To do so, the study formulates an integer programming model with respect to how consumers value different attributes/features for automobiles. The results of the analysis indicate that the recommended combination attribute levels is that of an electic vehicle, with air bags for all seats, six-seater, automatic transmission, Android operating system, tubeless tyres, 2000-4000 cc engine capacity, 200-250 litres boot space, 72 cm leg space, and sun roof. This combination is preferred by the largest percentage of customers/market share. The study has also identified

differences in the optimal combination for certain customer segments based on demographics.

Keywords: Automotive Industry, Consumer Preferences, Association Rule Analysis, Conjoint Analysis.

Article ID: ICAMAE-2023-3-22

AL-BASED RS MODEL FOR MONITORING AND MAPPING ENVIRONMENTAL, SUSTAINABLE LANDUSE LANDCOVER IN THE FRAMEWORK OF SMART CITY

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ABSTRACT

People from rural areas and other regions of India are moving to Bangalore in quest of better economic prospects, which has resulted in significant growth in the city's population because of urbanization. The city's infrastructure and services have been under tremendous strain because of the population expansion, and it has failed to meet demand. Infrastructure growth and upkeep have been difficult for systems including highways, public transit, water supply, and sewage systems. Because of the rise in the number of cars on the road, traffic congestion is a serious problem. The city's ecology has suffered because of the increased urbanization. Unchecked urban expansion has a negative impact on the environment in several ways, including the loss of green space, increasing air and water pollution, and biodiversity loss. By fusing the power

of ICT tools with AI/Machine Learning-supported remote sensing technologies, several initiatives have been reported in the smart city setting in recent years to make cities and human settlements more inclusive, secure, resilient, and sustainable. This work aims to enhance methods for mapping and tracking changes in terrestrial Landcover resources for the Bangalore region. The Landsat 5-TM and Landsat 8 OLI satellites were used to detect changes, and deviations from the sun and the topography were fixed before a Random Forest classifier was used to identify the satellite pictures. By integrating it with high-level numerical modeling data (such as a digital elevation model, or DEM), it becomes more effective at detecting terrestrial zones. The current initiatives in smart cities that use ICT, AI/ML, and remote sensing technologies to increase inclusivity, safety, resilience, and sustainability, with an emphasis on improving Landcover resource mapping and monitoring approaches. The central idea of the movement is to use technology to address urban problems and improve living conditions.

Keywords: land use (LU), land cover (LC), classification, remote sensing and GIS

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FACE RECOGNITION BASED ATTENTIVENESS SURVEY MODEL WITH AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARNING

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ABSTRACT

Number of students are increasing day by day in schools and universities, it's difficult for the teachers to cope up with a large number of students in class. So to have a track of how much students are paying attention in class we are trying to introduce a system which will monitor the learning process in class and provides feedback to the teacher based on the facial expression of the students during the lecture. With having track of all the students' activeness, attendance is one more thing which teachers should take care off. The conventional method of taking attendance is done manually by the teacher which requires considerable amount of time and efforts .Sometimes it may also involve errors and proxy attendance. As the numbers of students are more it is a challenging task for teachers to monitor and maintain the record of the students.

So to overcome this problem to some extent we are proposing a deep learning model with face recognition which will help teachers in recording attendance with attentiveness of the student.

Keywords- Deep Learning; Face Recognition

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DESIGN OF A REINFORCED RECTANGULAR VESSEL FOR HYDROGEN STORAGE IN HEAVY-DUTY FUEL CELL VEHICLES

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ABSTRACT

Hydrogen fuel cell technology has been identified as a prime solution to decarbonise the heavy-duty vehicle (HDV) sector, primarily due to its superior driving range compared to other sustainable alternatives such as battery electric vehicles. Currently, commercially available hydrogen fuel cell-powered vehicles employ type IV cylindrical pressure vessels which are volumetrically inefficient relative to the available storage space. This study presents an initial investigation of designing a reinforced type I rectangular-shaped vessel, i.e. a design with an efficient utilisation of the available space and increased volumetric hydrogen storage. This novel pressure vessel geometry incorporates an internal reinforcing structure to ensure both the structural integrity of the vessel and compliance with the standards and regulations for on-

board hydrogen storage. Initially, an analytical approach was conducted to find the base parameters of the wall and the internal structure of the reinforced pressure vessel. Subsequently, a finite element analysis of the reinforced pressure vessel was conducted to validate the analytical solution and to assess the structural integrity of the vessel under design pressure conditions. Finally, an optimisation study which involved varying the thickness and the hole radius of the internal structure was carried out, aiming to identify an optimal pressure vessel design. The optimised pressure vessel design satisfies the minimum burst pressure requirement of 78.75MPa, rendering it a potential candidate for on-board hydrogen storage in HDVs.

Keywords: - Pressure Vessels, Onboard Hydrogen Storage, Fuel Cell Vehicles, Design Space, Finite Element Analysis

Article ID: ICAMAE-2023-3-26

OPTIMIZING PANTOGRAPH PERFORMANCE WITH ALUMINUM METAL MATRIX COMPOSITES: A FEA-BASED FEASIBILITY STUDY

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ABSTRACT

The pantograph is a key component on top of trains that allows them to efficiently tap electricity from power lines and propel them. This research investigates the possibility of using Metal Matrix Composites (MMCs), specifically Aluminum MMCs, as a material for making pantograph parts with regards to the dynamics of the train's movement and external meteorological conditions. The study starts with a Computer-Aided Design (CAD) model which is created using PTC Creo design software and moves to detailed Finite Element Analysis (FEA) simulations executed by ANSYS sophisticated software suite. Such simulations are important in examining how dynamic performance of pantographs can vary. Incorporation of Al MMC materials into the structure of pantograph results in significant improvement in structural robustness with equal stress reduced by up to 0.18%. Similarly, Aluminum MMC materials reduce strain

energy by 0.063 millijoules. This study represents an entirely different shift towards increasing efficiency and service life of pantographs. The outcomes give an idea about new ways of employing modern materials, thus creating suitable approach for upgrading these systems.

Keywords: pantograph, Metal Matrix Composites, feasibility, CAD model, FEA simulation, structural enhancement, Aluminum MMC, equivalent stress, strain energy.

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NONLINEAR FINITE ELEMENT ANALYSIS FOR ENHANCED STRUCTURAL UNDERSTANDING IN RAIL WHEEL DYNAMICS

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ABSTRACT

The onset and propagation of fractures significantly impact the remaining operational lifespan of locomotive wheels and rail infrastructure, primarily influenced by contact stresses arising from their interaction. This study employs the nonlinear Newton-Raphson algorithm to comprehensively evaluate the structural characteristics and critical regions of the rail-wheel contact-zone. The CAD model for the rail wheel is developed in ANSYS Design Modeler, and structural analysis is conducted using its static structural analysis system. Through simulation, a comparative analysis between linear and nonlinear approaches reveals consistent underestimation of contact parameters—penetration and frictional stress—by the linear model. Despite both analyses predicting similar sliding regions, the linear approach consistently underestimates the penetration of the wheel on the rail and the associated frictional stress. Specifically, the linear analysis indicates a 25%

lower penetration value and a 6.38% lower frictional stress compared to the nonlinear analysis. This research emphasizes the significance of nonlinear analysis in capturing the nuanced complexities of real-world wheel-rail interactions. Additionally, it unveils the limitations of linear analysis in providing accurate predictions. Addressing these limitations enhances our understanding of structural dynamics, offering valuable insights for the design and maintenance of rail transportation systems.

Keywords: Wheel-rail contact, Finite Element Analysis, Nonlinear Newton-Raphson Algorithm, Structural Characteristics, Frictional Stress, Penetration, Rail Infrastructure

Article ID: ICAMAE-2023-3-28

GEOMETRIC NONLINEAR ANALYSIS OF AN ADHESIVELY BONDED COMPOSITE TEE JOINT UNDER STATIC LOADING CONDITIONS

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ABSTRACT

In the current paper, numerical analysis of an adhesively bonded Tee joint with wide applications in aerospace, automotive, marine, and other fields is carried out using the Finite Element Analysis solver ANSYS. A mesh convergence for the adhesively bonded Tee joint with an isotropic (Aluminium alloy) adherend is initially established and linear and geometric nonlinear analysis is performed to determine its deformation and Von Mises stress under various static loading directions . The results obtained from the present study are also verified with those available in the literature. A spew fillet is then incorporated in to the design of adhesive, and a parametri c study is done to establish the optimum spew fillet angle. It is observed that the introduction of a spew fillet significantly reduced the magnitude of stresses developed in the adhesive region of the Tee joint. Subsequently, orthotropic laminates of different

orientations are considered for the upper adherend due to their superior performance in comparison with metals . The results obtained from composite adherends are compared with those from the aluminium alloy. It is observed that an adhesively bonded orthotropic Tee joint with a spew fillet alleviated the stresses produced even further, thereby contributing to an improved and optimal design of adhesively bonded joints.

Keywords: Adhesive bond, Tee joint , Geometric non linearity, Spew fillet, Composites

Track 4

Fluids and Thermal Engineering

Article ID: ICAMAE-2023-4-1

A COMPREHENSIVE REVIEW OF RENEWABLE ENERGY SOURCES, SUSTAINABILITY CHALLENGES, AND CLIMATE CHANGE MITIGATION

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ABSTRACT

This comprehensive review paper provides an in-depth analysis of renewable energy sources, sustainability challenges, and their crucial role in mitigating climate change. As the world grapples with the urgent need for sustainable solutions, renewable energy sources have emerged as a promising pathway towards a greener and more resilient future. The paper explores the diverse range of renewable energy sources, including solar, wind, hydropower, geothermal, and biomass, highlighting their potential for clean and sustainable electricity generation. It examines the sustainability challenges associated with the integration of renewable energy into existing energy systems, such as grid integration, energy storage, policy frameworks, and technological advancements. Moreover, the paper underscores the critical role of renewable energy in

mitigating climate change by reducing greenhouse gas emissions and fostering a transition to a low-carbon economy. It emphasizes the importance of supportive policies, regulatory frameworks, and international cooperation to drive the adoption of renewable energy and achieve climate change mitigation targets. By presenting a comprehensive review of renewable energy sources, sustainability challenges, and climate change mitigation, this paper contributes to the understanding of the transformative potential of renewable energy in shaping a sustainable future.

Keywords: Renewable energy sources, sustainability challenges, climate change mitigation, policy frameworks, technological advancements, transformative potential

Article ID: ICAMAE-2023-4-2

DEVELOPING THE GREEN ENERGY SOLUTION USING PIEZOELECTRIC TRANSDUCER: A CASE STUDY OF THE ROADWAY OF UNIVERSITY

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ABSTRACT

Re-novating the existing system, building or process with new technology to achieve energy efficiency is one of the objectives of engineers. The roadway of the university can be designed to harness energy while remaining serviceable and durable. Hence, the net-zero energy challenge with a green-energy solution can be accomplished. The decision of site selection for placement of piezoelectric transducer in pavement depends on several factors. This paper used the various piezoelectric transducers (PZT) types to achieve net-zero energy depending on their functional constraints and traffic scenarios. The self-sustaining model was used by adjusting the density of sensors underneath the pavement through calculation and estimated energy demands in that zone. The pathway around the university was segregated into different zones per various variables that affected the sizing and number of the transducer tiles and their arrangement, speed limit

of vehicles, headcount, etc. It was found that proper integration of the PZT system, vehicle-to-infrastructure communication and real-time traffic volume and speed use around the building could lead to a net-zero energy building.

Keyword: - Institute, piezoelectric transducer (PZT), energy generation, cost estimation, economical impact, and environmental impact.

Article ID: ICAMAE-2023-4-3

APPLICATION OF TIRE PYROLYSIS OIL AS ALTERNATIVE FUEL IN DIESEL ENGINES: A REVIEW

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ABSTRACT

Tire derived fuel was of the major options which was widely applied in diesel engines as an alternative fuel. This present work of review was carried out for tire pyrolysis on various contemporary issues. It was found that among the several pyrolysis methods, vacuum and microwave pyrolysis stand out for their superior product yields and relatively rapid processing periods. Sulphur compounds can be successfully removed via ODS, and under normal circumstances, tpo with a very low sulphur concentration can be created. Low-sulfur waste tire oil can be utilized in engines either directly or in combination with gasoline. Higher viscosity affects the CI engine's atomization process because of its physicochemical characteristics of tpo. Proximate and elemental analyses of the waste tires were found to be crucial strategies for characterization of waste tires. It was found that cetane number should he high and low

aromatic content as well as low viscosity of tpo was suitable to make tpo as promising substitute for diesel engines.

Keyword: - Tire, Pyrolysis, Reactor, Desulphurization, Proximate, Ultimate.

Article ID: ICAMAE-2023-4-4

EXPERIMENTAL INVESTIGATION EFFECT OF SUT DIMENSIONS ON THE POWER PRODUCTION OF A SOLAR UPDRAFT TOWER POWER PLANT

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ABSTRACT

The development of low-cost renewable energy technology has recently gained a lot of attention around the world. A pilot setup with a chimney of three heights and a fixed collector diameter was built to improve performance of solar updraft tower power plant. In this study, an experimental investigation of a small-scale solar updraft tower (SUT) is conducted for various variables, such as the effect of chimney material, height, and diameters. To estimate the most optimal power output, the collector absorption material is also studied under two conditions: GI sheet and steel plate. For different experiment cases the temperature and updraft velocity are measured.

Keywords: solar updraft towers (SUT); chimney; collector absorption material; GI Sheet and steel plate

Article ID: ICAMAE-2023-4-5

CFD ANALYSIS OF SOLAR CHIMNEY POWER GENERATION

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ABSTRACT

Solar Updraft Towers (SUTs), also known as solar chimneys, are innovative renewable energy systems that harness solar radiation to generate electricity. This research aims to enhance our understanding of the fluid dynamics within solar chimneys, facilitating more efficient and sustainable energy generation from this promising technology.CFD simulations are conducted to investigate the behavior of air currents within the SUT and the resulting power generation efficiency. investigates the interrelationship between chimney height and collector diameter, to evaluate their impact on the solar chimney's performance. Two diameter chimneys are model and analyzed that is 23 mm and 66 mm for various heights. Results demonstrate with increase of tower height will increase the velocity of air and power generation. The findings contribute to the ongoing efforts to optimize SUTs as a clean and

renewable energy source. Numerical solutions are compared and is good agreement with experimental data.

Keywords: Solar chimney; chimney height and collector diameter; Discrete ordinate (DO) method; parametric investigation; CFD Approach.

Article ID: ICAMAE-2023-4-6

EFFECT OF INLET VELOCITY AND TEMPERATURE ON THE PERFORMANCE OF A CONVERGING-DIVERGING TYPE IRS DEVICE: A NUMERICAL EXERCISE

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ABSTRACT

A computational investigation has been conducted on a converging-diverging Infrared Suppression device (IRS) to analyze the impact of inlet parameters, velocity, and temperature. The numerical simulation focuses on a two-dimensional axisymmetric physical domain comprising two stacked conical funnels: converging and diverging. The system's mass entrainment rate and outlet temperature are computed by manipulating various geometrical and operational factors. The key among these factors is the inlet velocity and temperature. In this study, the mass entrainment and outlet temperature ratios, critical metrics for assessing IRSS performance, are graphed against the intake as mentioned above variables. The results demonstrate that as the inlet velocity rises, the mass entrainment ratio declines—an effect that intensifies with elevated

inlet temperature. This change is higher for a higher inlet temperature. Similarly, the outlet temperature ratio experiences an increase with heightened inlet velocity and temperature. For high intake temperatures, such as 8000 C to 9000 C, the inlet temperature falls by nearly 50%. This study differs from earlier work due to the new incorporation of a converging-diverging funnel, even though many researchers have attempted to improve IRSS efficacy. Additionally, the results obtained differ significantly from those reported by earlier researchers.

Keywords: - IRS device, converging-diverging, mass entrainment, outlet temperature

Article ID: ICAMAE-2023-4-7

IOT BASED REMOTE MONITORED AND OPERATED ENERGY EFFICIENT MULTIPURPOSE GREENHOUSE

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ABSTRACT

Greenhouse climate is a non-linear and uncertain system consisting of several major environmental factors such as temperature, humidity, light intensity and CO2 concentration. To control these factors a complex control system with several actuators working in coordination is designed. This project work aims at minimizing the energy consumed by the actuators used in greenhouses. To achieve this, a method to control the speed of single-phase induction motors used in fans/ ventilators is implemented, as they are predominantly

the most energy consuming unit in a greenhouse. The speed of the motor is varied in accordance with the varying parameters inside the greenhouse. Parameters considered in this project are temperature and humidity. Furthermore, an efficient mode of remote monitoring of greenhouse parameters is also proposed. Greenhouse ambient temperature and humidity values from the sensor unit are sent to an IoT (Internet of Things) platform, An application is developed to enable monitoring of parameters and facilitating their control remotely.

Keywords: Energy Efficient, IoT, Greenhouse, Remote Sensing, Induction Motor

Article ID: ICAMAE-2023-4-8

TWO-PHASE MULTIPLIER AND SLIP ANALYSIS FOR A CIRCULAR ORIFICE TO DETERMINE FLOW COEFFICIENTS

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ABSTRACT

Multi-phase flow analysis is predicted to have more uncertainty because of high turbulence in the flow phenomenon. The multi-phase study is an important research area for the flow pattern determination. Orifice is a mass flow measuring device that works with Bernoulli's principle of predicting pressure drop (Δp). A numerical CFD-based study will be conducted for a circular orifice on the determination of Δp. The study parameters are Reynolds number, (Re), volume fraction (X), area ratio (σ) and space ratio (τ) for the study. The range for parameters is considered Re up to 100000, ϕ =0.2-0.8, σ =0.3 – 0.7, τ =0.1-0.9, X = 0.2-0.8. The two-phase fluid is considered as air-water. The parameters will be determined for as output is Δp Slip (S) and Two-phase multiplier (φ). The study will be a

good contribution to the multi-phase analysis of flow measurement through orifice flow.

Keywords: Orifice, Multi-phase, Slip, Two-phase multiplier, Area ratio, Space ratio, Volume fraction

Article ID: ICAMAE-2023-4-9

CFD SIMULATION OF CLOSED LOOP PULSATING HEAT PIPE WITH GRAPHENE

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ABSTRACT

Cooling electric devices and circuit boards has been a challenging issue for decades. Heat pipes can overcome these issues and efficiently dissipate the heat from devices. In this paper, a complete CFD model of a closed-loop pulsating heat pipe (CLPHP) was built and simulated using ANSYS software. CLPHP was designed and developed, and working fluids were selected. The filling ratio of the working fluid has been fixed at 50%. In this study, the temperature distribution of DI water and a novel concentration of graphene nanoplatelets were investigated. Fluid flow, volume fraction, thermal resistance, and heat transfer phenomena at the evaporator and condenser were evaluated. The volume of fluid method (VOF) in ANSYS FLUENT was used

for the simulation process. The simulation results showed that there is a reduction in thermal resistance and an enhancement in the conductivity of heat from the evaporator to the condenser. From the simulation study, it was concluded that graphene nanoplatelets showed better thermal performance in CLPHP than DI water. Thus, CLPHP with graphene significantly transfers heat and is suitable for electronic cooling applications.

Keywords : Closed Loop Pulsating Heat Pipe, Computational Fluid Dynamics (CFD), Graphene, Volume of fluid (VOF), Multi phase flow, temperature gradient, performance analysis.

Article ID: ICAMAE-2023-4-10

KINETICS STUDY FOR ADSORPTION OF CRYSTAL VIOLET OVER RICE HUSK ACTIVATED CARBON

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ABSTRACT

Contamination of rivers and source water becomes a reoccurring challenge due to the increasing discharge of toxic dyes in the effluents of dye-loaded industries such as textile, rubber, paint and print industries among others. Therefore, the need for extensive research into techniques of treatment of effluent of dye-loaded industries cannot be over emphasize. Kinetics study for the adsorption of crystal violet (CV) on activated carbon (AC) synthesized from rice husk is presented in order to establish the kinetic parameters of adsorption of CV on the synthesized AC in wastewater treatment application. Using rice husk biomass activated carbon was synthesized using phosphoric acid as the activating agent. Adsorption equilibrium was attained at 300 min. The equilibrium adsorption capacity was 23 mg/L. The adsorption kinetics was best described by the Lagergren pseudo-second-order with high R^2 of 0.999.

The equilibrium rate constant, was 0.0016 g/(mg. min) and the equilibrium adsorption capacity was 24.9 mg/g. The n^{th} order reaction kinetic analysis described the adsorption kinetic as 1.93^{th} order and the reaction rate constant was described as = 0.0022 . The high consistency in both the Lagergren pseudo–second-order adsorption kinetic model and the reaction kinetic model suggested that the adsorption process proceeded in mechanism having highly common features as a solid-catalyzed reaction. Therefore, the adsorption mechanism of CV on the synthesized activated carbon was mainly pore diffusion driven.

Keyword: Adsorption kinetics, Rice husk, Activated carbon, Crystal violet.

Article ID: ICAMAE-2023-4-11

CFD STUDY ON SOLAR DRYER WITH DIFFERENT WALL CONFIGURATION FOR TROPICAL CLIMATE

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ABSTRACT

Solar energy is one of the best substitutes of conventional energy sources for tropical climate. It is observed that indirect solar dryer with modifications can be more efficient way of preserving post-harvest product for a longer period of time. It is found that most of the conventional solar dryer are made of gravel material with 40% porosity. This kind of material helps in increasing the efficiency by 2.47 % at night. However, a potential design of solar dryer need to focus on continuous removal of moisture while maintaining uniform temperature. Thus, an investigation has been carried out to establish the temperature distribution and the rate of moisture removal from the solar chamber using a CFD study. A standard k-ε model turbulence model of solar dryer with a wind blower has been generated to study the characteristics of hot air within it. The solar dryer has also been associated with a solar panel which helps to run the wind blower. The CFD

study reveals that a triple pass solar dryer can be helpful in increasing the efficiency by 81% by considering the factor like air velocity, humidity and mass of the products etc.

Keyword: - Computational Fluid Dynamics, Solar dryer, Wall Configuration, Tropical climate

Article ID: ICAMAE-2023-4-12

ENHANCING LATENT HEAT ENERGY STORAGE SYSTEMS WITH FINS AND NANOAL2O3-ENRICHED PHASE CHANGE MATERIALS

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ABSTRACT

The intermittency of solar energy greatly influences the effectiveness of many solar technologies. Solar thermal storage systems, which include sensible and latent heat storage systems, maybe a feasible solution to this problem. Among the available options, latent heat storage techniques excel in several aspects. They are renowned for their exceptional storage capacity, which enables them to efficiently store substantial amounts of energy. Furthermore, their charging and discharging processes exhibit almost isothermal behaviour, minimising temperature fluctuations. However, the limited thermal conductivity of the phase change material(PCM) used in the storage system poses

a challenge by slowing down heat transfer, resulting in prolonged charging and discharging periods. The current study proposes a hybrid strategy employing nanomaterials and fins as a solution to this issue. A design featuring C-shaped fins that efficiently harness the natural convection currents within the molten PCM is employed within the storage module. The research also delves into the impact of incorporating nano-aluminium oxide (nAl_2O_3) into the PCM. To evaluate the thermo physical properties of PCM, an experimental characterisation process on the nano-PCM composite is conducted, and data-driven correlations for thermal conductivity and dynamic viscosity are devised. Effectiveness of the proposed storage unit layered with PCM composites of varying mass fractions is investigated as well. Compared to longitudinal fin shape, C-shaped fins effectively reduces melting time by 59%, while nano-PCM composite with 1% nAl_2O_3 reduces charging time by 22%. Conclusively, the results of this study offer a promising pathway to address the barriers impeding the broader adoption of solar technologies.

Keywords: - LHS, NANOMATERIALS, FINS, PCM, SOLAR, HYBRID APPROACH.

Article ID: ICAMAE-2023-4-13

FLOW CHARACTERISTICS OF A MODIFIED SQUARE CYLINDER

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ABSTRACT

Bluff bodies can experience vortex-induced vibrations due to flow separation causing instability and severe structural damage. This study is concerned with the effect of geometry and aspect ratio (L/D) on the primary instability behind modified square-cylinders in a laminar, incompressible flow. A square cylinder's front, back, top, and bottom are modified to get concave and convex geometries. The aspect ratio for these is varied by changing the cylinder's length (L) and keeping diameter (D) constant. Five aspect ratios are considered with increments of 0.5 from 1 to 3. Results of the numerical investigation on concave and convex square cylinders are compared with circular and square cylinders at Reynolds number 100 and aspect ratio 1. Concave geometry offers less drag while convex geometry offers more drag than a square cylinder. The wake becomes more streamlined

and narrower on increasing aspect ratio from 1 to 3. A decrease of 15.8 % and 16.7 % in drag is observed for concave and convex square cylinders respectively as the aspect ratio is increased from 1 to 3. This reduction in drag explains the reduction in the frequency of vortex shedding found using Fast-Fourier-Transform Analysis and, thus, the reduction of 19.74 % and 37.3 % in the Strouhal number for concave and convex cylinders, respectively.

Keywords: - Instability, Aspect Ratio, Drag, Fast-Fourier-Transform, Strouhal Number

Article ID: ICAMAE-2023-4-14

CYLINDER DRAG REDUCTION THROUGH STRATEGIC CONTROL SURFACE IMPLEMENTATION: A COMPUTATIONAL STUDY

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ABSTRACT

Efficiently mitigating drag forces on objects immersed in fluid flows has been a key pursuit across various engineering applications. The manipulation of flow patterns around bluff bodies like cylinders holds paramount importance due to its widespread relevance in industries such as aerospace, automotive, and maritime. This study investigates effectiveness of drag reduction through implementation of control surfaces in the context of flow past a circular cylinder. The present research employs computational fluid dynamics simulations to explore the impact of control surfaces on drag characteristics of circular cylinder under gusty flow with static trailing edge mounted at rear stagnation point of the cylinder. Different lengths of the control surfaces are strategically chosen with varying gust frequency between 0–1.5π rad/sec at

moderate Reynolds number, thereby modifying the overall flow behavior. Through comprehensive analysis and comparison, the study unveils varying degrees of drag reduction achieved by different control surface configurations. The findings underscore the potential of control surfaces as effective tools for enhancing the efficiency and performance of cylindrical bodies in fluid environments. The present results provide valuable guidance for engineering designs aiming to optimize aerodynamic and hydrodynamic performance of cylindrical structures, fostering advancements in various industries requiring fluid-solid interactions.

Keyword: - Drag, Circular Cylinder, Control Surface, Gusty Flow, Cfd, Aerodynamics.

Article ID: ICAMAE-2023-4-15

DEVELOPMENT OF EXPERIMENTAL SET UP FOR TEMPERATURE MEASUREMENT ON THE BRAKE DISC OF PULSAR 150 CC MOTORCYCLE

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ABSTRACT

From the standpoint of safety, the braking system is an essential part of the motorcycle. The capacity of the brake disc composition to endure excessive frictional and durability to wear rate is the most crucial factor to take into account. Tolerating the maximum temperature that developed as a result of friction is also needed. Hence to increase the performance of brake disc we need to improve the thermal performance of brake disc. Thermal performance of brake disc is depending on the kind of material utilized for manufacturing of brake discs. As we know, brake disc assembly is rotating and moving from one place to another place in the actual application. Hence it is challenging task to do thermal analysis of brake disc experimentally. In this present study experimental setup is proposed for measuring the brake disc's surface temperature which can be useful to do the thermal analysis of the brake disc.

Keywords:- Brake disc, Thermal analysis, Experimental Set up, motor cycle.

Article ID: ICAMAE-2023-4-16

SOFC: REVIEW ON ADVANCEMENTS, CHALLENGES AND PATHWAYS TO SUSTAINABLE ENERGY CONVERSION

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ABSTRACT

Solid Oxide Fuel Cells (SOFCs) have emerged as a promising technology at the forefront of the global quest for clean and sustainable energy solutions. This comprehensive review paper explores the multifaceted world of SOFCs, shedding light on their working principles, construction, materials, fuel versatility, and the boundless prospects they offer for a sustainable energy future. The review begins by delving into the intricate workings of SOFCs, elucidating the electrochemical processes that underpin their high efficiency and versatility. A detailed examination of the cell's construction, including the key components such as the electrolyte, anode, and cathode, provides insights into the robust engineering required for their successful implementation. From perovskite compounds to ceria-based electrolytes, this review discusses the crucial role of materials in enhancing performance, stability,

and cost-effectiveness. Fuel flexibility is another critical aspect covered in this review, highlighting the capacity of SOFCs to efficiently convert a wide array of fuels, from hydrogen and methane to biofuels and carbon-neutral options The paper culminates in an exploration of the prospects of SOFCs. It discusses ongoing research and development efforts aimed at overcoming challenges related to cost, durability, and scaling up production. In summary, this review paper offers a comprehensive overview of SOFCs, spanning their working mechanisms, construction, materials, fuel adaptability, and promising prospects.

Keyword: - SOFC, PEMFC, Sustainable Energy, Hydrogen, Methane, Biomass

Article ID: ICAMAE-2023-4-17

REVIEW ON PERFORMANCE OPTIMIZATION OF VAPOR ABSORPTION REFRIGERATION SYSTEM USING DISTINCTIVE STATISTICAL ANALYSIS TECHNIQUES

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ABSTRACT

The implementation of less potent energy sources such as solar power, residual heat, and geothermal energy has led to an increased significance of VARS for cooling and air conditioning purposes. This study employed the RSM to statistically assess the ARS. Several innovative surface response techniques, including CCD and BBD, were investigated and compared to enhance the system's effectiveness. The aim of this study was to examine how various factors influence the outcome, such as mass flow rate, pump isentropic efficiency, condenser, evaporator, absorber, and generator temperatures, pressure ratio, refrigerant solution concentration, heat exchanger efficiency, and system cooling load, on the COP using statistical methods. The Taguchi, GRA method was also employed to optimize multiple performance criteria. Various

regression models were formulated for single, double, or triple effect VARS using software tools like EES, ASPEN PLUS, TRNSYS, MATLAB, and DESIGN-EXPERT, based on experimental design analysis. The study also proposed different correlations to identify research gaps. By outlining future research directions and conclusions, this article contributes to enhancing the performance coefficient of VARS.

Keywords: RSM, CCD, BBD, ANOVA, Grey Relational Analysis, Taguchi.

Article ID: ICAMAE-2023-4-18

EXPERIMENTAL INVESTIGATION OF SHOCK WAVES OVER WEDGES AND BLUNT SHAPES IN MINI SUPERSONIC WIND TUNNEL

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ABSTRACT

In the present study a mini supersonic wind tunnel is built using reservoir tank, 3D Printed Convergent divergent nozzle and Shadowgraph technique to observe shock waves over models. As the setup is cost effective and safe with the reservoir tank refilling capacity at less time than traditional supersonic flow reservoir it can be easily approachable for undergraduate students for multiple tests. The shock waves are observed over the wedge and blunt shapes placed inside the test section.

Keywords: shock wave, blunt shapes, supersonic, wind tunnel

Article ID: ICAMAE-2023-4-19

A GRAPHICAL ASSESSMENT OF ETHYLENE, HYDRAZINE, ISOPROPYL ALCOHOL, AND AMMONIA AS FUELS IN COMBINATION WITH NITROUS OXIDE, HYDROGEN PEROXIDE, AND OXYGEN OXIDIZERS: COMPARATIVE ANALYSIS USING PROPEP 3

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ABSTRACT

For any propulsive system to work efficiently, various parameters are taken into consideration such as its critical pressure, critical temperature, impulse, specific impulse and so on. Here a comparative analysis has been conducted with the help of simulation software ProPEP 3 which provides data for various fuel and oxidizer mixtures which range from lean mixture to rich mixture. This comparative study would help us understand which fuel to oxidizer mixture would be effective to use.The fuels that are used here are Isopropyl Alcohol, Hydrazine, Ethylene and Ammonia . The oxidizers used were Oxygen(Gas), Oxygen(Liquid), Nitrous Oxide and Hydrogen Peroxide.

Keywords: Hydrazine, ProPEP3, Oxidizer mixture, Ethylene

Article ID: ICAMAE-2023-4-20

GRAPHICAL ANALYSIS OF FUELS' CHARACTERISTICS ON COMBUSTION WITH OXIDIZERS

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ABSTRACT

Presently, all the major fossil fuel driven companies/ industries are trying to change their fuel to more renewable, sustainable, and environmental-friendly alternatives to tackle the issue of climate change and global warming. The need for alternatives includes ones like alcoholic fuels, Biofuels, and other sustainable fuels. This paper provides a graphical comparison of fuels such as Diesel, Gasoline, Paraffin, Methanol and Ethanol on combustion with oxidizers such as Oxygen (Gas and Liquid), Nitrous Oxide, Hydrogen Peroxide based on varying Oxidizer – Fuel Ratio. The parameters on which they are being evaluated include Impulse, Critical Temperature, Critical Pressure, Critical Velocity, Specific Impulse which are being calculated on ProPEP 3 software. These parameters are quite useful in the Aerospace Industry, Impulse

and Specific Impulse determine the total thrust the engine can generate and Critical Temperature, Critical Pressure, Critical Velocity are the design parameters, on which the engine design is built.

Keyword: Combustion, Oxidizer, Sustainable, Bio-fuels

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A REVIEW STUDY ON FLUID FLOW PAST BLUFF BODIES OF VARIOUS CROSS-SECTION PLACED IN DIFFERENT CONFIGURATIONS.

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ABSTRACT

The work done by various researchers in the field of fluid flow past bluff bodies having different cross-sections and placed in various configurations is reviewed in this paper. A comparison of the various results is also discussed in this paper in a tabulated form, as well as with the help of graphs between different flow parameters. This paper will surely be helpful for the new investigators working in the field of fluid-structure interactions to capture the vital data and information for continuing their investigation in this field. Flow patterns for fluid flow over bluff bodies at various Reynold numbers, spacing ratios, angle of attack, is also presented with the help of comparison of different contours available with help of ANSYS CFD simulations. Both experimental and numerical simulations work done in the past is analyzed and segregated in this paper. This paper focus on comparison

for different cross-section bluff bodies placed in various configurations with the help of tables, graphs, charts etc., to help innovative new researchers to continue their research work with the help of past twenty years research work data and information available in a single paper.

Keyword: - Bluff bodies, Reynold number, flow contour, spacing ratio, angle of attack.

Article ID: ICAMAE-2023-4-22

CENTRAL SOLAR TOWER TECHNOLOGY: HARNESSING SOLAR POWER AT ITS PEAK EFFICIENCY

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ABSTRACT

The search for effective and environmentally friendly power generation techniques is more important than ever due to the unrelenting advancement of climate change and the urgent demand for sustainable energy sources. In the field of renewable energy, concentrated solar power (CSP) technology is emerging as a possible substitute. By using concentrated solar radiation to harness the sun's energy, CSP offers the benefits of efficiency, safety, dependability, and low environmental impact—a major departure from the greenhouse gas emissions that come with burning conventional fossil fuels. Due in significant part to inefficiencies in current systems, solar energy's high cost has hindered its competitiveness despite its potential. An increasing number of people are focusing on high-temperature central solar receivers as a solution to this problem

because they offer better efficiency and lower costs. Solar power towers and other high-temperature central receivers are leading the way in CSP innovation. These systems may produce high-temperature thermal energy, usually between 500 and 1000°C, by increasing the concentration of solar radiation. This energy is then transformed into electricity. Globally, a number of solar power tower projects have demonstrated their potential, ranging from Spain's innovative efforts in the 1980s to the growth of CSP programmes in the US, Chile, and other countries. The best heliostat dimensions and economic viability remain obstacles, nevertheless. Further development also depends on developments in hybrid and thermal energy storage technologies, as well as on integrating solar power towers with other systems. Although there are still obstacles to overcome, solar power towers provide an environmentally responsible and economical alternative to generate electricity.

Especially solar power towers—has a lot of potential for the renewable energy industry. It is a strong option because of its consistent power supply and long-term potential for lower electricity prices. However, for its widespread acceptance, it is imperative that current legislative problems and cost discrepancies be addressed. Future sustainable energy is expected to change as solar power towers become a more cost-effective and ecologically friendly way to generate electricity as economies of scale take hold and technology advances.

Keywords: Central Towers, Efficiency , Solar Energy , Cost , Thermodynamic Cycle , Solar panels , Reflective materials

Article ID: ICAMAE-2023-4-23

AN INTEGRATED APPROACH TO FAILURE-BASED DESIGN SELECTION FOR GEARED MECHANISMS IN HEV TO REDUCE FUEL CONSUMPTION AND EMISSIONS USING MULTISURROGATE OPTIMIZATION MODEL

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ABSTRACT

The rise in pollution resulting from vehicle exhaust emissions prompted the development of diverse technologies capable of harnessing and converting numerous energy sources for more effective propulsion. Hybrid electric vehicles (HEVs) present a viable interim option due to the ongoing need for further advancements in electric vehicle (EV) technologies, namely in the realm of charging infrastructure and long-distance travel capabilities. This study presents a novel methodology for optimizing the geared mechanism in hybrid electric vehicles (HEVs) with the objective of reducing both fuel consumption and

emissions. The proposed approach aims to address the disparity by embracing and amalgamating concepts of machine design to mitigate fuel consumption and emissions. This is achieved through the implementation of a novel methodology that blends Finite Element Analysis (FEA), Model-based Design, and Design of Experiments. The approach utilizes standard Computer-aided design and multisurrogate assisted engineering design optimization to find suitable power-split design of a HEV, thereby evoking a new paradigm for eco-friendly design. An additional advantage of the aforementioned methodology is in its capacity to achieve precise predictions of outcomes using a reduced amount of data. In summary, the primary innovation of this methodology lies in its utilization of Finite Element Analysis (FEA) data to enhance fuel efficiency in an automotive context. This approach emphasizes the advantages of practical implementation through a virtual simulation environment, hence offering substantial returns on investment throughout the product development phase.

Keyword: - Computer-aided Engineering, FEA, Model-based Design, Design Optimization, Smart Algorithms.

Article ID: ICAMAE-2023-4-24

5G BASE STATION ENERGY MANAGEMENT: REVISITED

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ABSTRACT

The popularity of 5G enabled services is gaining momentum across the globe. It is not only about the high data rate offered by the 5G but also its capability to accommodate myriad of the connected devices. To ensure the Quality of Services (QoS), 5G could be deployed either in non-standalone or in standalone mode having their own merits. Due to infrastructural limitations, non-standalone mode deployment of 5G is preferred as compared to standalone mode. To achieve low latency, higher throughput, larger capacity, higher reliability and wider connectivity, 5G base stations (gNodeB) need to be deployed in mmWave. Since mmWave base stations (gNodeB) are typically capable of radiating up to 200-400 meters in urban locality. Therefore, high density of these stations is required for actual 5G deployment, that leads to huge power consumption. It is reported that Radio Access Network (RAN) consumes almost 70% of the input power

supply. Therefore, energy management methodologies at RAN are required. Many methodologies like symbol shut down, carrier shutdown, deep sleep etc., have been reported in the literature. In this work, a parametric study of these methodologies has been carried out. Based on this study the effective mechanism for energy management has been suggested.

Keyword: - Energy management, Base station, RAN, mmWave.

Article ID: ICAMAE-2023-4-25

PROCESS OPTIMIZATION OF BIODIESEL PRODUCTION FROM MIXED PONGAMIA, ANIMAL FAT AND WASTE COOKING OILS USING RSM & PERFORMANCE CHARACTERISTICS OF CI ENGINE WITH VARYING BIODIESEL BLENDS

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ABSTRACT

Biofuel plays a predominant role in the sustainable growth of any developing country due to its renewability and lower toxicity. This led the researcher to work on alternative fuels. In this aspect, Sample 1 consists of a composition comprising 50% by weight of raw Pongamia oil, 25% by weight of raw animal fat oil, and 25% by weight of used cooking oil. On the other hand, Sample-2 comprises a composition consisting of 60% by weight of crude Pongamia oil, 20% by weight of raw animal fat oil, and 20% by weight of used cooking oil. Biodiesel blends are investigated for their optimization and performance through diesel engines. Optimization

is performed using RSM, with yields of 98.32% and 97.82% obtained for samples 1 and 2, respectively. The optimized conditions were maintained as 8.15:1 molar ratio, 1.2 wt. % catalyst concentrations, 75 min of reaction time, 64°C temperature, and 6.74:1 molar ratio, 1.193 wt. % catalyst concentrations, 74 min of reaction time, and 64°C temperature for samples 1 and 2, respectively. The sample properties meet the ASTM D6751 standards. Both the samples are blended with the diesel in an appropriate ratio, and the performance tests are carried out in a single-cylinder diesel engine at variable load conditions. The brake thermal efficiency obtained for sample 2 is higher than that of sample 1. At B100, sample 1 had 27% of BTE, whereas sample 2 had 29%. The BTE of B20 blends in samples 1 and 2 is 31.5% and 33%, respectively. The brake-specific fuel consumption for samples 1 and 2 at B100 blend ratios is 1.45 kg/kWh and 1.4 kg/kWh, respectively.

Keywords: Pongamia, Animal Fat, Waste Cooking Oils, RSM, Biodiesel, CI Engine

Track 5

Aerospace Engineering

Article ID: ICAMAE-2023-5-1

NUMERICAL INVESTIGATION OF SERRATED BLENDED WINGLET AERODYNAMIC PERFORMANCE

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ABSTRACT

The numerical analysis of the Wing model with and without Blended winglets is the primary goal of the suggested article. Here, the inquiry compares the parameters of the wing created with and without Serrated Blended Winglets (SBW) to demonstrate the numerous performance and parameter differences between the designs. Here, talks centred on aerodynamic properties including the lift-to-drag ratio L/D, lift coefficient CL, and drag coefficient CD. The tapered wing design employed in this study is NACA 653218 airfoil. The Solid works software is used to carry out and develop the models' geometry. The major goals of this effort are to increase aircraft efficiency by reducing the induced drag created on the wing tip during the battle action. Utilising the ANSYS Software, flow parameters (such as lift and drag) are monitored for entire design configurations throughout the analysis phase. The

result of the work is the winglets with serration gives more efficiency than normal winglets at higher angle of attack.

Keyword: - Blended winglet, Lift-to-Drag Ratio, ANSYS Fluent, Solid works, CFD, Sweep Angle.

Article ID: ICAMAE-2023-5-2

MODELLING AND SIMULATION OF JET IMPINGEMENT COOLING OF A SOLID SURFACE BASED ON STATE SPACE METHOD

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ABSTRACT

Controlling the rate of heat transfer in the hot strip rolling mill is essential during jet impingement cooling. A state feedback pole placement technique has been used for temperature tracking and a control system is designed and simulated. A Single Input-Multiple Output (SIMO) control structure has been investigated for the cooling of a steel plate or electronic equipment by impinging air jet. Thermocouple locations embedded on the metal surface were used to formulate the semi-discrete 1-D transient heat conduction control volume problem for the state-space based control model. For the plant validity tests, a general open loop model has been incorporated. The transient conduction equation has been used to represent the nonlinear variation of the

total temperature following a heat transfer coefficient correlation for the strain rate of air from nozzle exit. For a single nozzle, keeping the surface temperature of the steel plate as reference (demand), the temperatures at all the nodes inside the plate are obtained by using a set of ordinary differential equation (ODE) in the MATLAB and SIMULINK environments.

Key Words: Jet Impingement Cooling, SIMO Control, Cooling Rate, State Space Model

Article ID: ICAMAE-2023-5-3

PACKET ERROR RATE ANALYSIS OF IEEE 802.11P PHYSICAL LAYER FOR V2V COMMUNICATION IN VANETS

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ABSTRACT

Vehicular Ad Hoc Network (VANET) is a multi-hop wireless network in which moving vehicles act as nodes to communicate with each other. VANETs can provide safety and comfort to drivers and avoid traffic congestion. Many safety applications of VANET require high Quality of Service (QoS) for reliable communication between high-speed moving vehicles. However, the unique characteristics like high mobility of vehicles, frequent network disconnections and dynamic topology challenge the QoS support in VANETs. As the basic information unit used in physical layer is a bit packet, so the best metric to measure the performance of physical layer is the Packet Error Rate (PER). In this paper the performance of vehicle-to-vehicle communication in IEEE 802.11p physical layer under different modulation schemes, Packet size, and channel delay profiles is observed and analysed in terms of

PER in the presence of Additive White Gaussian Noise (AGWN) and Rayleigh fading channels. Simulations are carried out in MATLAB and the results show that small packet size and lower order modulation schemes give better network performance in terms of PER than large packet size and higher order modulation schemes respectively in a vehicular environment at the cost of low data rate.

Keywords: - VANET, ITS, QoS, PER, ICI, IEEE 802.11p

Article ID: ICAMAE-2023-5-4

AUTONOMOUS MULTI-ROTOR UAVS: A HOLISTIC APPROACH TO DESIGN, OPTIMIZATION, AND FABRICATION

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ABSTRACT

Unmanned Aerial Vehicles (UAVs) have become pivotal in domains spanning military, agriculture, surveillance, and logistics, revolutionizing data collection and environmental interaction. With the advancement in drone technology, there is a compelling need to develop a holistic methodology for designing UAVs. This research focuses on establishing a procedure encompassing conceptual design, use of composite materials, weight optimization, stability analysis, avionics integration, advanced manufacturing, and incorporation of autonomous payload delivery through object detection models tailored to satisfy specific applications while maintaining cost efficiency. The study conducts a comparative assessment of potential composite materials and various quadcopter frame

configurations. The novel features include a payload-dropping mechanism, a unibody arm fixture, and the utilization of carbon-fibre balsa composites. The quadcopter is designed and analysed using the proposed methodology, followed by its fabrication using additive manufacturing and vacuum bagging techniques. A computer vision-based deep learning model enables precise delivery of payloads by autonomously detecting targets. This comprehensive design methodology is validated through successful flight tests of the fabricated drone.

Keywords: - Quadcopter, Composite Material, Additive Manufacturing, Payload, Autonomous UAVs, Artificial Intelligence.

Article ID: ICAMAE-2023-5-5

SQUARE CYLINDER AERODYNAMICS: INSIGHTS FROM AEROACOUSTIC ANALYSIS

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ABSTRACT

An in-depth analysis of the aeroacoustic noise generation mechanism has been sought to gain comprehensive insights into the complex phenomenon of noise production in aeroacoustic systems. This study delves into the intricate realm of square cylinder aerodynamics through a comprehensive aeroacoustic analysis. The primary objective of this research is to unravel the underlying mechanisms governing the complex flow phenomena and noise generation surrounding a square cylinder. ANSYS Workbench has been used to investigate the intricate interactions between fluid dynamics and acoustics at low Reynolds numbers of 100 and 200. The study focuses on identifying the key factors that influence noise generation, such as flow turbulence, unsteady pressure fluctuations, and the interaction of solid surfaces with the surrounding fluid. A dipole noise pattern is predicted for the flow at Re = 100 and 200 with the maximum value located at top

and bottom surfaces which is mostly influenced by the lift fluctuation, and the minimum value at a location in the vortex street, determined by the drag fluctuation. Our findings shed light on the aeroacoustic signatures specific to square cylinders, offering valuable insights into the understanding and control of noise generation in various engineering applications, from aerospace to civil engineering.

Keyword: - Aeroacoustic, Square Cylinder, Reynolds Number, Turbulence, Aerodynamics.

Article ID: ICAMAE-2023-5-6

THERMO STRUCTURAL ANALYSIS OF NOZZLE SUB-ASSEMBLY WITH COMPOSITE LINERS FOR GAGANYAAN MISSION

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ABSTRACT

In order to ensure the safety of crew in manned missions like GAGANYAAN, a human rated launch vehicle with dedicated Crew Escape system (CES) is much needed in case of any exigency during flight operation or at launch pad. In this present work, nozzle sub-assembly of a Special Purpose Solid Rocket Motor (SPSRM) in CES was analyzed in detail. This Motor has conventional straight nozzle with composite liners bonded to hardware using bonding resin. The nozzle convergent & divergent hardware is connected through flange joint with liners of Carbon Phenolic (CP) and 4D Carbon-Carbon (4D C-C) throat insert with Silica Phenolic (SP) backup. The liners are designed to bear thermal loads primarily and structural loads will be taken care by metallic hardware. During motor operation, liners experiences higher temperature as it is directly

exposed to hot combustion gases. To ensure the bond integrity, temperature at liner to hardware interface should be within allowable limits. Material properties like coefficient of thermal expansion, strength and modulus varies with respect to temperature. Also, due to the presence of high flow velocity &heat flux at inner surface of liners which acts for short duration, there exists high temperature gradient. Therefore, a detailed thermo structural assessment is essential to assess the structural integrity of the liners during motor operation. Hence, an integrated three dimensional Finite Element (FE) model of nozzle hardware with liners has been analyzed with combined temperature & pressure loads corresponding to Maximum Expected Operating Pressure (MEOP). In this paper, directional stresses of nozzle liners, gap openings, hardware stresses etc. are discussed in detail. Also, analysis results were compared with the measured data during static test of the motor.

Keywords: Thermo-structural, Solid Rocket Motor, Nozzle, composite liners, Finite Element

Article ID: ICAMAE-2023-5-7

NUMERICAL SIMULATION OF CASCADE FINS WITH VARIED CHORD RATIOS OF PLANAR MEMBERS AT HIGHER ANGLE OF ATTACK IN SUBSONIC REGIME

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ABSTRACT

A new type of missile control device that consists of intersecting planar members supported by a frame are called Grid fins. At high angle of attack Grid fins does not stall (delayed) as is seen in planer fins and are more aerodynamically efficient at high Mach numbers. This advantage makes them ideal for highly manoeuvrable missile, spaceship or bombs. However, their use has been limited as intersecting planar member structure creates more drag. Simplified geometry of grid fin without cross members are being used, which is called 'cascade fins'. In this study flow around cascade fins with varying chord ratio has been simulated using CFD at high angle of attack and low subsonic speeds. The aim of the study was to understand the link between aerodynamic coefficients and geometric parameter of chord ratio (middle member chord to outer chord) in cascade fins. The CFD results showed that the (Cl / Cd)

co-efficient increases, although the increase is non-linear due to the cascade effect. In the angle of attack regime of 5° to 15°, which is the most operated-upon angle of attack regime for missiles, it can be observed that an there is appreciable increase in (Cl/Cd) as compared to baseline model. The Analysis shows that the proposed model reduces drag by up to 17% at an AOA of 50o. The percentage reduction in drag decreases as the angle of attack decreases. We can interfere from the above that the proposed model is effective at reducing drag at high angles of attack.

Keywords: Grid fins, cascade fins, aerodynamic coefficients, stall, CFD, chord length

Article ID: ICAMAE-2023-5-8

CFD SIMULATION OF HIGH ANGLE OF ATTACK WITH VARYING THE GAP RATIO OF PLANNER MEMBERS OF CASCADE FINS AT SUBSONIC FLOW

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ABSTRACT

Grid fins are lattice-like structures composed of intersecting small planar surfaces, supported by an outer frame that provides structural integrity. These Grid fins are positioned perpendicular to the airflow, generating significant force and moment on a moving object. Unlike conventional planar fins, grid fins exhibit stall at higher angles of attack. Flow passing through the grid fins becomes energized at these higher angles of attack, preventing flow separation from the fin surfaces. Grid fins are highly efficient and find applications in agile vehicles, missiles, and bombs. However, one major drawback is they produce substantial drag. The simplest form of grid fin is called 'Cascade' fin. Cascade fins eliminate cross members and feature only a specific number of horizontal planar members with end plates. In this research used cascade fin to further study to explore grid fin's aerodynamic characteristics

behavior with respect its geometrical parameters. This research aims to establish a relationship between the gap ratio (Middle members gap to outer member's gap) and aerodynamic coefficient. By varying the gap ratio, we seek to understand its effect on aerodynamic coefficient such as lift and drag coefficients. To investigate this, we employ 3D Navier-Stokes equations (CFD Analysis) to determined results of this study. This study presented sheds light on the aerodynamic performance of cascade fins and their potential to enhance the agility and effectiveness of high-performance missile and bomb systems.

Keywords – Grid Fin, Cascade fin, aerodynamic efficiency, gap ratio, CFD, Angle of attack

Article ID: ICAMAE-2023-5-9

COMPUTATIONAL ANALYSIS OF CASCADE FINS WITH TAPERED PLANFORM PLANAR MEMBERS OVER HIGH ANGLES OF ATTACK AT SUBSONIC SPEED

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ABSTRACT

Grid fin is newly introduced technology mainly used to control the tail control missile. It has external frame which supports an internal grid of intersecting surfaces of less chord length. It is advantageous as it has delayed stall and doesn't indicate a sharp decrease in the loading characteristics especially at high angle of attack. It has very less hinge moment at all angles of movement which reduces actuator power requirement and they are made of honeycomb structure which provides more strength to weight ratio and reduces overall cost & weight and makes them ideal for highly manoeuvrable missile or bombs. Only disadvantage of grid fin is the enhanced drag force and same can be little mitigated by cascaded fins which does not have cross member and hence reduces overall drag force without affecting other required parameters. In this study flow

around cascade fins with three tapered planform planner members has been simulated using ANSYS FLUENT at high angle of attack and low subsonic speeds. The CFD results showed that the (Cl /Cd) coefficient increases, at angle of attack in the most operated regime of 4° to 15°, there is an appreciable increase in (Cl /Cd) as compared to baseline model, although the increase is non-linear due to the cascade effect. However, variant cascade fins model comes with higher drag than baseline, which reduces their aerodynamic efficiency. The cascade effect also reduces flow separation, which improves aerodynamic performance at high angles of attack.

Keywords: Grid fins, cascade fins, aerodynamic coefficients, stall, CFD, Planform

Article ID: ICAMAE-2023-5-10

AERODYNAMIC ANALYSIS OF WING WITH PROTUBERANCES (HUMPBACK WHALE STRUCTURE)

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ABSTRACT

The research was carried out to understand more about how the tubercles on the humpback whale flipper affect aviation models. The new design of a flipper model's tubercle pattern is suggested. According to the findings, models with Leading Edge (LE) tubercles had better lift and a delayed stall angle. Counter-rotating vortex pairs (CRVPs) are created because of the contact between the LE tubercles and the wave-like trailing-edge flow divergence structure, which improves the aerodynamic qualities. One of the major findings of this study is that an approach that is more realistic might be able to produce better performance than a model with an even allocation of tubercles. The greatest possible lift coefficient (Cl) value for the optimized geometry is 0.78, which is an improvement in Cl over the validation design.

Keyword: - Tubercles, NACA 0021, Amplitude, Wavelength Ratio, Humpback Whale.

Article ID: ICAMAE-2023-5-11

COMPUTATIONAL STUDY ON EFFECT OF FREE STREAM TURBULENCE ON BIO-INSPIRED CORRUGATED AIRFOIL

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ABSTRACT

Nature inspires mankind to do innovation by mimicking. The idea stemmed from the nature has led to remarkable discoveries and innovation. The tiny dragonflies with their superlative flight skills have gathered considerable interest and motivation from research community. Most of the research undertaken on dragonfly corrugated airfoil neglected the effect of free stream turbulence on corrugated pattern, which the dragonfly would encounter during flight. Therefore, the present study aims to conduct numerical investigation on the corrugated airfoil present in the midsection of dragonfly forewing (Aeshna cyanea) to understand the aerodynamic effects of free stream turbulence. 2-dimensional cross section of corrugated profile of dragonfly along wing chord is considered in understanding effect of free stream turbulence by presenting the aerodynamic performance characteristics.

Computational analysis, where Spalart-Allmaras Turbulence model with necessary boundary conditions were implemented. Here, the turbulence intensity varied from 1% to 6% at Reynolds number~10000, having a chord length of 0.081m. It is found that turbulent intensity decreases the aerodynamic efficiency of the corrugated wing at zero angle of attack.

Keyword: - Corrugated airfoil, free stream turbulence intensity, low Reynolds number aerodynamics, micro aerial vehicles.

Article ID: ICAMAE-2023-5-12

NUMERICAL SIMULATION OF RBCC INLET AT SCRAMJET MODE MACH 5 USING RAMP SHAPED MICRO VORTEX GENERATOR

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ABSTRACT

In this paper, the scramjet mode of a dual duct Rocket Based Combined Cycle (RBCC) inlet of a definite geometry is optimised by reducing the adverse effects of boundary layer separation. Numerical simulation of the geometry is done to improve the inlet performance by increasing the pressure recovery using ramp micro vortex generator. The scramjet mode is simulated using ANSYS Fluent at Mach number 5. Aiming for higher pressure recovery at the exit this paper proposes the use of MVG. Effect of two ramp vortex generators at a distance is observed and compared with the other two cases of no ramp vortex generator and one vortex generator placed at distance from the leading edge of the ramp.

Keyword: - Hypersonic, RBCC, Scramjet, Micro vortex generator, Engine inlet, Supersonic, Ramp

Article ID: ICAMAE-2023-5-13

COMPUTATIONAL STUDY OF THE SHOCK WAVE BOUNDARY LAYER INTERACTION INDUCED SEPARATION BUBBLE IN SCRAMJET ENGINE INTAKE.

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ABSTRACT

This paper gives the preliminary computational report of the Separation Bubble created due to the Shock Wave Boundary Layer Interaction in the scramjet engine intake without the use of variable geometry. In scramjet engine intake, the three successive shocks have been created by using three ramps which is designed idealistically by using the semi wedge angles such that all three shocks will converge and impinge on the cowl lip. 2 Dimensional, Reynolds-Averaged Navier-Stokes equation is incorporated for the computational studies at different Mach Numbers and found that at various Mach No. the formation of separation bubbles at cowl of the inlet, its size and the location at the cowl varies. At higher Mach No., i.e., at M above 8 it is found that, the designed scramjet engine inlet there is a challenge in starting i.e. The engine remains unstart

as the impinging shocks hitting deep inside the inlet throat instead of the leading edge of the lower cowl lip and at M=4,5,7 the designed scramjet engine works as desired, but that the same time at M=4,5 the size of the separation bubble will also increase, at M=7 the size of the separation bubble shrinks when compared to previous criteria as the position of impinging shocks hitting the leading edge of the lower cowl lip of the inlet varies, the above criteria play an important role in formation of separation bubble as well as to make the engine remain started. It is discussed that at different Mach how the modified inlet design responds and the separation bubble induced due to shock wave boundary layer interaction.

Keyword: - Scramjet, SWBLI, SB, Mach No., Separation Bubble, Shock Wave Boundary Layer Interaction

Article ID: ICAMAE-2023-5-14

EVOLUTION OF AIRCRAFT SURFACE DEFECT DETECTION WITH ADVANCED LEARNING

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ABSTRACT

Meticulously detecting surface defects is of paramount importance to ensure the safety and reliability of aircraft. The examination of aircraft surfaces, known for its complexity and the need for specialized knowledge, has undergone a significant transformation with the introduction of deep learning methods. This research paper presents a review focusing on the application of Deep learning (DL)Models such as CNN, YOLO, GAN etc. for detecting defects in aircraft surfaces, marking the first comprehensive examination of this burgeoning field. The review scrutinizes a twenty-one primary studies, encompassing methodological approaches and conceptual groundwork. The study also covers major use cases and discusses their significance in enhancing the defect detection for aircraft surface. The results of this comprehensive review underscore the potential of deep learn-ing in enhancing the accuracy

and efficiency of visual inspection, particularly in detecting defects on aircraft surfaces. This research provides a comprehensive compilation of use cases for the application of computer vision and deep neural networks within the aviation industry, accompanied by a technology readiness level assessment. The compelling outcomes of this research endeavor underscore the urgency of continued exploration into deep learning techniques for the detec-tion of surface defects in aircraft. These insights propel the aviation industry to-ward safer and more efficient aircraft inspection practices

Keywords: Aircraft Surface Defect Detection, Computer vision, Deep learning, Use cases

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IMPACT OF SWIRL RECOVERY VANES ON A SINGLE ROTATING PROPELLER UNDER TRANSONIC CONDITIONS

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ABSTRACT

The objective of this study is to evaluate the influence of swirl recovery vanes (SRVs) on the efficiency of a propeller during cruising conditions at an elevation of 35,000 feet. A numerical investigation was conducted in order to enhance the propulsive efficiency of a rotor and rotor-stator configuration. The main goal of the vanes is to efficiently capture and restore the rotational motion found in the slipstream of the rotor. The positioning of the vanes is at the downstream of the rotor, and the augmentation of thrust is accomplished by optimising the distribution of stator twist. The results acquired in the wind tunnel test was subjected to cross-validation by comparing it with the primary flow effects of the rotor using ANSYS CFX. This experiment was specifically focused on the utilisation of an isolated transonic rotor. The results of computational study using the stable Reynolds-Averaged Navier-Stokes (RANS)

method showed that adding vanes to a propeller-based model reduced swirl by a large amount, which improved propelling efficiency and could lead to gains of up to 8%. One notable outcome resulting from the utilisation of the swirl recovery vane is the consistent distribution of torque between the propeller and the swirl vanes throughout the extent of operational circumstances, particularly when considering the chosen vane angle. The fundamental objective of swirl recovery vanes is to recuperate a portion of the rotational kinetic energy or swirl that exists in the slipstream of a propeller, leading to greater thrust and enhanced efficiency.

Keywords: - Propeller, SRV, Thrust Coefficient, Power Coefficient, Efficiency, Transonic.

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ADVANCEMENTS IN VIMANA TECHNOLOGY: A COMPREHENSIVE ANALYSIS OF DESIGN, DEVELOPMENT, AND APPLICATIONS

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ABSTRACT

Vimanas are mythical flying machines described in ancient Hindu Vedas. They are said to possess advanced capabilities such as the ability to fly at high speeds, become invisible, and travel into space. The concept of Vimanas has captivated scholars and enthusiasts for centuries, inspiring various interpretations and theories about their meaning and function. This paper provides an overview of the history and mythology of Vimanas, exploring their cultural significance and examining the various theories surrounding their existence. It also discusses the challenges of studying Vimanas, given the lack of concrete evidence or scientific data. The paper draws on a range of sources, including ancient texts, archaeological discoveries, and modern interpretations, to provide a comprehensive overview of the phenomenon of Vimanas. It examines the different types of Vimanas described in the texts, their alleged

capabilities, and their potential role in ancient Indian society. Overall, this paper aims to contribute to the ongoing research surrounding Vimanas, shedding light on their cultural significance and examining the ways in which they have captured the imaginations of people throughout history.

Keywords: Vimanas, Vaimanika Shastra, ancient vehicle.

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A BRIEF STUDY OF WING MORPHING: REVIEW

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ABSTRACT

The advancement in Technology demands an improvement from already existing aircraft. There are various methods of improving the performance of an aircraft. The research conducted in past decades has been fruitful in terms of aerodynamics, structure, and performance parameters of aircraft. Various techniques have been developed in the history of aviation for improving the aircraft's performance parameters. One such technique that has been in the aviation industry since the time of the first confirmed flight of an aircraft is evolving and changing wing shape according to required flight conditions. This method is known as Wing Morphing. Wing morphing is a promising tool that helps in altering aerodynamic performance and improves the efficiency of an aircraft. The aim of this review article is to present previous research conducted on wing morphing, its applications, limitations, and advantages. Wing Morphing is mainly categorized into three methods such as Wing Platform, Out of Plane, and

Airfoil morphing method. Each one of these methods of morphing is discussed based on their position on the aircraft's wing. Each one of the morphing methods has an idea to improve the aircraft's performance. Also, how these methods can be used to replace active control devices of an actual aircraft is discussed.

Keywords: Wing Morphing, Morphing Techniques, Aircraft Performance Parameters, Flight Conditions, Aerodynamic performance.

Article ID: ICAMAE-2023-5-18

LIFE ESTIMATIONS OF LEADING-EDGE VORTEX CONTROLLER ASSEMBLY BASED ON MEASURED VIBRATION TEST DATA USING RANDOM VIBRATION ANALYSIS APPROACH.

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ABSTRACT

Levcon (Leading Edge Vortex Controller) is a deflectable aerodynamic control surface in wing apex region to reduce the approach speed of the naval aircraft for carrier landing. The present paper gives the fatigue life cycles estimation of the control surface assembly parts and the maximum level of vibration limit allowed for the mechanical components based on fatigue life considerations. To obtain the vibration level limits, and fatigue cycles, random vibration analysis approach using Msc-Nastran has been carried out with accurate measured acceleration power spectral density (PSD) data from ground high speed taxi trials. And the maximum stress response in the levcon assembly parts are calculated for fatigue life cycle calculations and to set the limits of maximum vibration levels in terms of Grms. The same methodology used for fatigue

calculations of landing gear door assembly parts for a typical fighter aircraft

Key words: Random Vibration Analysis, Transient Response Analysis, Levcon, Power Spectral Density, Finite Element Model, Transient Response Analysis, Door Assembly

Article ID: ICAMAE-2023-5-19

DESIGN OF HEATER CIRCUIT FOR 8S1P LITHIUM-ION BATTERY PACK FOR NANOSATELLITE APPLICATION

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ABSTRACT

An Electric power system is the heart for the nanosatellite which provides the power to the entire subsystems of satellite to achieve the mission. In an electric power system, the battery cells play a crucial role in providing the power to the subsystems of nanosatellite during eclipse period. The working of lithium-ion batteries at cold temperature about less than +5OC will affect the performance and reduces the lifetime of the battery cells. To maintain the operating temperature of lithium-ion battery cells, the design and development of heater circuit plays a key role. In this paper, the heater circuit is designed to maintain the temperature of 8S1P battery pack between +50C to +100C especially during the eclipse period. In addition,

the behaviour of battery pack voltage is monitored during the sun and eclipse period where the battery cells experience the hot and cold temperature conditions.

Keyword: - Battery cells, CubeSat, Electric power system, heater circuit, temperature.

Article ID: ICAMAE-2023-5-20

ENHANCING ACCURACY AND EFFICIENCY IN DETECTING AIRCRAFT SURFACE DENTS AND SCRATCHES THROUGH CNN AND QCNN ALGORITHM

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ABSTRACT

This is to introduce an innovative approach to address a critical challenge in the aviation industry the swift and precise detection and classification of dents on aircraft surfaces. The problem at hand is characterized by the need for automated inspection methods that surpass the limitations of manual assessments, leading to enhanced safety and operational efficiency. The proposed solution offers a two-tiered strategy: Convolutional Neural Networks (CNNs): Leveraging advanced deep learning techniques, CNNs are employed to analyze aircraft surface images. These networks excel in identifying regions of interest (ROIs) that may harbor dents, serving as an efficient initial screening

tool. Quantum Convolutional Neural Networks (QCNNs): At the forefront of quantum computing, QCNNs are integrated to explore the quantum realm for enhanced feature extraction within identified ROIs. Quantum circuits delve into the intricate nuances of dent patterns, elevating detection precision. The multi-faceted challenges encompass dataset curation, model training, quantum computing resource utilization, and real-time dent identification. Success in this endeavor holds the promise of revolutionizing aviation safety and maintenance practices. The fusion of CNNs and QCNNs not only offers the potential to expedite dent detection but also positions quantum computing as a transformative force in defect recognition across safety-critical domains.

Keywords: Convolutional Neural Networks (CNNs), Quantum Convolutional Neural Networks (QCNNs), dent detection, aviation safety, quantum computing, image analysis.

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ARTIFICIAL INTELLIGENT BASED SPACE TRAVEL TO TRACK THE MOTION OF ARTIFICIAL BODIES AND HUMAN HEALTH MONITORING USING AUGMENTED REALITY

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ABSTRACT

Augmented Reality Perceives the virtual functionality that anchors the real-world entities to make it possible for the simple calibration of most complex functions. Here different areas have been focused on Artificial Bodies such as satellites, space cameras, vehicles, etc, monitoring human mental health, military, gaming, education, entertainment, visual effects, and designing new product launches, training, remote assistance, etc. Due to the digitalization and quick proliferation of new digitized technologies, Artificial Intelligence has made it possible with utility agent methodology. Here with the different techniques of AI, we ensure new tools for the knowledge transfer in our environment which ensures 100% efficiency using the effects of Augmented Reality. In the Digital world,

people use automation and prediction using the Internet of Things, Machine Learning Algorithms, and Deep Learning methodologies to make it possible to detect objects in Artificial bodies and to monitor health care of human interface using AR techniques. With the sources of Training and testing datasets using machine learning algorithms, we can predict and identify objects using computer vision and web modules used in AI-based Tools. Recent studies depict the features of interactive learning and its uses in education, home automation, AR and its popular corporates such as Google Glass, Microsoft Holo lens, Binocular HMD, Data Gloves, and Magnetic Tracker used to collect information and process the information using Lookup Global Pose, virtual Scene fusion, and place recognition to process modules used in AI which were tracked. High-level aspiring corporates and continuous experimentation make it successful in its development and it has been garnered. Here we use the Probabilistic View Invariant Pose Embedding Technique used to detect the movement of Artificial Bodies and the change in health monitoring by training and testing modules in AI algorithms.

Keyword: - augmented reality, artificial intelligence, deep learning, space travel, artificial bodies.

Article ID: ICAMAE-2023-5-22

ASSESSING THE GROWING THREAT: A COMPREHENSIVE STUDY OF SPACE DEBRIS

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ABSTRACT

Space exploration has significantly advanced our understanding of the universe, but it has also given rise to a formidable challenge - space debris. With the proliferation of space missions, the accumulation of space debris has emerged as a significant threat to both operational satellites and the broader domain of space exploration. This paper delves into the implications of space debris on space exploration, examines historical incidents illustrating the consequences of space collisions, and evaluates current solutions while introducing innovative approaches for mitigating space debris. The primary objective of this research is to conduct a comprehensive analysis of the space debris issue and its extensive ramifications for space exploration. By exploring past incidents and inspecting existing solutions, and to find places that need improvement and come up with new ways

to deal with this urgent problem. The surge in space debris is intrinsically linked to the increase in space missions. Present solutions, including Tentacles, Mono robotic arm, Muti robotic arm, Net capture, Tether gripper, Harpoon, drag argumentation, Electrodynamic Tether, Contactless and Contact Removal methods are discussed. In conclusion, space debris poses a critical challenge for space exploration, highlighted by historical incidents and the growing quantity of orbital debris. Addressing space debris conundrum is pivotal for ensuring the safety and sustainability of future space missions and endeavors.

Keywords: Space debris, Ramifications, Historical incidents, Comprehensive analysis, Mitigating space debris, Future space missions.

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EXPERIMENTAL EVALUATION OF BORON-TITANIUM-BASED SOLID FUEL USING A LAB-SCALE DUCTED ROCKET MOTOR

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ABSTRACT

Boron has gained renewed interest for its exceptional heating values at both gravimetric and volumetric levels. It is the second-highest energetic metalloid fuel in the periodic table. However, its efficient combustion is hindered by B_2O_3 formation around the active boron particles. It has been found that boron-based solid fuel has lots of potential for solid fuel ramjets (SFRJ) and solid fuel-ducted rockets (SFDR). The current investigation uses a hybrid fuel-ducted rocket (HFDR) that operates on gaseous oxygen. Titanium nanoparticles are used as a boron combustion enhancer when they are combined with a boron and paraffin wax mixture. Paraffin wax serves as both a fuel and a binder for boron and titanium particles. For the testing of diverse samples, a unique LabView program was created to

regulate firing time and total oxygen flow time. In the present study, the combustion performance of three distinct solid fuel samples, including pure paraffin wax, paraffin wax loaded with boron particles, and paraffin wax loaded with boron and titanium particles, was investigated experimentally. The combustion performance is studied based on the regression rate of various solid fuel combinations at an oxygen mass flux of 302.6 kg/m^{2}s. When boron burns produce green emissions in the flame, the green colour is observed in the rocket exhaust, which is recorded by a DSLR camera as well. Material characterization techniques such as FE-SEM, XRD, and TGA are applied to as-received boron and titanium particles. The unburned solid fuel grain recovered from the primary combustion chamber is analysed using a normal X-ray to visualise the post-combustion port diameter. The energy produced by paraffin wax and boron-based solid fuel combinations is intended to reveal a variety of combustion-related facts for the boron particles and the current ducted rocket engine design.

Keyword: Rocket engine design, fuel-ducted rockets, solid fuels, titanium nanoparticles

Article ID: ICAMAE-2023-5-24

COMPARATIVE ASSESSMENT OF NUMERICAL MODELS FOR THE SIMULATION OF THERMOVIBRATIONAL-DRIVEN SOLID PARTICLE ACCUMULATION PHENOMENA IN MICROGRAVITY CONDITIONS

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ABSTRACT

Considering the recent theoretical discovery and confirmation by means of space experiments on board the International Space Station of solid particle self-organization phenomena driven by the joint application of vibrations and a temperature difference to a liquid, this study is devoted to a critical assessment of the numerical strategies to be used to reproduce with a good level of success and fidelity such experimental findings and improve our understanding of the related cause-and-effect relationships. Accordingly, a diversity of model types, ranging from simple to complex, in which various effects are selectively included or excluded, are used, and the results carefully diagnosed against the experimental evidence. The considered

liquid is ethanol, while the dispersed particles are made of glass and display different size and density according to the considered experimental run. Gravity is absent and vibrations with different amplitudes and frequency are imposed. Two different computational platforms are considered for the ensuing numerical analysis, i.e. ANSYS Fluent and OpenFoam. Both are equipped with Eulerian-Lagrangian solvers where different levels of coupling between the involved fluid and solid phases can be selected. For ANSYS Fluent these are the Discrete Particle Modelling (DPM), i.e. a standard two-way coupled approach and the Dense Discrete Particle Modelling (DDPM) where in addition to the localized exchange of momentum between the two phases, the inter-particles stresses are also somehow taken into account. Similar options are also available in OpenFOAM. We show that the agreement between the numerical and experimental findings depends significantly on the level of coupling and (especially) the ability of the solver to capture properly particle mutual-interference effects.

Keywords: Discrete Particle Modeling, OpenFOAM, Fluent, Space Station

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THE APPLICATION OF SYMMETRICAL MOTORIZED MOMENTUM EXCHANGE TETHERS FOR TWO-WAY EARTH-MARS TRANSPORTATION

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ABSTRACT

This paper presents a novel strategy for the use of symmetrical motorised momentum exchange tethers for a two-way continuous payload transfer system between Earth and Mars. Symmetrical tethers do not necessarily deorbit on payload capture and release because there is no change in the geometrical location of the centre of mass when in operation. A novel strategy is proposed requiring two tethers, whereby one rotates prograde and the other retrograde, and two dummy payloads in suitable parking orbits around each planet to provide overall mass balance. Two additional outrigger payloads are tethered to the stator side of the central drive motor facility to provide a counter inertia against which the primary propulsion side rotates. If the two sides of the motor facility are reasonably balanced, they will contra-rotate effectively, facilitating spin-up of the tether and

reset to desired initial conditions for subsequent phases. A methodology has been developed to calculate the orbits of the tethers and the dummy payloads around Earth and Mars, and a drag perturbation analysis has been carried out on selected sets of results to determine the orbit decay. Finally, some major failure scenarios are discussed and some recovery options are proposed.

Keyword: - Motorised tethers, symmetry, momentum exchange, two-way interplanetary propulsion.

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EFFECT OF VERTICAL AND HORIZONTAL VIBRATIONS, VESSEL SIZE AND LAYER HEIGHT ON THE FLUIDIZATION OF LUNAR REGOLITH

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ABSTRACT

With the considerable current focus on the further exploration and eventual habitation of the Moon and Mars, it has never been more important to further the understanding of how to manipulate the resources abundantly available on these planets. Along these lines, this project aims to develop novel ways of handling the regolith that makes up the lunar soil by use of "vibrations". The final objective is the definition and validation of a new approach to overcome well-known drawbacks related to these materials, typically induced by their extremely abrasive and reactive nature (which make their manipulation and transport particularly difficult, especially in the lunar environment). By applying vibrations with various orientations to small samples of lunar regolith simulant, this granular

material can be forced to display a fluid-like convective behavior, forming structures such as self-sustaining heaps. The effect that varying the height of the bed of simulant has on the mode and rate of convection exhibited by the material is investigated coupled with an assessment of the effect of the size of the related vessel. Some recent experimental findings are critically discussed in relation to the resulting (enhanced) ability to manipulate and transport lunar regolith.

Keywords: Granular Material, Vertical Vibration, Lunar Regolith

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