

IEI

EPITOME

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In this issue

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Certificate of **Grant Innovation Patent** was granted to Shri Rohit Kumar by **Australian Government** on 'An Investigation into the Friction Stir Welding of Aluminum Pipe with Stainless Steel Plate'.

Patent Number : 2021100894

Title : An Investigation into the Friction Stir Welding of Aluminum Pipe with Stainless Steel

Patent Application Type : Innovation

Date of Grant of Patent : 12 May 2021

Inventors : Upendra Rajak, Rohit Kumar, Pradeep Muley, Shobha Lata Sinha, Prerana Nashine, Gaurav Dwivedi, Thokchom Subhaschandra Singh, Sakendra Kumar, Prem Kumar Chaurasiya, Tulala Raja Santosh Kumar

Application Status : Granted



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Re-elected as **Chairman** of **Chartered Engineers Pacific (CEP)** for the fourth consecutive year during the AGM held on February 16, 2022. CEP is a group of almost a thousand internationally trained engineers who reside in British Columbia, Washington State, Alaska and the Yukon. CEP's members are the local members of five UK based engineering institutions — Institution of Civil Engineers, Institution of Engineering & Technology, Institution of Mechanical Engineers, Institution of Structural Engineers, and Chartered Institution of Building Services Engineers.



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Received **University Medal** in March 2022 from Jadavpur University, Kolkata for standing **First** at the **Master of Construction Engineering Examination 2021** and stood **Second** in **2nd National Engineering Olympiad Examination** organised by ASSOCHAM National Council on Education in February 2022.

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Book

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FIBER OPTICS & AVIATION: INTEGRATION

This is the first book in our country describing the utilization of fiber optics technology in aviation. As on today almost all new generation aircrafts are installed with some fiber optics systems and/or fiber optics sensors. This book gives all the latest advances taking place in aviation as far as fiber optics technology is concerned. As of today, no IIT / university / engineering college of aviation branch (Aeronautical Engineering) syllabus is having this latest technology included in their subject, hence this is the right time to include this subject as a compulsory subject for students so that they are fully aware of this new technology incorporated in all-new generation aircraft.

Practitioners and Students may use this book “**Fiber Optics & Aviation: Integration**” as a postscript to my earlier written book “**Fiber Optics Fundamentals and Advances in Optical Communications**” for better and intended understanding.

Both books are available at Blue rose, Amazon, and Flipkart, and e-books (colored) are available at Google Books and Scribd.com

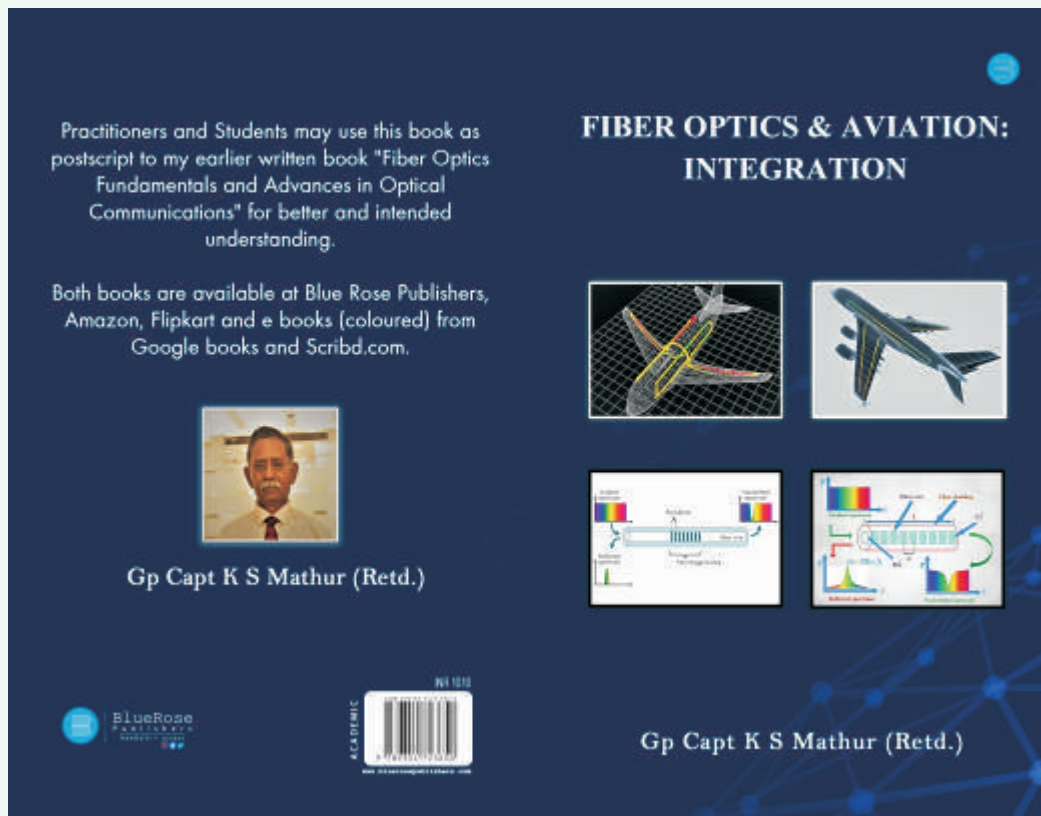
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Publication by Members

Book Chapters

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Cutting Force Assessment in HSM of Inconel 718 Aided with Water Vapour as an Eco-friendly Cutting Fluid

Recent Advances in Manufacturing Processes and Systems, Lecture Notes in Mechanical Engineering, Springer, Singapore, Dave, HK, Dixit, US, Nedelcu, D (eds), 2022, pp 243-251, ISBN: 978-981-16-7787-8

DOI: https://doi.org/10.1007/978-981-16-7787-8_17

Co-author: Raju S Pawade

Abstract: The need to comply for higher production rate with desired quality but with incorporating green manufacturing practices has been continually pressurising the manufacturers. This can be partially achieved by employing high-speed machining(HSM) using eco-friendly cutting fluids and keeping vigilant process control. In this context, the current paper examines machinability characteristics in turning of exotic super alloy Inconel 718 at high speed using coated carbide tools and eco-friendly cutting fluid being water vapour. Experiments have been performed following response surface methodology involving central composite design by varying three process parameters, viz. cutting speed, feed rate and water vapour pressure. A special tool holder having in-built fluid supply channel has been used as tooling for facilitating precise delivery of cutting fluid as water vapour onto machining zone. Measurement and analysis of the cutting forces were carried out as the same is one of the crucial indicators of process mechanics. Analysis showed that response surface quadratic model for cutting force is statistically significant. The feed rate, water vapour pressure as well as the interaction between feed rate and water vapour pressure was highly dominating factors influencing cutting force correspondingly having contributions of 19.64%, 20.97% and 40.03%, respectively. Increase in water vapour pressure was highly helpful towards lowering of cutting forces on account of better penetrability and performance of water vapour into machining zone. Overall usage of water vapour cutting fluid in feasible HSM parametric range may enable in achieving better surface integrity and higher tool life for machining Inconel718, thus fulfilling the requirements of higher productivity, better quality and green machining.

Keywords: Inconel 718, Water Vapour, HSM, Eco-friendly, Turning, Cutting Forces

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Effect of Water Distribution Network Pipes Size on Flow Rate of a House Connection and its Hydraulic Analysis

Advanced Modelling and Innovations in Water Resources Engineering, Lecture Notes in Civil Engineering, Springer, Singapore, 176, 2021, pp 257-263, Print ISBN: 978-981-16-4628-7, Online ISBN: 978-981-16-4629-4

DOI: https://doi.org/10.1007/978-981-16-4629-4_18

Co-author: C R Suribabu

Abstract: Supply of water from the distribution pipeline to the house service connection varies street to street due to variation of water pressure. It is commonly noticed that houses located near to the service tank or pumping station get more supply than the houses located far away from the source or at dead-end users despite the house service connection pipe diameter is being the same. Supply at the outlet point of house connection directly depends on the pressure available at that point. In general water distribution analysis, the demand in the particular street will be divided into two quantities after clubbing the demand estimated in the street and assigned as a nodal demand. So, the demand is fixed and for which analysis will be carried out using hydraulic simulation. But, actual supply to the house is difficult to ascertain in this method. In the present study, how to determine the actual supply to the house service connection point through a hydraulic simulation is illustrated using a sample network. The study illustrates how simulation can be done without fixing nodal demand in the hydraulic simulation engine for house service connection having intermittent water by treating it as open orifice and water is being collected directly in the sump. The result of the study depicts that the diameter of water distribution lines and loss of pressure head poses unequal distribution of water to the consumer. Further, the study reveals that equity of supply can be ensured unless the flow at the house service level is controlled

Keywords: House Service Connection, Hydraulic Simulation, Water Pressure

Publication by Members

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A Brief Review on the Performances of Two-Bladed and Three-Bladed H-Darrieus Rotors

Proceedings of the 3rd International Conference on Communication, Devices and Computing, Lecture Notes in Electrical Engineering, 851, 2022, pp 63-72, Online ISBN: 978-981-16-9154-6, Print ISBN: 978-981-16-9153-9

DOI: https://doi.org/10.1007/978-981-16-9154-6_7

Co-authors: Rocky Medda, Debjit Gope, Abhik Chakraborty, Nayan Debnath & Sangram Das

Abstract: In recent times, the demand for renewable energy has increased very rapidly. Among all the renewable energy sources, wind energy is one of the most reliable options due to its high energy generation and zero CO₂ outflows to the climate. Wind turbines are a type of device which produces energy from the wind. Wind turbines are primarily categorized into two types, horizontal axis wind turbines (HAWTs) and vertical axis wind turbines (VAWTs). HAWTs are popular to use commercially, but the development and research on the VAWTs are increasing gradually nowadays. In this present work, a brief review of the performances of two-bladed and three-bladed H-Darrieus rotors has been done considering different performance parameters like tip speed ratio, solidity, and power coefficient. It is seen that a two bladed H-Darrieus rotor having a NACA0018 profile with a solidity of 0.12, tip speed ratio (TSR) of 4.5 showed the optimum power coefficient compared to the other investigations of similar rotors. Again, for the three-bladed H-Darrieus rotor, the highest power coefficient is achieved by the LS-0413 blade at a TSR of four which is higher than the NACA0018 blade for the same rotor. This study deals with the research progress of two-bladed rotor and three-bladed H-Darrieus rotor which can be helpful for future researchers to further improve the designs and performances of the same.

Keywords: H-Darrieus Rotor, Power Coefficient, Tip Speed Ratio, Solidity, Wind Turbine

Performance Study of a Cambered Blade H-Rotor by CFD Analysis

Proceedings of the 3rd International Conference on Communication, Devices and Computing, Lecture Notes in Electrical Engineering, 851, 2022, pp 315-324, Online ISBN: 978-981-16-9154-6, Print ISBN: 978-981-16-9153-9

DOI: https://doi.org/10.1007/978-981-16-9154-6_30

Co-author: Dipankar Sarkar

Abstract: Vertical axis wind turbines (VAWTs) have performed well and delivered a prominent fortitude to harvest the energy from the complex wind condition; as because of it, the application and development are increased in the past few decades. This present study is conducted to analyze the performance of an unsymmetrical LS-0421 profile three-bladed H-rotor and then compared with a symmetrical S-1046 profile three-bladed H-rotor. At the solidity of 0.42, and at the low TSR range of 2.0–4.0, the LS-0421 rotor shows better performance. Between two different computational wind speeds (6 and 8 m/s) conditions, in 8 m/s condition, the H-rotor has obtained the highest CP of 0.41 at TSR 3.5. Additionally, this study has covered only the 2-dimensional computational simulation; there will be a bit different result in 3-dimensional simulation than this study result.

Keywords: Power Coefficient, Lift Coefficient, TSR, LS-0421, H-rotor

Publication by Members

Papers Published in the Journals

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Filter Bank Multicarrier Modulation Techniques for 5G and Beyond Wireless Communication Systems

European Journal of Electrical Engineering and Computer Science, 6(2), 2022, pp 18-24, ISSN: 2736-5751

DOI: <https://doi.org/10.24018/ejece.2022.6.2.423>

Abstract: Higher data rates, higher mobility, lower latency, and better quality of service are the prime requirements for future communication systems. It is expected to provide connectivity to the Internet of everything, time-sensitive/time engineered application, and service to high-fidelity holographic society. Its performance in terms of data rate, latency, synchronization, security, and reliability will be much better compared to 4G and 5G mobile communication systems. This paper investigates the performance of the pulse shaping-based filter bank multicarrier (FBMC) modulation technique used in 5G mobile communication systems. Simulation results show that the FBMC system has a better performance compared to the conventional orthogonal frequency division multiplexing (OFDM) system in terms of many parameters such as achievable channel capacity, signal to noise ratio, time, and frequency response, out of band leakage, etc.

Keywords: Division Multiplexing, Filter Bank Multicarrier, Modulation Technique, Novel Orthogonal Multiple Access Technique, Orthogonal Frequency, Spectrum Efficiency

Robot-Assisted Ultraviolet Disinfectant with Dispenser for Healthcare Related Services

European Journal of Electrical Engineering and Computer Science, 6(1), 2022, pp 1-5, ISSN: 2736-5751

DOI: <https://doi.org/10.24018/ejece.2022.6.1.383>

Co-authors: Sai Kumar, Boddu Devika & Kolluri Rahul

Abstract: Recently healthcare sector has attracted service robots to prevent the spread of infection. During COVID-19 pandemic, service robots have been able to reduce direct contact of front-line healthcare workers by separating them from direct exposure to infection. Robots have been used for delivery systems, disinfection of the exposed area, remote monitoring of patients, etc. In the present work, we have designed a disinfection robot that radiates ultraviolet C rays for UV sterilization of hospitals that kills 95.0% of bacteria within 20 second of exposure from a distance of 0.5 meter. UVC disinfection is more effective than disinfection by hydrogen peroxide, and with other chemical-based disinfectants like chlorine, chloramine, etc. Our designed robot can also be used as a dispenser in hospital delivery system for transporting medicine, laboratory samples, etc. Its use will not only increase logistics efficiency but will also avoid spread of Hospital Acquired Infections (HAIs), healthcare associated infections, eliminate human error, and allow health workers to engage themselves in their higher priority works.

Keywords: Disinfection Robot, Dispenser Robot, Healthcare Associated Infection, Hospital Acquired Infection, Ultraviolet Light

Internet of Things Enabled Intelligent and Smart Irrigation System

International Journal of Engineering Research and Applications (IJERA), 11(12)(1), 2021, pp 33-39, ISSN: 2248-9622

URL: <chrome-extension://efaidnbmninnbpcajpcgclefindmkaj/http://www.ijera.com/papers/vol11no12/Ser-1/E1112013339.pdf>

Co-authors: Mallela Sreeja & Peddineni Vyshnavi

Abstract: Internet of Things (IoT) has made irrigation of agriculture fields more smart, convenient and comfortable. It has enhanced yield quality by providing intelligence feature in the soil condition monitoring using plethora of sensors and actuators. IoT has enabled farmers to become more knowledgeable and has simplified their decision making process for the irrigation of their agriculture land. By Using IoT, agriculture fields can now be irrigated remotely and status of soil parameters can be monitored more precisely even when farmer is away from their agriculture fields. In this paper smart irrigation system using IoT has been implemented which can monitor soil temperature, moisture content and amount of rain water using different sensors. These parameters can be monitored remotely using Wi-Fi module and brought under control by switching on water pump motor with the help of required accessories. Implementation of this smart irrigation system has improved the quality of product apart from enhancing the productivity of the farm while providing comfort, convenience and information to the farmer.

Keywords: Internet of Things, Smart Irrigation, Water Utilization, Soil Monitoring, Intelligent Decision

Publication by Members

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Optical Emission Spectra Characterization of Plasma Discharge during the Processing of Milk and Evaluation of its Quality Attributes

IEEE Transactions on Plasma Science, 50(4), 2022, pp 1128-1136, Print ISSN: 0093-3813, Electronic ISSN: 1939-9375

DOI: 10.1109/TPS.2021.3140089

URL: <https://ieeexplore.ieee.org/document/9690090>

Co-authors: M Dharini & S Jaspin

Abstract: This study characterized the optical spectra of continuous low-pressure plasma system and evaluated its effect on milk processing. Plasma was characterized at different input power levels (24.8, 58.9, and 117.6 W which corresponds to the input voltage of 1, 1.5, and 2 kV) with a 1-cm electrode distance. Based on the characterization, the input power level 117.6 W was selected to produce maximum reactive species. The system was operated at 117.6 W to decontaminate milk flowing inside the quartz tube using three different milk flow rates 3, 6, and 9 mL/min (accounting for 5-, 2.5-, and 1-min plasma exposure time). The maximum reduction in total microbial count obtained after treatment was 1.2 log CFU/mL at an exposure time of 5 min (3-mL/min milk flow rate). Significant changes were observed in the physicochemical properties of milk after treatment. However, the only adverse effects observed were the viscosity and color of milk at 5- and 2.5-min treatment, which might be because of the use of unhomogenized milk. The continuous plasma system operated at 117.6 W reduced the microbial load in milk; further optimization of the process parameters is necessary for the complete elimination of microbial load and to increase the shelf life.

Keywords: Exposure Time, Microbial Reduction, Milk, Optical Emission Spectra, Physicochemical Properties, Plasma

Chlorpyrifos Pesticide Reduction in Soybean using Cold Plasma and Ozone Treatments

LWT - Food Science and Technology, 159, 2022, 113193, ISSN: 0023-6438

DOI: <https://doi.org/10.1016/j.lwt.2022.113193>

URL: <https://www.sciencedirect.com/science/article/pii/S0023643822001281>

Co-authors: R Anbarasan, S Jaspin, B Bhavadharini, Akash Pare & R Pandiselvam

Abstract: To meet market demands, soybean is predominantly grown with the excess use of harmful pesticides like chlorpyrifos, which leaves poisonous residues on the seeds' surfaces. In this study, we have treated chlorpyrifos (1, 2 and 3 mg/kg) infused soybean with ozone (300–550 mg/l) and low pressure (2 mbar) cold plasma (CP: 1.0–2.0 kV) for up to a period of 30 min to reduce the pesticide residues. However, it was found that at higher pesticide concentrations, ozone treatment can only cause 50% pesticide reduction after 30 min exposure, even at 550 mg/l concentration. In contrast, CP treatment took only 6 min to achieve the same at 2.0 kV voltage level but caused a significant reduction ($P \leq 0.05$) in moisture content and seed coat integrity. However, the water absorption of CP treated samples was higher (~230%) than ozone-treated samples (~200%). Furthermore, increased pesticide concentration reduced the pesticide degradation rate for ozone ($0.078 - 0.0643 \text{ min}^{-1}$) and cold plasma ($0.160 - 0.143 \text{ min}^{-1}$) treatments even at higher treatment intensities. Nevertheless, CP was effective against chlorpyrifos than ozone treatment and caused minor quality changes in soybeans.

Keywords: Ozone, Cold Plasma, Degradation Kinetics, Soybean, Chlorpyrifos

Human Taste-Perception: Brain Computer Interface (BCI) and its Application as an Engineering Tool for Taste-Driven Sensory Studies

Food Engineering Reviews, 2022

DOI: <https://doi.org/10.1007/s12393-022-09308-0>

Co-authors: R Anbarasan & Diego Gomez Carmona

Abstract: Sensory satisfaction is the key to consumer acceptance which also decides the success of any food products in the market. Though different sensory parameters like appearance, odor, and texture are considered for deciding the overall acceptability of food, taste plays a major role. As sensory panels cannot be a true representation of consumer's taste perception, industries focus on market surveys. In reality, consumers taste perception varies according to the product cost, brand, and their age and health condition. The process of food tasting starts from tongue, where different taste receptors respond to various taste stimuli and pass the signals to the cortex of the brain region. These signals cause the electric current to flow through the brain neural networks and increase oxygen-containing blood utilization in specific brain areas. Using non-invasive gadgets such as electroencephalography, magnetoencephalography, functional MRI, and brain computer interface (BCI) technique, these signals can be sensed and decoded into useful sensory data. This review explains the taste recognition pathways of different taste stimuli and the basic steps involved in BCI techniques for detecting and discriminating them. In addition, it also explores the BCI-related taste-driven sensory studies and the limiting factors associated with them to emerge as a future sensory method.

Keywords: Sensory, Taste, Brain-Computer Interface, Functional MRI, Electroencephalography, Magnetoencephalography

Publication by Members

Effect of Plasma Bubbling on Textural and Engineering Properties of Ready-to-Eat Pearl Millet Flakes and Puffs

IEEE Transactions on Plasma Science, 2022, pp 1-7, Print ISSN: 0093-3813, Electronic ISSN: 1939-9375

URL: <https://ieeexplore.ieee.org/document/9678103>

Co-author: R Lokeswari

Abstract: Ready-to-eat (RTE) millet grain flakes and puffs are gaining importance in the modern era because of their nutritional and health benefits. In this work, air plasma has been generated and bubbled into pearl millet during soaking, followed by analyzing its flaking and puffing characteristics. The voltage 180, 200, and 220 V with airflow rates of 10 and 12 lph for 1 and 2 h was exposed to treat pearl millet samples. An increase in conductivity, total soluble solids (TSS), and drop in pH of the soaked medium was observed with the bubbling of plasma. The plasma bubbling exhibited an improvement in the pearl millet's flaking and puffing properties. The noteworthy changes ($P < 0.05$) in expansion volume, bulk density, color, moisture content, crispiness, and hardness were observed in flaked and puffed samples. An increase in the expansion ratio (ER) of pearl millet flakes and puffs from 4.2 to 8.3 and 4.9 to 9.5 decreases in bulk density of flakes and puffs from 0.36 to 0.11 and 0.14 to 0.06 kg/m³, respectively, was noticed with the plasma bubbling. The textural properties like the crispiness of the flakes and puffs elevated, and hardness was reduced with the given treatments. The decrement in yellowness index (YI) and increase in whiteness index (WI) was observed in both flaked and puffed samples with the rise in exposure time. The synergistic effect of plasma reactive species in combination with hydration aids in improving grain properties and helps in diversifying the utilization of millet grains.

Keywords: Expansion Volume, Flaking, Pearl Millet, Plasma Bubbling, Puffing

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Computational Analysis of Influence of Particle Size, Oxygen Concentration and Furnace Temperature on the Ignition Characteristics of Pulverized High Ash and High Moisture Coal Particle

Alexandria Engineering Journal, 61(8), 2022, pp 6169-6180

DOI: <https://doi.org/10.1016/j.aej.2021.11.047>

Co-authors: Anand Shankar Singh, V Mahendra Reddy, Ahmed Elwardany & Hemachandra Reddy

Abstract: Energy is a critical component in any given region's growth. India has the world's fourth- largest coal reserves. Therefore, energy generation coal-based power plants is still a significant source of power in the country. However, the performance of Indian coals is poor compared to foreign coals such as South African, Indonesian, and US coals due to the high ash and moisture content. Seventy percent of country electricity need is still dependent on coal power even with known negative environmental consequences such as the production of CO₂ & greenhouse gases, and air pollution caused by SO_x, NO_x, coal sludge, coal dust, and by-products of coal combustion. In this work, effect of coal types, particle sizes, and furnace temperatures on the ignition delay time of pulverized coal particle is investigated. In the current study, the ignition delay time of four Indian coals (IS1, IS2, IS3, and IS4), two Indonesian coals (IAS1 and IAS2), and one South African coal (SA1) were examined for particle sizes ranging from 35 to 115 μm, furnace temperature ranging from 1000 to 1700 K, and oxygen concentrations ranging from 12 to 20% in gas. Furthermore, ignition delay analysis of different coal mixtures (Indian and foreign coals mixtures) has also been studied. Numerical analysis of ignition delay time has been performed using MATLAB. Results show that the ignition delay time of coal particles increases with a decrease in furnace temperature and an increase in particle size. Results also show that the Indian coals have a larger ignition delay time than other considered coals, and ignition characteristics of Indian coals can be enhanced by mixing with high-grade ones. An increase in oxygen concentration also reduces the ignition delay time of the coals.

Keywords: Coal, Ash, Moisture, Ignition Delay, Devolatilization, Oxy-fuel Combustion

Publication by Members

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A Pseudo-random Pixel Mapping with Weighted Mesh Graph Approach for Reversible Data Hiding in Encrypted Image

Multimedia Tools and Applications, 2022

DOI: <https://doi.org/10.1007/s11042-022-12350-z>

Co-authors: Shaiju Panchikkil & Yu-Dong Zhang

Abstract: In recent years, reversible data hiding (RDH) in encrypted images got much attention due to its wide applications in the areas such as cloud computing, military image transmission, medical image transmission, etc. This paper introduces a new solution for reversible data hiding in encrypted images. One of the main challenges while designing a reversible data hiding scheme in an encrypted image is the embedding rate and bit error rate during image recovery. The scheme proposed in this manuscript ensures a good embedding rate and the lossless recovery of the original image. The key idea behind the proposed technique is that the encrypted image will be partitioned into non-overlapping blocks, and the pixels in each block will be categorized into white pixels and black pixels based on a predefined pattern. The black pixels will be mapped into a new pixel value based on the two bits from the secret message that is to be embedded into the selected image block. For mapping purposes, we generate four different random permutations of all the possible gray-scale values (0 to 255). At the receiver side, corresponding to each block in the image we have to generate four different weighted mesh graphs. The image recovery and data extraction are carried out by analyzing the total edge weight of these mesh graphs. The results obtained from the experimental study are much better while comparing with a few of the well-known recently introduced reversible data hiding schemes in encrypted images.

Keywords: Image Encryption, Random Permutation, Reversible Data Hiding, Weighted Mesh Graph, Smoothness Measure

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Performance Investigation of Cavity Shaped Blade on H-Darrieus Wind Turbine in Built Environmental Condition

Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 2022

DOI: <https://doi.org/10.1080/15567036.2022.2038311>

Co-authors: Yogesh Kumar, Agnimitra Biswas & Rajat Gupta

Abstract: This present investigation is carried out to improve the performance of H-Darrieus wind turbine in the built environment, where it mostly experiences low wind speed. Here the effect of circular cavity on aerodynamic performance of the rotor is investigated using a subsonic wind tunnel test facility to check which side cavity on the airfoil (inner or outer side) is beneficial in terms of the rotor's static and dynamic performances. For this, S1046 and NACA 0021 airfoil blades are considered at various low wind speeds of 5, 6 and 7 m/s for different rotor aspect ratios. A Computational Fluid Dynamics (CFD) study is also simultaneously conducted to realize the intrinsic flow physics of the cavity airfoil blade profile. Results show that inner surface cavity on both the blades improves their self-starting ability but only at 5 m/s wind speed, which is not so when wind speed is 7 m/s at which NACA 0021 blade without cavity performs better. Again, NACA 0021 blade without cavity exhibits the highest performance of all the considered blade shapes, for which the highest power coefficient of 0.15 is achieved at a tip speed ratio of 1.25 and wind speed 6 m/s. At wind speed 7 m/s, the NACA 0021 blade rotor having outside cavity has a lower maximum power coefficient but wider operating range than that of NACA 0021 blade without cavity. CFD results show that H-Darrieus rotor having NACA 0021 blades at 30° azimuthal angle with circular cavity at 1/4th chord distance from its leading edge located at its inner surface, can generate higher lift force. However, circular cavity will be useful for starting performance of H-Darrieus rotor, which is not so for its dynamic performance, although operating range is improved.

Keywords: H-Darrieus Rotor, Cavity Blade, Torque Coefficient, Power Coefficient, CFD

Publication by Members

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Numerical Study on Fire Resistance Behavior of EPS Sandwich Panels

Materials Today: Proceedings, 2022, ISSN:2214-7853

DOI: <https://doi.org/10.1016/j.matpr.2022.01.319>

URL: <https://www.sciencedirect.com/science/article/pii/S2214785322003480>

Co-authors: Dibya Jyoti Basu & Debasish Bandyopadhyay

Abstract: A low-cost, energy-efficient earthquake-resistant building system appears to be an alternative solution for India's critically needed affordable housing. Insulating Building Sandwich Panel (IBSP) is a high-tech pre-fabricated building system, which consists of expanded polystyrene (EPS) insulation core confined by pressurized in-site concrete reinforced with galvanized welded steel mesh at both side tied with shear connector. It has several advantages being energy efficient, low cost, greater seismic resistant features. However, performance of these IBSP against fire and resistance to bullet penetration are very important criteria to be ensured. Fires are becoming a growing hazard in built environment, particularly for mass housing. Thus, study of the fire resistance of these building systems is significantly important. The present paper aimed to numerical study of these IBSP under fire loading by developing a thermo-mechanical model of the sandwich panel adopting a transient heat-transfer analysis coupled with temperature-displacement analysis. Based on the heat transfer analysis, the cross-sectional temperature gradient of the panel is evaluated. Subsequently, the increased temperature causes in stress redistribution, which may result in deterioration of strength, stiffness and the overall service life. The proposed study also looks at the variations in stress on material fiber caused by different fire exposure. It is observed that the changing non-linear cross-sectional temperature gradient during a fire event can cause adequate distress, which may lead to the formation of thermal cracks in the panel. A three-point bending test is used to record the distribution of stresses on different temperature zones. The ABAQUS software is used for the Finite Element Analysis (FEA) of these panel. It seems that the study of the fire resistance of EPS sandwich panel is quite significant considering the safety and durability of this alternative sustainable building construction for affordable housing.

Keywords: ABAQUS, Coupled Temperature-displacement Analysis, EPS Panel, FEA, Fire Resistance, Heat Transfer Analysis

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(xx) Supporting Documents/links [which are clearly indicative of the incumbent's achievement(s)]	
<i># publications in local seminar, conference and symposia will not be accounted</i>	

Nota BENE

FORMAT FOR PUBLICATION(S) BY MEMBERS — BOOKS/ BOOK CHAPTERS

A passport size
color photograph
(scanned image)

(i) Prefix (Er/Dr/Prof)	
(ii) First Name	
(iii) Middle Name (if any)	
(iv) Surname (Last Name)	
(v) Email and Mobile Number	
(vi) Designation	
(vii) Organization of affiliation	
(viii) Membership No (please use the prefix F/M/AM as the case may be)	
(ix) Title of Book	
(x) Title of Book Chapter	
(xi) Book Chapter Number	
(xii) Publisher Details	
(xiii) ISBN	
(xiv) Date of Publication (Date-Month-Year)	
(xv) Co-authors (if any)	
(xvi) About the book (100-150 words)	
(xvii) Supporting Documents (complimentary copies for IEI Headquarters)/links [which are clearly indicative of the incumbent's achievement(s)]	

** accommodate works published in journals/reputed conference proceedings/books for the last one year*

Notification for Advertisement in IEI Epitome

The Institution of Engineers (India) reserves a coveted privilege in being the largest multi-disciplinary professional body of engineers encompassing 15 engineering disciplines with a Corporate membership of over 2 lakhs maintaining a national/international presence through hundred twenty five Centres and six Overseas Chapters, Fora's and Organ (Engineering Staff College of India). The Institution has been disseminating the various information through IEI-Epitome and other publications.

We would like to share with you that we are now providing the facility to advertise engineering / technical products/services, information brochure, recruitment notices etc. in our official publication portal IEI Epitome (12 issues-140000 reach online). Besides, IEI Epitome is also uploaded on our website (www.ieindia.org) on a monthly basis and is accessible to all free of cost. Given its immense footprint in the engineering and technical diaspora spanning the globe, IEI with its distinguished heritage of a century provides you the ideal portal to connect with the National and International Engineering and Technical Community at very competitive rates. We invite you to take this unique and privileged opportunity to advertise and communicate your service and product portfolios under our prestigious banner and make us your brand emissaries in your promotional campaigns.

The booking form containing details of each publication, rates for the advertisements and the advertisement form are appended below.

BOOKING FORM

Publication	Description	Type	Rate (Rs.) including GST	Number of Issues / Volumes	Total (Rs.) including GST
IEI Epitome	Inside Full Page	Colour	30,000		
	Inside Half Page	Colour	15,000		
	Inside Quarter Page	Colour	8,000		
Less discount* @%					
Total Cost of Advertisement					
*5% discount for advertisement in 6 consecutive issues of IEI Epitome					
*10% discount for advertisement in 12 consecutive issues of IEI Epitome					
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Cheque / Draft No. Drawn on					
NEFT/RTGS/IMPS/Online Net Banking Transfer to IEI Account (please enclose the transaction slip generated):					
Transaction date: Name of Bank & Branch					
Transaction ID/UTR No./Payment Reference No. :					
Date:					
Mobile No.					
Email:					
GSTIN: Signature with seal					

Notification for Advertisement in IEI Epitome

Details required for Payment to IEI -- NEFT/RTGS

Sr No	Particulars	Details
1	Name and address of the Beneficiary	The Institution of Engineers (India) 8 Gokhale Road, Kolkata 700 020
2	Account Number of Beneficiary	005010100002704
3	Account Classification	SB
4	Name and address of the Bank Branch (where payments are to be sent by Applicant)	Axis Bank Ltd, Kolkata Main Branch, 7 Shakespeare Sarani, Kolkata 700 071
5	Branch Code	005
6	The 9 Digit MICR code of the Branch (as appearing on the MICR cheque)	700 211 002
7	IFSC Code of the Bank Branch for RTGS mode	UTIB0000005
8	IFSC Code of the Bank Branch for NEFT mode	UTIB0000005
9	Email ID of Beneficiary for advice of payment by Bank	technical@ieindia.org
10	PAN	AAATT3439Q
11	Name in PAN	The Institution of Engineers (India)
12	GSTIN	19AAATT3439Q1ZR
13	Service Tax Registration Number	AAATT3439QSD027

Notification for R&D Grant-in-Aid

To promote appropriate technology, assist in building up design & research talents and, most importantly, to help in nurturing potential R&D venture amongst engineering students pursuing Diploma/UG/PG/PhD courses, The Institution of Engineers (India) had instituted the R&D Grant-in-Aid program way back in 2001.

Like every year, the Institution invites applications for the session 2022-2023 for funding industry-oriented R&D projects and research initiatives aimed at improving the life-style of common people from engineering students pursuing full time Diploma/UG/PG/PhD engineering program in AICTE/UGC/NAAC approved Institutions/Colleges/Universities. The application form and guidelines are available in our website <https://www.ieindia.org>. The projects should be carried out under the guidance of faculty members who are Corporate Members of IEI. Membership criteria for student(s), guide(s) and Institution(s) are as follows:

Project Category	Student/Applicant Membership	Guide(s) Membership	Institutional Membership
1. Diploma	Exempted [Membership of Student Chapter is desirable]	AMIE/MIE/FIE	Not Mandatory
2. UG (BE/BTech/AMIE/Equivalent)	'Student Member' (SMIE)	AMIE/MIE/FIE	Applicant's Institute should preferably be an Institutional Member with NBA/NAAC Accreditation or valid NIRF Rank
3. PG (ME/MTech/Equivalent)	AMIE/MIE/FIE	MIE/FIE	Applicant's Institute should preferably be an Institutional Member with NBA/NAAC Accreditation or valid NIRF Rank
4. PhD	AMIE/MIE/FIE	MIE/FIE	Applicant's Institute should preferably be an Institutional Member with NBA/NAAC Accreditation or valid NIRF Rank

The soft copy of the duly filled-up applications (in editable format), as per the pro-forma available in our website www.ieindia.org, should be sent through email to research@ieindia.org and one printed copy of the same should reach the following address:

Director (Technical)
The Institution of Engineers (India)
8 Gokhale Road, Kolkata 700 020

Applications received in format other than that available on our website will not be accepted. Application should be forwarded through the Guide, Head of the Department or Head of the Institution. Please note that preference will be given to project proposals received from Institutions who are members of The Institution of Engineers (India) and with NBA / NAAC Accreditation or valid NIRF Rank. Kindly go through the guidelines (visit link <https://www.ieindia.org/webui/IEI-Activities.aspx#RnD-Initiative>) carefully before filling up the application.

The grant is not intended for the faculty members who have access to other avenues of research funding. Proposals received will be scrutinized and the recipients of R&D Grant will be informed accordingly.