International Conference on Mechanical & Civil Engineering

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Organized By

Department of Mechanical Engineering

Koneru Lakshmaiah Education Foundation, AP -522502

Good morning, all! "Thank You" is a prayer that cannot be seen or touched. It must be felt by the heart. I feel honored and privileged to get the opportunity to propose a vote of thanks on this special occasion.

I thank all the honorable delegates who blessed us with their presence. I am also very thankful to all Program Advisory Committee members and the invited speakers. Words are not enough to thank their constant guidance and support in shaping **International Conference on Mechanical & Civil Engineering**.

I am very thankful for our current and formal faculty colleagues and non-teaching staff members who always stand by and motivate us. I feel proud, and thank you for making this event successful.

President KLEF

Er.Koneru Satyanarayana

It has been our pleasure to host all the participants of **International Conference on Mechanical & Civil Engineering** at K L E F. The participants were very enthusiastic.

I am thankful to all the participants for coming to KL University to attend the conference. We have been fortunate to have some eminent persons from academia, industry, and utility working in Current Research Areas. I am sure that the participants must have benefitted by attending this conference. I am very much thankful to all the sponsors of this conference. Without their generous financial support, organizing this conference would not have been possible.

Vice-Chancellor

Dr.G.Pardha Saradhi Varma

A splendid evening finally comes to an end. On behalf of K L E F, I feel honored to thank all the dignitaries who have taken valuable time to make **International Conference on Mechanical & Civil Engineering** a grand success.

I am thankful to the steering committee members for giving us the opportunity.

I take this opportunity to thank all the reviewers and technical committee members for providing their valuable comments in time and helping improve the quality of the papers presented at the conference.

My Best Wishes to the Technical Committee, Publication Chair, HoD, research scholars and faculty, and staff members. I am also thankful to all who have helped us organize the conference.

Registrar(I/C)

Dr.A. Jagadeesh

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Comparative Study of Pressure Variations in Water Distribution Network Due to Change in Location of Elevated Service Reservoir

A.Aravindan

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Abstract: This paper compares the pressure variations in a water distribution system due to a change in the location of an elevated service reservoir with an intermittent type of supply for a continuously increasing demand. For this study Water Gems connect edition software is used for the design of a water distribution network. This study is conducted in the Eturnagaram habitation of Mulugu district. The Water Distribution Network is designed for 30 years with PVC as pipe material and intermittent type of supply. Further, this water distribution system is analyzed for pipe bursts and proposes a framework for the operation and maintenance of the water distribution network. This analysis is found that the initial or existing design is stimulated for extended period analysis or intermittent type of supply but this comparison states the network is not suitable for extended period analysis as more pressure will be on the network causing more damage and breakage to pipes. The existing network and the alternate network are not suitable for intermittent supply so provisions should be made for a continuous supply.

Keywords: Water distribution system, Water Gems, Pressure variations, Operation and maintenance, Pipe networking.

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The Study of Variation of PM10 Concentrations With Meteorological Conditions In Ambient Air

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Abstract: A review of the annual PM10 concentrations over 3 years showed the study area was subjected to severe particulate pollution. Meteorological data of Hyderabad city obtained from Central Pollution Control board (CPCB) at ICRSAT monitoring station. Investigations of daily PM10 concentration variation with the meteorological records were done it was identified that a unique aspect of the monsoon climate, changes in wind direction, and wind speed mainly governs the general trend of concentration of PM10 within each year. The results in this study are obtained by graphical representation of the collected data. PM10 concentrations show fluctuations concerning meteorological factors. An increase in relative humidity results in a corresponding decrease in PM10 concentrations. For the majority of the year, the winds blow from the south. The south-western winds which bring the monsoon greatly disperse the PM10 concentrations in the ambient air. Higher wind speeds also result in significantly reducing PM10 concentrations.

Keywords: Particulate matter; relative humidity; wind speed, wind direction; meteorological condition

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Bio-Gas production from different organic wastes

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Abstract: As our metropolitan zones seek after development and eat up enormous amounts of energy and produce monstrous measures of waste, we are confronted with the test of dealing with the present circumstance in a manner which is both capable and economical. One practical urban waste-to-energy technology is anaerobic digestion. Anaerobic absorption (AD) has been a useful fuel hotspot for more than 100 years and is of now being occupied with nations over the world in rustic territories to create electricity and heat, however it presently can't seem to make an enormous movement to the urban environment however it is a practical and mature process. Applied to the organic waste that is generated in the urban environments, anaerobic digestion could provide an evaluative solution to the increasing garbage problems while simultaneously decreasing external energy necessities. The cost of transporting waste outskirts of cities to landfills will keep on rising and if a considerable portion of this waste could be held, digested, reduced, and transformed into useable energy in the urban environment, then this is something to be seriously considered. The present paper is to investigate the practicality of power and energy generation through the use of anaerobic digestion of organic waste in the urban environment.

Keywords: Bio-Gas, Anaerobic digestion, organic waste, methanogenesis

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Removal of Nitrobenzene From Water Using Activated Carbon Prepared From Water Hyacinth

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Abstract: The prevailing study is of the adsorption efficiency of nitrobenzene onto the activated carbon prepared from the water hyacinth by phosphoric acid activation under the considerations of effect of pH (2,4,6,8,10 and 12) of nitrobenzene sample and consequence of initial concentration (20,100 and 200mg L-1) and contact time. The samples were analysed in high performance liquid chromatography (HPLC). The outcome shows that the change in pH of the nitrobenzene sample does not impact the adsorption capacity or adsorption rate. But whereas, the increase in original concentration of nitrobenzene has shown that the adsorption of nitrobenzene was rapid at initial stages and gradually increased with time till the stability is reached with the adsorption values of 19.3, 84.7 and 158.3 for initial concentrations of 20,100 and 200mg g-1 respectively. This study indicates that activated carbon formulated from water hyacinth is efficient for the removal of the nitrobenzene from the water.

Keywords: nitrobenzene, activated carbon, water hyacinth, adsorption

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Prediction Model for Significant Duration of Strong Motion in India

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Abstract: The duration of a ground motion has a bigger influence on the response of a structure. As a result, by accurately anticipating the duration of ground motion, the seismic design of structures can be controlled. As a result, the goal of this research is to develop a new prediction model for earthquake ground motion duration. Using an Indian database recorded between 1986 and 2001, an equation for predicting the significant duration ($D_{s5-95\%}$) is constructed. The database consists of 148 horizontal acceleration time histories recorded on rock and soil sites with the magnitude varying from 4.5 to 7.2 and hypocentral distance from 10 to 400 km. Artificial Neural Networks (ANNs) are employed for developing the prediction model. Moment magnitude (Mw), hypocentral distance (Rhypo), site condition (S) are chosen as input parameters and $D_{s5-95\%}$ is chosen as the output parameter for the ANN model. A two-layer feed-forward neural network was selected to properly predict the duration of a ground motion. Levenberg-Marquardt (LM) back propagation (BP) algorithm was selected to train the network after testing. The significant duration increases as the hypocentral distance and magnitude of the earthquake increase. In rock sites, the significant duration was predicted to be higher than in soil sites. Sensitivity analysis was conducted to determine the order of importance of input variables on the output parameter. The developed ANN model was compared with the existing duration prediction models.

Keywords: Strong motion; Significant duration; Neural network; Database; Sensitivity.

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Measurement of Delay using Travel Time Reliability Statistics in an Urban Outer Corridor

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Abstract: Unexpected delay on freeways is the prime cause of dissatisfaction in road users. Increasing traffic, adverse environmental conditions, accidents, time, season, location and many more factors influence travel time and cause delay. There is no direct method to estimate delay. It is calculated from trip time estimates. Thus, it is a very big challenge for transportation professionals to develop a model that accurately estimates the trip time for a trip at a particular time, by a specific mode of transport. Subsequently, the reliability of the delay calculated from those trip time estimates is often doubtful. Further, the measurement of delay using the trip time data is another big thing. This paper is a step toward measuring the delay in an accurate way using travel time reliability measures. The study was conducted on the two modes of public transportation (City bus and Auto) in an urban corridor of length 16.3 km, in Hyderabad city, India. In this study, a license plate survey was conducted for data collection, travel time-based statistical analysis was employed for estimation of trip time and by making use of travel time measures, the delay was measured. The approach was validated graphically to portray its accuracy.

Keywords: trip time, travel time, delay, city buses, passenger autos

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Travel data collection using a smart phone for the estimation of multimodal travel times of intra-city public transportation

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Abstract: All the available modes of travel and their respective travel parameters must be known to the commuters before their trip. Otherwise they may either spend more money or more time for the trip. In addition to this, recent pandemic, rapidly spreading novel corona virus is demanding a smart solution for contactless commuting. This paper suggests a practical solution to make both the above possible and it emphasizes the applicability of two developed android applications, one for travel data collection and another to predict travel time for a multimodal trip within the study area. If the whole trip is by a single mode, the user can get the corresponding travel time estimate from "Google maps". But, if the trip is by multiple modes, it is not possible to get the total travel time estimate for the whole trip at a time from "Google maps". A separate travel mode for "auto" is unavailable in "Google maps" alongside drive, two-wheeler, train or bus and walk alternatives. It is also observed that the travel time estimate of "Google maps" for the city buses is inaccurate. Hence, the two modes (Buses and Autos) were chosen for the study. Unless and until the travel times and stopping times of the two modes are known, it is not possible to predict their trip times. Hence, the mobility analysis was performed for the two modes in the study area to find their respective average travel rate at peak hours, across 15 corridors and the results were presented.

Keywords: commuters, multimodal travel time, public transport, stopping time, travel rate, travel time

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Evaluation of damping modification factors for floor response spectra via machine learning model

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Abstract: In the last few decades, the seismic performance of Non-structural components (NSCs) has been a subject of extensive research. The dynamic behavior of NSCs, can cause damage to buildings, resulting in severe financial losses, injuries, and death. The necessity of assessing the seismic demand on NSCs in seismic design cannot be overstated. Current building regulations include overly simple relationships for defining design inertia forces on non-structural acceleration-sensitive components. Building code formulations are frequently unable to forecast realistic accelerations of NSCs. Floor Response Spectra (FRS) approach determines the seismic demands on acceleration-sensitive NSCs better. In this study, elastic FRS at a floor level of a linear single-degree-of-freedom system is investigated under near-field earthquakes. Damping modification factors (DMFs) for the elastic FRS are calculated for the various damping ratios of the NSCs ranging from 0.1% to 30%, the tuning ratio (i.e., the ratio between the NSC vibration period, *Ts*, to the building structural period, *Tp*) ranging from 0.1 to 3, and the building structural period ranging from 0.5 *s* to 4 *s* with 0.5 *s* interval. Also, artificial neural networks (ANNs) were employed to generate an empirical expression to determine the DMFs for elastic FRS. The DMFs were observed to be highly dependent on the building structural period, damping ratio and the tuning ratio of the NSC. The proposed expression is then compared with the existing relations in the literature. The expression is further validated by comparing the predicted DMFs to those obtained from time-history analysis with different ground motion records used to build the model.

Keywords: Floor response spectra; Artidficial neural networks; Non-structural component; Near-field earthquakes.

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Bed Load Computation for Gravel Particles In Gravel-Silt Mixture

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Abstract: Fluvial hydraulics deals with the process of erosion, transportation, and deposition of sediment in channels by the action of flowing water. This paper presents experimental results on bed load transport rate of gravel particles transported from mobile channel bed made of gravel-silt mixture. Gravel and sand particles were observed transported as bed load due to their coarser size while silt transported as suspended load. Bed load was collected at regular time interval of like 15 minutes, 30 minutes, 60 minutes, etc. Bed surface profile and water surface profile were measured spatially at an interval of 50 cm at the center line of the test section along the flow. It was observed that collected bed load decreases with the time passes and the run was continued till the equilibrium condition i.e., low amount of bed load collected for a long duration and simultaneously bed surface profile and water surface profile come into nearly stable state. This condition is here treated as equilibrium condition as there is no feeding of sediment in the channel and test section also tends to in stable condition with nearly no outflow of sediment. At the end of run, layer of gravel particles was found on the top surface of the channel bed in the mixture of gravel-silt; however, high degradation was observed towards the upstream of test section. A relationship has been developed to compute the total bed load which found in good agreement with the observed data.

Keywords: Bed load, Cohesionless sediment, Equilibrium condition, Gravel particles, Hydraulics, Sediment transport

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Forest Fire Monitoring using Hot-Spot Analysis

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Abstract: India is one of the mega biodiversity zones in the world contains various varieties of forests occupied by a wide variety of species. Forest cover is deteriorating at an alarming rate due to the high increase in anthropogenic activity. Besides other factors, wildfires are the leading cause of forest degradation in Sri Venkateswara Wildlife Sanctuary. The SVWS contains a wide range of flora and fauna like Red sanders, sterculia urens, Ficus religiosa, Slender loris, and Golden gecko. The present study analyses the forest fire events from 2016 to 2019 using MODIS and VIIRS datasets from Active Fire Data to know the fire hotspots and cold spots using hotspot analysis (Getis-Ord Gi*) tool in ArcGIS environment. Hotspot analysis is one of the traditional methods used in various disciplines to describe the region or value higher relative to its surroundings. In this study, the hotspot analysis function in ArcGIS 10.8 is based on Gi* spatial statistics developed by Getis and Ord in 1992. It was used to estimate the z-score and pvalues to reject or accept the null hypothesis that the features are structured randomly(Getis & Ord, 2010). The methodology analyses the feature, estimating the Gi* statistics group of values within the threshold distance (d) from the feature i. SVWS is the only wildlife protective zone in Andhra Pradesh as per the UN Environment International Union Conservation of Nature (IUCN). The study identified that significant fires are happening in the south region of SVWS as per VIIRS and MODIS. Major fires have occurred in Mixed forest and some parts of the deciduous forest. This study will help these regions identify the fire hotspots, regulate the fire, and take the necessary precautions to control the fire and policymaking.

Keywords: Forest fire, GIS, Hot-Spot Analysis

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Lockdown impact on NO2 concentrations across Indian hotspots using OMI observations

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Abstract: Covid 19 marked as a deadly pandemic hit the world in the early 2020's. Stringent measurements were implemented to contain the virus. India implemented the first phase of lockdown on 25/03/2020 for 21 days, where almost all the activities are put to pause restricting vehicular moments and Industrial activities, resulting in a significant decline in Nitrogen Oxide concentrations. NO2 considered a vital trace gas in anthropogenic emissions is a short-lived gas In most ambient situations NO2 itself is not released from the source in fact only 5 to 10% is produced directly from the source, remaining 90-95% is generated as Nitric oxides during the combustion process (Hussain I et al, 2004). Anthropogenic emissions from Thermal power stations, steel plants, and Traffic are the major humane sources of NO2. A report by POSOCO stated that a 26% fall in energy consumption has been noticed within the initial 10 days of lockdown (POSOCO report, 25-03-2020). Due to the unavailability of the workforce, and reduced demand these stations operated with minimum capacity. This paper attempts to visualize the reduction in NO2 concentrations during the lockdown period for the whole India. The NO2 concentrations in the base period and Lockdown period have been calculated. Major Thermal stations and steel plants across the country have been mapped and averaged NO2 concentrations from a High-resolution satellite aboard Aura, Ozone Monitoring Instrument(OMI) for the period of 25th March to 14th April from 2017 to 2020 are compared. The thermal stations observed an average reduction of 29.57%, while the steel plants noted an average reduction of 28.31% in comparison to the base period.

Keywords: Covid-19, OMI observations, NO2 concentrations

Experimental Study on Incipient Motion For Clay-silt-sand Mixtures

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Abstract: Erosion and scour in a stream are most hazardous and common hydrological processes. Hence, it is essential to study the incipient motion in an alluvial stream. An experimental study has been carried out that lead to the formulation for critical shear stress of sand particles in clay-silt-sand mixture in which clay varied from 10-50% on weight basis. The influence of clay on appearance of the top surface of channel bed was identified and found to be varied with change in clay content in the mixture. Clay content in the mixture found to be main factor that control incipient motion condition, however, other parameters like bulk density of mixture, sediment size and its standard deviation identified as parameters that govern the critical shear stress. A relationship has been proposed for the computation of critical shear stress of sand particles in clay-silt-sand mixture that found to be in good agreement with the present study data. The particles were detached as aggregates and mass type erosion appeared on the top surface of the channel bed for 40-50% clay content while appearance of line along with lumps observed for 10-30% clay content in the mixture. The presence of clay in the sediment mixture results in significant increase in the critical shear stress of sand particles. The main parameters governing the incipient motion process is identified as clay content and bulk density along with hidden-exposure probability of sand particles. A relationship is proposed for the computation of critical shear stress of sand particles for cohesive mixture of clay-silt-sand which found in good agreement with the observed data of the present study. The proposed relationship also exhibit good results for clay-sand mixture.

Keywords: Clay content; Clay-silt-sand mixture; Critical shear stress; Silt content

OPTIMIZATION OF REINFORCED BENTOCRETE COLUMN PARAMETERS UNDER ECCENTRIC COMPRESSION

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Abstract: Replacing cement with pozzolanic materials to some extent in construction is found to be one of the sustainable approaches in construction industry. Pozzolanic materials of industrial origin like fly ash and GGBS will have to be replaced with natural pozzolanic materials once the world moves towards renewable energy sources. Bentonite is one such pozzolanic clay materials which is rich in SiO_2 content. The performance of bentonite modified concrete (Bentocrete) was assessed in the present study. Bentocrete exhibited better performance than OPC concrete in terms of strength durability. However, no test results are available on columns using Bentocrete. the evaluation of Bentocrete in a structural component is essential to find out its applications as structural concrete. So, a research program was undertaken to investigate the strength and behavior of reinforced Bentocrete columns under eccentric compression and providing the optimal solutions. The experimental study of this investigation consisted of tests on forty columns with Bentocrete and OPC concrete in eight series. All the specimens were nominally of same length and cross-sectional dimensions. The performance of Bentocrete columns in terms of load carrying, deflection, compressive strain and resistance to cracking was better with 5% replacement, on par with OPC columns, and slightly less than OPC columns with 15 % replacement. A novel optimization model was developed based on the experimental data; optimization was performed using Response Surface Methodology (RSM). The variables of the study are bentonite substitution (0%, 5%, 10% and 15%), longitudinal reinforcement ratio (2.09 and 3.04) and eccentricity (0, 0.1, 0.3, 0.5 and 0.7). Ultimate load, transverse deflection at mid-span, and compressive strain were considered as responses influenced by these variables. The models generated from RSM were valid with statistical significance in all the factors considered. The optimum solutions were proposed with desirability of 1.0. Suitability of use of Bentocrete in structural concrete was confirmed by this investigation.

Keywords: Bentonite, Bentocrete, R.C. Columns, Eccentric compression, Optimization.

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ANALYSING THE FACTORS THAT DIRECT THE ADAPTION OF LEAN PRODUCTION TECHNIQUES IN PRECAST INDUSTRY

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Abstract:

The purpose of this paper is to implement lean production techniques in the Precast industry to improve the productivity by eliminating the waste. Lean is a philosophy and a style of production management that emphasises utilising less of everything while yet producing high-quality products at the lowest possible cost and in the shortest amount of time. It also provides and focuses on implementation of three lean tools SMED, VSM and 5S methodology to develop a framework for these concepts by using a questionnaire approach to investigate the factors that lead to implementation of these tools. The data obtained by the questionnaire is analysed by using PLS-SEM tools. The obtain results from this analysis gives the interrelationship between the factors and the improvement of the productivity due to the implementation of lean tools.

Key words:

Precast Industry, Lean production tools, VSM, SMED, 5S, PLS-SEM, Productivity.

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The Effect of Alumino silicate on the Mechanical Properties of Geopolymer Concrete - Artificial Neural Network

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Abstract

This paper presents and discusses the details and findings of experimental and predictive studies conducted to ascertain the mechanical properties of aluminium silicate materials such as ground granulated blast furnace slag (GGBS) and fly ash (FA) based geopolymer concrete specimens. The percentages of GGBS and Fly ash, as well as the percentage of manufactured sand (m-sand) used to replace conventional river sand in the production of geopolymer concrete, are the major parameters considered in the experimental study. The activator in the production of geopolymer concrete was sodium hydroxide and sodium silicate solutions. The compressive strength, split-tensile strength, and flexural strength of the geopolymer concrete were determined. As the percentage of GGBS was increased, the test results showed that the mechanical properties of geopolymer concrete improved. Furthermore, the test results revealed that increasing the percentage of m-sand used increased the mechanical properties of the geopolymer concrete up to an optimum dosage, after which mechanical properties decreased. The mechanical properties of geopolymer concrete predicted using an Artificial Neural Network (ANN) were found to be in good agreement with the test results.

Keywords: Geopolymer concrete, Alumino silicate materials. Alkali activated solutions, Artificial neural network.

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Project Delivery System Selection Of Indian Residential Projects Using Analytic Hierarchy Process

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Abstract:

The paper serves as a resource to the clients who are attempting to implement the appropriate project delivery system for their residential buildings. PDS has a significant impact on project time, cost, quality, and contract management as one of the key criteria in determining project success. This paper focuses on the selection of appropriate PDS system by considering these three factors i.e., cost, time, and quality. Among all the PDS methods Design-Build, Design-Bid-Build, and construction manager at risk are utilised in this study. The questionnaire survey approach is used to obtain the data for the above selection of the PDS for the residential building. The results obtained by this questionnaire survey is analysed through the MCDM -AHP approach. This tool provides the best PDS for the construction of the residential building.

Key words:

Project delivery system, Residential buildings, DB, DBB, CMAR, Cost, Time, Quality, AHP.

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BOF steel slag aggregate application in metakaolin-based geopolymer

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Abstract:

Steel slag, an industrial by product of the steelmaking process, has previously been not utilised so far. The feasibility of using basic oxygen furnace (BOF) steel slag aggregate in metakaolin-based geopolymer was thoroughly evaluated in this paper. The use of steel slag aggregate (SSA) as a full replacement for natural limestone aggregate produced higher volume stability, improved compressive strength, less drying shrinkage, and improved anti-freeze properties in geopolymer concrete. Furthermore, the water glass activator was shown to be superior to NaOH because free oxides in steel slag could be consumed in water glass solution. The mechanism underlying the superiority of BOF SSA in conjunction with alkalis was discussed from the standpoint of chemical reaction. The diffusion of Ca ions to form the gel and densify the microstructure enhanced the geopolymer matrix and interfacial transition zone (ITZ). For the analysis of the improved geopolymer matrix and strengthened ITZ, XRD, TGA, and SEM/EDX techniques were used. This study may make it easier to recycle and upgrade steel slag for use in construction.

Keywords: Steel slag aggregate Alkali activated metakaolin Waste management Volume stability

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Study on alternate materials for the improvement of pavement subgrade and bituminous layer of flexible pavement on expansive soil

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ABSTRACT: The present work was made with an objective to evaluate critical approach for the formation of flexible pavement over an expansive soil in Guntur districts of Andhra Pradesh .The above districts have the top soil layer loamy, silty clay and sandy clay (Atlas, S 1998, 'Soil survey and land use organization' The soil samples were collected from the above districts at 31 locations. They were tested in the laboratory to identify their index properties, In-situ density, Natural Moisture Content (NMC), Specific gravity, Standard proctor compaction, Free Swell Index (FSI) and Subgrade strength of the soil were found in in-situ and laboratory. The FSI and soaked California Bearing Ratio (CBR) values are the criteria to decide the swelling nature and subgrade strength. Based on FSI and CBR value, the soil is classified under high swelling nature and poor subgrade strength.

Key words: Free Swell Index, California Bearing Ratio.

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Reinforcement Corrosion in Concrete Structures and Service Life Prediction—A Review

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Abstract:- Over the past two to three decades, reinforcement corrosion has been extensively described in the literature. One of the biggest issues with durability occurs when the rebar in the concrete is exposed to chlorides, either from the chemicals in the concrete or from the environment around it. The other reasons of reinforcement corrosion include carbonation of the concrete or the infiltration of acidic gases into the concrete. In addition to these, there are a few other variables that affect reinforcement corrosion, some of which are related to the quality of the concrete, such as the water-to-cement ratio, the cement content, impurities in the ingredients, the presence of surface cracks, etc., and others which are related to the external environment, such as moisture, oxygen, humidity, temperature, bacterial attack, stray currents, etc. Utilizing a variety of electrochemical methods, corrosion's causes and extent are evaluated. Using empirical models and experimental techniques, the remaining service life of a corroding RC structure is predicted. A study of the mechanisms underlying reinforcement corrosion, monitoring techniques, and methods for estimating the remaining service life of structures are all covered in this article.

Keywords: Mechanisms; Service life prediction; Reinforcement corrosion.

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Utilization of Marble Dust in High Strength Concrete

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ABSTRACT: Marble is a standout amongst the most imperative materials utilized as a part of the development business. Marble powder is delivered from the preparing plants amid the sawing and cleaning of the marble squares and around 20 - 25% of the handled marble is transformed into powder structure i.e., marble powder. Marble dust which is a waste material from development site is blended with concrete as a substitution. As marble powder is the waste item which is gotten amid the procedure of sawing and molding of the marble by the guardian marble rock, contains substantial metals in it which makes the water unfit for use. Marble powder makes numerous ecological issues. Because of ecological issues, it greatly affects the human wellbeing and also on the nature. To control its belongings we need to utilize this waste. Marble dust which is a waste material from the development site is blended with the solid.

Key words: Marble, Marble Dust, Construction Waste.

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Applications of Satellite & Ground–Based Measurements and multi-temporal Land Surface Temperature (LST) images in the portions of Eastern Antarctica.

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Abstract: The study presents the multi-temporal Land Surface temperature estimation in Eastern Antarctica from MODIS LST and Bharati station air temperature data (Tair). Four passes of MODIS Aqua and Terra do not coincide with the observed maximum/minimum temperatures at Antarctica. Automatic Weather Station (AWS) at Bharati records air temperature data at every minute. The Geographic considerations such as latitude and longitude control the regional distribution of temperature at the continental scale, elevation and distance from the coast in case of Antarctica. The comparison between AWS Tair and the acquired field data during 36th Indian Scientific Expedition to Antarctica (ISEA-36) shows that observed field temperature varies with depth and distance from coast. The deviation in the observed field temperature vs depth relationship is attributed to the presence of ice lens in the snow strata. The gaps in MODIS LST image is filled by multiple linear regression model and multi-temporal LST images are generated by regressing the Bharati AWS data with other affecting parameters. Modeled LST and original LST images coincide well at near as well as far locations. The generated maximum and minimum LST time extracted from modeled hourly LST images coincide with the observed maximum and minimum Tair time from Bharati AWS station.

Keywords: Terra Satellite, Aqua Satellite, MODIS Sensor, Global warming.

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Analyzing the cost overruns factors in road and bridge construction projects, case study of Burundi

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Abstract: For any landlocked countries, road and bridge construction sector are one of the most important for trade and economic growth, like Burundi. Nonetheless, this sector of activity, like any other, is subject to unforeseen challenges and risks that tend to limit and negatively impact the performance and profitability of the projects carried out. The purpose of this work is to identify and categorize the various factors that contribute to cost overruns in Burundi road and bridge construction projects. A structured questionnaire survey with 24 factors was designed and distributed to 55 stakeholders from various professions and sectors of activity involved in road construction projects; the results gathered will serve as a foundation for understanding the challenges faced by road construction projects in terms of cost management, and will assist stakeholders in developing techniques and methods to mitigate significant factors and risks that can negatively affect project costs and lead to cost overruns. The ranking of factors was done using the relative importance index (RII) technique. The results revealed that most common factors responsible for cost overruns are as follows; lowest bid price system, with a value of RII of 0.86, underestimation of project costs by contractors, with a value of RII of 0.83, poor project implementation strategies, with a value of RII of 0.83 and delays beyond the control of stakeholders, with a value of RII of 0.82, weak and insufficient technical studies, with a value of RII of 0.82.

Keywords: Burundi, Cost overruns, Construction, Projects, Relative importance index

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Monitoring and Assessment of Drought using Remote Sensing and Association Rules

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Abstract: Drought is a natural threat that exists in all climatic zones around the globe and its intensity, there is a need to categorize drought events and the probability of occurrence for better planning and management of relief and rehabilitation. In this study, drought monitoring indices namely the Standard Precipitation Index (SPI) and Vegetation Condition Index (VCI) was utilized to break down the observed variability of monsoon droughts over Andhra Pradesh state. Precipitation data between 1991-2019 was used to evaluate the SPI and to evaluate the VCI from NDVI data collected from 2011 to 2019 using multi-temporal Terra MODIS Vegetation Indices Product (MOD13Q1). In this analysis, more often drought events occurred in 3 and 6 months SPI during monsoon season. In this study how data mining techniques (such as the Association Rules) are used to explain the association between VCI and SPI to predict the probability of occurrence of drought. The association rules formed by the VCI and the 3-month SPI with 77 percentage of confidence and 1.11 of lift, which indicates the higher accuracy of the rules and the effect on vegetation ford rainfall accumulation. This research incorporated the various software and dataset levels used to predict the probable occurrence and severity of drought using the current situation. The analysis revealed the advantages of NDVI and rainfall for indices of spatial and multi-temporal drought to identify and forecast the characteristics of drought.

Keywords: Drought, Standard Precipitation Index (SPI), Vegetation Condition Index (VCI), Precipitation, Normalised Difference Vegetation Index (NDVI), Association Rules.

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Sedimentation Assessment Of Maithon Reservoir Using Remote Sensing Technology

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Abstract: Reservoir is one of the most efficient measures for integrated water resources development and management. The reservoir storage curve is a vital parameter for multipurpose reservoir operation and its precision is a key issue for water balance and strategic risk management. Compared with the traditional approach, the method based on remote sensing (RS) data provides better information, which can be helpful in reservoir operation and management The reservoir storage curve is a vital parameter for multipurpose reservoir operation and its precision is a key issue for water balance and strategic risk management. Compared with the traditional approach, the method based on remote sensing (RS) data provides better information, which can be helpful in reservoir operation and management. Maithon Reservoir was chosen as a case study to obtain the new storage curve that is based on Landsat data for the period 2018-19. The inflows of the reservoir were calculated on the basis of the water spread area by using Per-pixel classification technique and designed storage curve is much less than the one using the designed curve estimation curve. These waters spread area were used in simple volume estimation Prismoidal formula and the volume between different water levels are calculated. These volumes were added up to assess the revised capacity between the water level 137.74 m and 146.3 m for the period 2018-19. The assessment revealed that the loss of capacity between the water levels is 6.7M.cum/year. This study shows the reservoir water spread and in turn the amount of sediment deposited in a reservoir are can be effectively estimated using Per-pixel based approach.

Keywords: Reservoir sedimentation, water spread area, Per-pixel approach, Landsat_8OLI.

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Dam break analysis of kalyani dam using HEC-RAS

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Abstract: Because of siltation and high flood waves, catastrophic failure of dams may occur. In this study HEC-RAS model is used for dam break analysis of Kalyani dam constructed across Swarnamukhi River near Tirupati, Andhra Pradesh. In the present analysis, HEC-RAS was used to simulated unsteady flow in the Kalyani dam and results are mapped, in terms of water level in the river and floodplains. The height shape results as of the barrier breakdown model supply a general dimension of the overflow danger and provides nearby intended for emergency alert was prepared. The procedure intended for congregation along with prepare information, create an unsteady-flow module in HEC-RAS model. The area of water spread, depth of water along with probable maximum flood, travel time and plot to overflow succession was assess in this study. All these information predicted from the HEC-RAS model will helpful in defining the maximum height of flood protection structures in the area to protect it from flooding during high floods. The results of the study will be helpful for evacuation planning, estimation of damages and post flood recovery in the area.

Keywords: Disaster, Flood, HEC-RAS, Planning.

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Rainfall Trend Analysis and IDF Curve Generation for Bujumbura Mairie in East Africa

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Abstract: Present study aimed to analyse rainfall trends and IDF curve generation for Bujumbura Mairie using historical data for the past 30 years. In this study, the procedures adopted consisted of the statistical analysis of daily rainfall, rainfall anomaly, rainfall regression, Mann Kendall test, Sen's slope, and return period using: Gumbel Method, long Pearson method, log-normal method, and Normal method. To do so, rainfall data from 1991-2020 was employed. The data that we collected was analysed using SPSS software. Result showed that there were 88.97 non-rainfall days' means in the long-wet season FMAM (Feb, Mar, April, and May) and 294.67 non-rainfall days mean in 30 years from 1991 and 2020. After analysis, the excess rain years observed were 2020 for both the annual and long-wet seasons. Fourth deficit rain years (1994, 2005, 2006, and 2018) were observed for annual and long wet-season analysis. To quantify the possible effects of climate change and adapting to them is an important way of reducing vulnerability to them. The relationship between the IDF curves that is determined in this study is intended to use statistical analysis of the rainfall data observed for the past 30-year record.

Keywords: Bujumbura, rainfall analysis, long wet Saison, climate change

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An analytical approach on life cycle cost analysis of a green building

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Abstract: Cost effectiveness plays a very significant role in any construction sector. Life cycle value evaluation is the most price effective option among distinct substitutes in the construction industry to consider future strolling costs associated with a building. Improper understanding of application of life cycle costing is viewed one of the hindrances to construction industry. This research demonstrates to establish a life cycle budget for the complete existence of a green construction for 80 years by using life cycle costing technique. It is shown that future costs are 5.7% greater than the initial construction cost. Among total life cycle budget 67% constitutes the energy cost. Correlation between existing condition of solar panels and suggested solar panels are studied. And it is found that implementing monocrystalline solar panels of 370wp reduces its total life cycle cost by 5%.

Keywords: Construction sector Life cycle costing (LCC) Life cycle cost analysis (LCCA) Green buildings Net present value Solar panels.

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Seismic Performance of RCC Multistored Building with Base Isolators

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Abstract: Stability of a structure plays a vital role for economical and human loss during earthquakes, here base isolation is an approach mostly used for protecting structures from seismic forces. Base isolation is a interface system located between a structure and its foundation for the function of decoupling horizontal forces from earthquake ground motions, thereby reduce seismic damage to the structure and its contents. In this study we have designed lead rubber bearing (LRB) and friction pendulum system (FPS) type of isolators for G+9 RCC multistoried building in which modeling of G+9 building is carried out in ETABS 2016 as per IS 1893 (part 1) 2002 as per codal provisions. An equivalent static and time history analysis is done for fixed base, LRB, FPS isolators. Finally this reveals the seismic performance of building with different types of seismic base isolators by comparing the storey displacement, storey shear, storey drift and base shear. In base isolation concept Friction pendulum isolator is a type of base isolator a study of non-linear analysis is carried for RCC G+25 structure in ETABS 2015 in which comparion is done for single, double and triple friction types of bearings the results obtained are the base shear,story isplacement,story drift reduction is observed in Triple friction pendulum type of bearing. Hence triple friction pendulum is superior than among the two isolators

Keywords: Bearing, Base Isolation, Story Drift, Story Displacement, story shear, Time History.

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Seismic Evaluation of Prestressed Concrete Box Girder Bridge

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Abstract: Prestressed concrete members have high resistance towards loads, impacts,shocks and less cracks than RCC members. now a days earthquake is major issue to structures like buildings ,bridges ,dams etc. In this modeling and analysis is performed out by using CSI BRIDGE software. Response spectrum analysis of prestressed box girder concrete bridge is carried out and determining the bent demand capacity values ,bent column force demand values, bent column moment demand values ,column cracked section properties, bearing demand force values ,bearing demand deformation values. The effect of seismic analysis of an Reinforced concrete bridge is studied by using CSI software for prestressed box concrete girder is constructed along deck slab at interactions it provides two lane traffic for free flow movement on bridge. This is one of the method for controlling traffic problems grade junctions, controlaccidents, low fuel consumption etc

Keywords: Bent Cap, Bearing,CSI Bridge,Prestress Concrete,Response Spectrum Analysis

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Combined strategy of building vibration control by using tuned Mass Damper and base isolator

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Abstract: Horizontal loading as a result of an earthquake is a dominant aspect which causes damage to the structure. The volume of damage is high in case of highrise buildings. Many techniques are developed in recent years for resisting the structure from damage due to the earthquake.This present study deals with Base Isolation technique and Tuned Mass Damper for finding the inter-storey drift of a high-rise building. Base Isolation technique is used for partially absorbing the seismic energy. This Base Isolation technique can be used for new structures. Tuned Mass Damper is one the techniques for reducing the seismic effect on structures as it reduces the displacement causing from seismic energy. This research work deals with the performance evaluation of baseisolated structure along with Tuned Mass Damper using SAP2000 © Published under licence by IOP Publishing Ltd.

Keywords: Acceleration; Base isolators; Lateral displacement; Storey drift; Tuned mass damper

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Seismic fragility analysis of multi span highway bridge based on probabilistic approach

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Abstract: This paper represents the seismic behavior of multi-span highway bridges subjected to different PGA. There are many techniques of seismic assessment using computer technologies of which fragility analysis is one of them. Fragility analysis is a system reliability analysis to evaluate the seismic loss in a built environment. The methods used in this paper involve modeling the bridge using SAP2000 and using the peak ground acceleration from past earthquake data as input data to the software to examine whether the structure could be further affected by horizontal or vertical ground movement. In this paper, SAP2000 is used to conduct non-linear static analysis and non-linear dynamic analysis subjected to different PGA's that represent 12 historical earthquakes. The main objective of this study is to determine conventional and unconventional fragility curves. Finally, by considering different structural parameters, the fragility curves with the assumption of a log-normal distribution are obtained based on the capability and demand of the bridge structure.

Keywords: Fragility analysis; Multi span highway bridge; SAP2000; System reliability; Unconventional fragility curves

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A Resistance Examination Model of CAD Congregations Considering Thermo-Mechanical Engineering Distortions of non-inflexible Parts

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In digital mock-up (DMU), the sensible demonstrating of congregations with mathematical and layered deserts is among the principal objectives of a few examination works. This demonstrating permits the expectation of the Mechanical Engineering and utilitarian way of behaving of systems at the beginning phases of the item life cycle. In any case, the presumption of unbending body is embraced in the majority of the CAD apparatuses and a few actual factors,for example, the distortions because of Mechanical Engineering and warm loads are dismissed. Then, the incorporation and the communication between Mechanical Engineering plan apparatuses as well as designing estimation and examination devices are required. In such manner, this paper proposes an intelligent CAD model for the resilience examination of Mechanical Engineering gatherings by considering both assembling deserts and thermo- Mechanical Engineering distortions of parts. The layered and mathematical resiliences are considered by assurance of the get together designs with absconds in view of the most pessimistic scenario approach and the little relocations torsor boundaries. A limited componentmodel is applied to reproduce the misshapenings of non-inflexible parts coming about because of thermo-Mechanical Engineering burdens. A clever technique in view of the utilization of the Levenberg Marquart calculation is applied in this work to reproduce the B-spline surfaces comparing to disfigured countenances of non-unbending parts. The last CAD model of reasonable parts is acquired from the above reproduced surfaces. The mating imperatives between couples of inflexible and non-unbending parts are updated toward the finish to get every one of the practical arrangements of the gathering and to control the utilitarian necessity. The modern contextual analysis shows that the introduced tolerancing model is an intelligent choice support apparatus for architects and creators in DMU.

Keywords, Geometrical and dimensional defects, Mechanical Engineering and thermal loads, Non-rigid parts

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Transfer learning for Independent Chatter Identification in Machining

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Huge adequacy chat vibrations are quite possibly the main peculiarity in machining processes. It is in many cases negative in cutting tasks causing an unfortunate surface completion and diminished device life. In this manner, prattle location utilizing machine learning has been a functioning exploration region over the course of the past 10 years. Three difficulties can be distinguished in applying machine learning for chat location on the loose in the industry: a deficient comprehension of the comprehensiveness of prattle features across various cycles, the requirement for automated feature extraction, and the presence of restricted data for every particular workpiece-machine apparatus blend, e.g., while machining one-off items. These three difficulties can be assembled under the umbrella of move realizing, which is worried about concentrating on how information acquired from one setting can be utilized to get data in new settings. This paper studies automating gab discovery by assessing move learning of conspicuous as well as clever gab recognition techniques. We examine chat characterization exactness by utilizing an assortment of features separated from turning and processing tries different things with various cutting designs. The concentrated strategies incorporate Fast Fourier Transform (FFT), Power Spectral Density (PSD), the Auto-correlation Function (ACF), and deterioration-based devices, for example, Wavelet Packet Transform (WPT) and Ensemble Empirical Mode Decomposition (EEMD). We likewise inspect later methodologiesin view of Topological Data Analysis (TDA) and closeness proportions of time series in light of Discrete-Time Warping (DTW). Further, we found that the DTW approach beats any remaining techniques while preparing to utilize the processing data and tried on the turning data. Accordingly, TDA and DTW approaches might be liked throughout the time-recurrence-based approaches for completely automated jabber recognition plans. DTW and TDA likewise can be additional profitable while pooling data from either restricted workpiece-machine device blends or from little data sets of oddball processes.

Keywords, Transfer learning Machine learning Chatter detection Turning Milling Topologicaldata analysis Dynamic time warping

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Impacts of Rotation Tool-incited Intensity and Material Stream Conduct on friction stirlapped Al / Steel Joint Arrangement and Resultant Microstructure

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Solid joining of Al/steel through grinding mix lap welding (FSLW) is emphatically subject to interfacial large scale/miniature designs. Be that as it may, what the hidden thermo-MechanicalEngineering cycle means for them and how they can be controlled stay hazy. In this review, a 3D coupled Eulerian-Lagrangian limited component model was coordinated with a tracer molecule procedure to mimic the FSLW of Al alloy 5052 and high-strength DP590 steel, to clarify the job of hardware prompted intensity and material stream. The outcomes showed that the material stream recycled close to the shoulder and pin, which basically started from the propelling side of the Al and the withdrawing side of the steel. Expanding the rotational speed escalated the overall material stream, bringing about expanded relocation on the steel side. Deficient steel movement around the pin at lower rotational speeds was mostly answerable forthe miniature voids and non-holding surrenders at the lap interface. The nonconcurrent combination of Al and steel moving from the progressing and withdrawing sides, individually, topped off the prompt hole, in this way normally holding the lapped interface behind the pin. The rotational pin impacted the snare construction and steel section arrangement through the shearing and pressing of the steel movement stream. Material between relocation created an intercalated structure at the lapped Al/steel interface. The very high temperature, roughly above Al 5052 solidus temperature, under the pin base caused the development of a thicker intermetallic compound (IMC), in this way extensively diminishing the interfacial strength. Multi-scale Mechanical Engineering strength evaluations demonstrated that an intercalated interfacial construction with a thickness of Al-rich IMC layer under ∼1.0 μm was alluring in light of the fact that it showed a higher local interfacial strength than the Al matrix.

Keywords, Friction stir lap welding Coupled Eulerian– Lagrangian modelling Aluminium /steel joint Temperature Material flow Microstructure

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Forecast of cutting power and surface quality, and optimization of cutting parameters involving new surmising framework in high-speed milling process

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During the genuine fast machining process, it is important to diminish the energy consumption and work on the machined surface quality. Be that as it may, the proper forecast models and ideal slicing boundaries are challenging to acquire in complex machining conditions. Thus, a novel intelligent system is proposed for expectation and optimization. A novel adaptive neuro- fuzzy inference system (NANFIS) is proposed to foresee the energy consumption and surface quality. In the NANFIS model, the enrollment elements of the data sources are ventured into: participation unrivaled and enrollment substandard. The enrollment capacities are changed in light of the machining hypothesis. The contributions of the NANFIS model are cutting boundaries, and the results are the machining exhibitions. For optimization, the ideal cutting boundaries are gotten utilizing the improved particle swarm optimization (IPSO) calculation and NANFIS models. Moreover, the IPSO calculation as a learning calculation is utilized to prepare the NANFIS models. The proposed intelligent system is applied to the high velocity milling interaction of compacted graphite iron. The trial results show that the expectations of energy consumption and surface roughness by taking on the NANFIS models ultimately depend on 91.2% and 93.4%, separately. The NANFIS models can anticipate the energy consumption and surface roughness all the more precisely contrasted and other intelligent models. In view of the IPSO calculation and NANFIS models, the ideal cutting boundaries areacquired and approved to lessen both the cutting power and surface roughness and further develop the milling efficiency. It is exhibited that the proposed intelligent system is pertinent to real high velocity milling processes, subsequently enabling sustainable and intelligent manufacturing.

Keywords, Novel adaptive neuro-fuzzy inference system (NANFIS) model, Improved particle swarm optimization (IPSO) algorithm, Energy consumption, Surface roughness, Multiobjective optimization

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Optimization of fused deposition modeling process parameters utilizing a fuzzy inference system combined with Taguchi philosophy

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Fused deposition modeling (FDM) is an additive manufacturing technique used to create mindboggling parts in 3D, inside the most limited conceivable time without utilizing tools, dies, fixtures, or human intervention. This article observationally reports the impacts of the cycle parameters, i.e., the layer thickness, raster point, raster width, air hole, part direction, and theircollaborations on the precision of the length, width, and thickness, of acrylonitrile-butadiene- styrene (ABSP 400) sections created utilizing the FDM technique. It was found that constriction won along the heading of the length and width, though the thickness expanded from the ideal worth of the manufactured part. Optimum parameter settings to limit the reactions, like the adjustment of length, width, and thickness of the test example, have been resolved utilizing Taguchi's parameter design. Since Taguchi's philosophy neglects to get uniform ideal element settings for every reaction, in this review, a fuzzy deduction framework joined with the Taguchi philosophy has been taken on to produce a solitary reaction from threereactions, to arrive at the particular objective qualities with the general optimum component level settings. Further, Taguchi and artificial neural network predictive models are likewise introduced in this review for a precision assessment inside the components of the FDM manufactured parts, exposed to different working circumstances. The anticipated qualities got from the two models are in great concurrence with the qualities from the trial information, with mean outright rate blunders of 3.16 and 0.15, separately. At long last, the corroborative experimental outcomes showed an improvement in the multi-reaction execution file of 0.454 while utilizing the ideal FDM parameters over the underlying qualities.

Keywords, Fused deposition modeling (FDM),Dimensional accuracy, Fuzzy logic, Performance characteristic, Multi-response performance index (MRPI), Artificial neural network (ANN)

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Impact of alloying elements on surface temperature field of aluminum piston in dieselengine

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For three sorts of Aluminum-Silicon (Al-Si) combination piston materials with various alloying element contents, the boundaries, for example, warm dissemination coefficient, explicit intensity limit and warm conductivity were estimated, and the impacts of Cu and Ni on the warm properties of the materials were examined. Under similar handling conditions, three sorts of engine aluminum amalgam pistons of various materials were manufactured. Thepiston surface temperature under the evaluated working state of the diesel engine was estimated by the hardness plug temperature adjustment technique. The dissemination of piston surface temperature field was reproduced by ANSYS finite element analysis, and the surface temperature analysis consequences of key pieces of the piston were gotten. The outcomes showthat the finite element reproduction aftereffects of piston surface temperature field are steady with the temperature estimation consequences of hardness plug test, and the temperature change of key explicit areas of piston has the comparable pattern. The warm conductivity of aluminum compound piston material increments with the increment of temperature. There is a conspicuous temperature inclination from the piston head to the piston skirt. High warm conductivity can lessen the surface temperature of the piston head. The expansion of alloying elements, for example, Cu and Ni will diminish the warm conductivity of aluminum composite materials and increment the surface temperature of piston. Consequently, legitimate controlling of the substance of alloying elements have some control over the intensity obstruction and high temperature execution of piston materials.

Keywords, Diesel engine pistonSurface temperatureThermal conductivityHardness plugAlloying element

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Examination of the influence of the shaping system and finishing processes on the properties of the surface and subsurface of hybrid components

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Because of the expanded integration of functions, a large number need to meet high and some of the time incongruous necessities. One method for taking care of this issue is Tailored Forming. Here, hybrid semi-finished items are manufactured by a joining or cladding process, which are then hot-framed and finished. For the design of hybrid components for a potential later modern application, information about properties of hybrid components is required. In this paper it is examined the way that the particular cycle steps of the Tailored Forming process chain change the surface and subsurface properties of the applied cladding layer. For this reason, shafts made of unalloyed steel are provided with a high-alloy austenitic steel X2CrNiMo19-12 cladding by laser hot-wire cladding. Accordingly, hot forming is carried outby cross-wedge rolling and the finishing by turning and deep rolling. After each cycle step, the subsurface properties of the cladding, for example, microstructure, hardness and residual stress state are examined. Subsequently, the impact of various cycle steps on the subsurface propertiesin the process chain of assembling hybrid shafts can be analyzed. This information is important for the particular change of characterized properties for a necessary application behavior.

Keyword, Tailored forming, Residual stress, Laser hot-wire cladding, Deep rolling, Cross-wedge rolling, Hybrid components

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Design optimization with further developed torque performance of another flux-intensifying PMSM involving multilayer boundaries for solar water pumps

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A novel flux-intensifying interior (FII) permanent magnet synchronous motor (PMSM) in view of multi-facet barriers in rotor structure with further developed torque execution for sun oriented water siphon framework is proposed here. The conventional interior (CI) PMSM produces most extreme absolute torque on utilization of negative current along d-axis, bringing about an addition of demagnetization plausibility of permanent magnets (PMs). In spite of the fact that flux-intensifying PMSMs settle this issue, their hesitance torque is lower because of the diminished saliency distinction. This issue is tackled by the presented FII-PMSM, which produces higher hesitance torque through uniquely designed barriers. Two kinds of barriers tobe specific, inner and outer cutoff barriers are designed in rotor along quadrature axis. The inner barriers acknowledge flux-intensifying impact while the outer cutoff barriers increment the saliency distinction and thus the hesitance torque. Furthermore, the components of barriers are streamlined by utilizing parametric optimization to amplify saliency contrast and minimize torque ripples. The limited component techniques based electromagnetic exhibitions of FII- PMSM like inductance bends, torque profiles, airgap hole flux density, back electromotive force plots, efficiency map, output power map and PM flux density are acquired and contrastedwith the CI-PMSM with show the superiority of presented motor.

Keywords, Flux-intensifying interior PMSM (FII-PMSM)Multilayer barriersPermanent magnetReluctance torqueTorque ripples

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Formability and interface design of Al/Mg/Al composite sheet rolled by hard-plate rolling (HPR)

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The most effective method to further develop the bonding skill and quality execution of heterogeneous plates has forever been one of the troublesome issues in the field of elite execution heterogeneous composite sheet shaping and assembling. In this paper, another assembling technique for heterogeneous clad plate, hard plate rolling clad plate, is proposed. The hot rolling course of Al/Mg/Al composite piece regardless of hard plate was considered. The outcomes show that the shear stress in the rolling direction (RD) can be transformed into the compressive stress in the normal direction (ND), and then, at that point, the welding strainbetween various composite layers can be expanded. This strategy can stifle the bending and edge break deserts and essentially further develop the shape quality and framing skill. Simultaneously, through the investigation of the point of interaction construction of the composite plate, it tends to be realized that the metallurgical bonding can be accomplished with a little decrease in the wake of adding the hard plate. Two clear layers of Al3Mg2 and Al17Mg12 intermetallic compounds show up at the Al/Mg interface. The thickness of the dispersion layer is essentially bigger than that of the conventional hot-moved clad plate, and the thickness of the dissemination layer can reach 38 μm when the decrease is 60%. The yieldstrength is 172.3 MPa and the prolongation is 21.5%. To summarize, the hot rolling of hard- plate gives a groundbreaking plan to the framing and assembling of superior executionheterogeneous composite plate.

Keywords, Hot-rolled, Composite plate, Al/Mg/Al ,Metallurgical bonding, Joint strength

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On the extent of the stylish idea of 3D printed plastic parts

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3D printing is quite possibly the most intelligent ongoing manufacturing innovations at both design and manufacturing level. Until this point in time, the interest and association that individuals have displayed towards the likelihood to show and deliver parts without anyone else have supported the multiplication of 3D printers. In any case, an uncorrected design or a design that doesn't fit the machine capacities could prompt parts with unfortunate tasteful elements that decrease the client saw quality and the assumption for the simple client ease of use of the innovation. The reason for this paper is to approve the heartiness of the tasteful quality index (AQI) that is utilized for the assessment of the client saw quality of 3D printed parts. A particular reference part that was designed for 3D printing defects to have a high likelihood of event is viewed as delegate and incredibly huge for the stylish quality of 3D printed parts. In this work an imitation of the reference part is printed with three distinct 3D printers and assessed by nine clients. An extra copy is likewise created for consistency appraisal, and the quality assessment test was rehashed two times in multi month. The AQI marker results to be reliable and powerful over the clients and time. The proportion of the AQIand the reference part appear to be easy to use devices and may give a helpful design-aid to a prompt comprehension of the possibility of a particular design highlight in a structure of clientintelligence.

Keywords, Design for fused deposition modelling, FDM, Aesthetic quality, Polymers, 3D printing, Interactive design

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Physical modelling with trial validation of high ductility metal cutting chip formationrepresented by copper machining

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This paper resolves issues of predicting chip formation in high strain machining conditions. Atotal actual model of chip formation requires both plasticity and chip/tool friction models. Friction models are usually somewhat phenomenological, with friction coefficients estimated from the conditions where the models are applied. This paper's proposition is that friction risesout of the plastic reaction of the chip material in touch with the cutting tool. Very huge strains are produced in the contact district. On account of machining highly ductile metals huge strainslikewise happen in the main part of the chip. This paper applies a Mechanical Engineering Threshold Stress plasticity model reached out to high strains (equivalent strains >5) torecreating chip formation in copper machining, without expecting estimated upsides of frictioncoefficients. On account of copper machining there is certainly not a brought together wellspring of exploratory information against which to approve simulations. There is a need togive such a source. This paper reports broad outcomes from machining three coppers in everyday designing conditions. At all cutting rates there stays an orderly distinction between the recreated and exploratory chip thicknesses. Likewise, at low cutting velocities a trial perception is that chip formation cycles among low and high thicknesses. The simulations don't foresee this. The examinations show the cycling to happen when the chip thickness ascends toat least multiple times the whole thickness. It is guessed with some proof that the cycling is related with plastic disappointment instead of with strain solidifying, as is presently regularly given as the clarification. Demonstrating huge strain plasticity and disappointment of highly ductile metals, for metal machining simulations, stays inadequate.

Keywords, Metal machining,Mechanical Engineering threshold stress model, Friction model,Force measurement ,Chip thickness measurement ,Hardness testing

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Synthesis and Mechanical Engineering Behavior of Bi-directional Woven E-glass Fibereinforcement Filled with Aluminum Oxide/Silicon Carbide Epoxy Polymer Compositesare a type of composite made of epoxy resin and polymer

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The examination paper depicts the improvement of another arrangement of polymer composites from Epoxy. The polymer lattice composite (PMC) involves epoxy tar (LY 556), E-glass fiber as a supported material and Alumina and silicon carbide as filler material. The epoxy tar (LY 556) and hardener (HY951) were blended at 10:1 at room temperature. It is integrated by various weight rate of aluminum oxide/silicon carbide (1:1) (0, 2, 4 and 6 wt%).The testing incorporates the examinations of Mechanical Engineering properties in elastic and flexural mode. It is noticed from explore work that 4 wt% aluminum oxide-silicon carbide filled glass fiber supported epoxy composite example have ideal Mechanical Engineering properties. It includes yield strength (102.56 MPa), malleable modulus (4167.85 MPa), ductile extreme strength (170.839 MPa), flexural strength (162.5515 MPa) and flexural modulus (10736.4287 MPa), which is expected in all broad application regions where the epoxy-based composites are unmistakably utilized like — auto, airplanes parts and sports merchandise.

Keywords Polymer composite · Epoxy · Alumina · Silicon carbide

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In India's Additive Manufacturing Industries, Life Cycle Assessment: Needs,Challenges, and Solutions

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Indian assembling ventures are currently more centered around the reception of new plans of action over conventional plans of action to accomplish supportability in strategic policies. Presently the enterprises are evaluating their ecological effects on advance supportability and life cycle appraisal applications. This study zeroed in on the semi-organized interview with the Indian additive assembling specialists from the Southern and northern locale of India. The review was directed on email interviews, top to bottom calls and a numerous decision poll study circled through messages. The interviewees addressed the various stakeholders in the Indian additive assembling businesses with differing information on life cycle appraisal including the additive assembling item producers, specialists for AM ventures, research establishments and the scholarly world. The specialists recommended that there is a requirement for good comprehension the various variables in additive assembling enterprises which will assist them with bringing down their fossil fuel byproducts and lead the LCA in the ventures with legitimate LCA devices and data sets accessible for additive assembling businesses. This study will be useful for the specialists and R&D in businesses to give bits of knowledge that how Indian additive assembling enterprises experience the utilization of life cycle appraisal. In the review, a few mindfulness issues are tended to which will be valuable for Indian additive assembling enterprises to extend and speed up the existence cycle evaluation applications in additive assembling ventures.

Keywords Life cycle assessment, Sustainability, Additive manufacturing, Industries, Survey, Challenges.

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Examination of Barriers in Sustainable Supply Chain Management for IndianAutomobile Industries

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The assembling businesses of India are confronting the worldwide strain to embrace the supportable store network the executives rehearses. While there are a few examinations connected with assembling businesses across the world to inspect the hindrances yet these investigations are from created countries. There are extremely less investigations which are onassembling businesses and from emerging countries. To overcome this issue, it is vital to recognize the basic obstructions which impact the execution of supportable store network the executives in the assembling ventures of India. Thusly, this study distinguishes the basic boundaries in the execution of feasible production network the executives rehearses. There are complete nine basic hindrances found out after writing audit and specialists feelings from the ventures and the scholarly world. All out ten assembling ventures managing in the car areas were designated to gather the information and reactions gathered from the both scholarly community and industry. Further information is combined and AHP strategy is applied to rank the hindrances and assess the impact of the boundaries on the SSCM execution. Cost of the supportability and efficient circumstances in the assembling ventures is viewed as most affecting obstruction among every one of the boundaries. The discoveries of this study plans to help the Indian assembling ventures in the underlying manner so strategy producers and administrators from the assembling enterprises can distinguish the most impacting hindrance and work in future to dispense with that for the execution of SSCM in their strategic approaches to accomplish business greatness. Additionally, this study can be useful to the partners to accomplish the feasible advancement objective 2030.

Keywords Sustainable development · Sustainable supply chain management · Sustainable manufacturing · Manufacturing industries · Analytical hierarchy process · Barriers · India

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What We Think We Know About Machine Learning in CAD/CAM and What We Don't

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Improvement in assembling exercises has moved the ventures towards the reception of Industry 4.0 practices. Presently the enterprises are embracing key empowering advances of Industry 4.0, for example, AI and man-made brainpower in the strategic approaches and assembling exercises to lessen the human exertion and complete the client requests in the base time. The reception of CAD/CAM with the AI strategies in the plan designing has changed the market situation as well as the business drifts everywhere. Still the exploration is restricted around here. Businesses don't know about the momentum research progress around here and there is no review which has planned the examination progress of AI in CAD/CAM and the examinedhow ventures can take benefit from this innovation. This study focuses on the review planningof CAD/CAM research progress with AI in which we have examined what has been finished and what are a few regions which actually needs further exploration work. This study involvesthe Scopus data set for the bibliographic information assortment and bibliometrix R bundle forthe investigation of information.

Keywords Computer aided manufacturing · Computer aided design · Machine learning · Industry 4.0 · Bibliometrics · Bibliometric analysis

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Evaluation of Traditional and Hybrid Controllers for Robotic Manipulator Control

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Controlling of robot has consistently turned into a critical work for engineers these controllers were appeared beginning around 1950, when a PID controller was utilized to control complexframeworks the construction of this controller was exceptionally simple to plan and has consistently stay a most famous controller in the business in view of its clarity and minimal expense. it is sufficiently adequate to deal with straight framework yet was ill suited for nonlinear framework, analysts and researcher has attempted to determine the disadvantages of PID by fuzzy logic controller which was compelling for nonlinear framework further as the year passes by new controlling methods has shown up which were all the more remarkable regarding controlling in contrast with the past ones. neuro logic controller came to deal with those frameworks which are mind boggling, exceptionally nonlinear and inadequately progressively investigated and further this controller was join with the Traditional controllers and bring about neuro PID controller and neuro Fuzzy PID controller. This paper presents a nitty gritty survey on different controlling procedures which are being utilized in the controllingof Mechanical Engineering manipulator beginning from the improvement of the main controller till now.

Keywords Controlling · Nonlinear system · Robotic manipulator first section · Traditional controller · Hybrid controller

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Techniques to Measure Residual Stresses in 3D Printed Objects: A Review

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Additive manufacturing is a quickly developing manufacturing strategy utilized in manufacturing objects because of its exact outcomes and complex shapes can be made with accuracy. Remaining burdens are the peril to this strategy which influences the Mechanical Engineering properties and state of the article to that end it is basic to quantify the lingering pressure present in the AM part to expand the unwavering quality of the article. These anxieties can cause the strength disappointment and other related disappointments of the article. Likewise on the off chance that lingering stresses are not eliminated from the item, the article isn't adjusted and can be fitted appropriately. This paper plans to place different techniques ina single spot to gauge remaining pressure in a 3D printed object.

Keywords 3D printing · Additive manufacturing · Neutron diffraction method · Non-destructive testing · Semi-destructive testing · X-ray diffraction method

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An Evolutionary Tomographic Reconstruction Procedure for Identifying Defects UsingUltrasound Time-of-Flight

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Primary respectability of designing materials is impacted by outer as well as interior imperfections. Tomographic remaking is valuable for recognition of inward imperfections in a nondestructive manner. A novel tomographic recreation method is depicted and displayed to can possibly recognize any imperfections present in a materials cross-segment. The calculationis planned in accordance with the standards of real coded genetic algorithms (RCGA). The proposed calculation doesn't need the client to enter definite trademark property of material imperfections thought to be available in the material cross-segment being analyzed. The calculation works its direction with some limited scope of the trademark property as information. Consequences of a few mathematical investigations exhibit the viability ofproposed RCGA based recreation technique.

Keywords Non-destructive testing · Tomographic reconstruction · Real coded genetic algorithms · Time-of-flight of ultrasound

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Grain Refinement of the AA6XXX Series Using Equal Channel Angular Pressing: DieDesign and Parameters

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Essential need of industry is to have a material with less weight and high strength. There are number of strategies to improve Mechanical Engineering properties and microstructure, among which equal channel angular pressing is viewed as best method. Equal Channel Angular Pressing (ECAP) is one of the popular grain refinement methods of extreme plastic disfigurement. For this interaction the pass on assumes a significant part. Factors like corner point, channel point, erosion, number of passes, courses, back pressure and a lot more might influence the consequences of the interaction. In the ongoing concentrate every one of the boundaries for the ECAP cycle impacting the Mechanical Engineering properties for the AA6XXX series has been assessed and examined for the better end. For the most part ECAP passed materials have better Mechanical Engineering, microstructure and actual properties. Two fundamental alloying components for the 6000 series are Si and Mg. AA6xxx is known for its straightforwardness in plan, high solidarity to weight proportion, impervious to consumption, versatility and has different applications, for example, they are utilized in aircraft, automobile, defense, medical applications and so on.

Keywords Equal channel angular pressing · Plastic deformation homogeneity · Die design · Fabrication · corner angle

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Using the interpretive structural modellingApproach to Analyze the Drivers of Leanand Green Manufacturing

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Client mindfulness towards the maintainability, natural execution and government approacheshave authorized the assembling firms to carry out best strategies and practices to satisfy clientassumptions. In this review, the drivers for lean and green assembling have broke down whichwill assist the associations with lessening the waste outflows, work on the natural execution and increment the benefit. A sum of sixteen drivers are recognized from the writing and talkedwith specialists' group for additional review. These drivers are additionally broke down with interpretive structural demonstrating (ISM) way to deal with see the relationship among drivers. The review shows that cost decrease, expansion in piece of the pie, government supportand sufficient innovation advancement are the critical drivers for the lean and green assembling. Eventually, paper closes the review for certain ramifications. These ramificationswill direct the administration and policymakers to zero in on the fundamental drivers for lean and green execution in the assembling business.

Keywords Lean manufacturing · Green manufacturing · Drivers · Interpretive structure modelling · MICMAC analysis

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Sustainable Manufacturing Enablers' Quantifiable Contribution in Indian SMEs

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The expense imperatives are higher similarly for Small and Medium Enterprises (SMEs) in India. Considering repeating cutthroat improvements in item interest, plan, values, life cycle and expanding climate and government rules, SMEs are expected to design the assembling on practical premise as to stay in business for long run. In this study we have thought about twelve significant empowering agents for SMEs. We have shortlisted the empowering agents after part of writing survey and afterward they are portray into four aspects thinking about well- qualified's perspective. Creator expects that these distinguished significant empowering agentswill help the administration of SMEs in India to design their business on supportable premise as to stay cutthroat feasible and developing.

Keywords Sustainable manufacturing (SM) · Small and medium enterprises (SMEs) ·Enablers · Analytical hierarchy process (AHP)

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Injection Timing Optimization for a C.I. Engine Using Gomutra Emulsified Diesel

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High temperatures conditions are liable for smoke and NOx emis sions in pressure start motors. Utilization of water emulsified diesel fuel works with low-temperature burning of diesel whichis viewed as an unmistakable choice for discharge decrease. Adjusting to this innovation, gomutra emulsified diesel (GMD) fuel has been tried in this examination for further developedresults. The exploratory review has been performed on a fixed, consistent rpm, direct-injection

C.I. motor. 15% gomutra emulsified diesel with 4% emulsifier was used for streamlining of the injection timing with GMD emulsions. The impact of injection timing at different IT 19º, 21º, 23º and 25º btdc was then investigated. It was seen that hindrance by 2º btdc, for exampleat IT 21 motor execution got improved with lower diesel thump. It was seen that the BTE wasworked on up to 24.2% at IT 21º btdc when contrasted with 23.9% at IT 23º btdc. Furthermore,NOx was likewise observed to be decreased extensively. By and large, it is presumed that the presentation of motor with emulsion fuel could be improved by impeding the fuel injection timing.

Keywords Water · Emulsion · Gomutra · Cow-urine · Emissions · Injection Time

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A Bibliometric Review of the Circular Economy and Sustainable Manufacturing

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By the appearance of the fourth modern upset generally change utilizing shrewd designing and computerized change has changed the creation framework. Presently all gadgets are outfitted with computerization and AI which has turned into a need the majority of enterprises. There is a need of address the chance of feasible assembling. This will assist with accomplishing the supportability 2030 objectives. This study guides to expect to distinguish that how manageableassembling is research is contributing in the exploration of round economy. In this study planning different execution lattices removed and top diaries, top useful creators and profoundly refered to papers top catchphrases and are assessed. This paper sums up the maintainable assembling in roundabout economy during the year 2015-2020 and gives the future examination scope on the premise concentrate on planning.

Keywords Circular economy · Sustainable manufacturing · Bibliometric analysis · R studio

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Machine learning algorithms benchmarking for constant shortcoming predictablescheduling on a shop floor

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To choose a legitimate AI calculation for shortcoming unsurprising planning on a shop floor, ten calculations in the AI field have been chosen, carried out and looked at in this examination. Because of the absence of material genuine information to the creators, an information age technique is proposed as far as information intricacy, number of information credits and information profundity. On top of the strategy, six datasets are created by choosing three-levelinformation credits and three-level information profundities, which were utilized to prepare theten calculations. The exhibitions of the calculations are assessed by considering three lists including, preparing precision, testing time and preparing time. The outcomes show that credulous Bayes classifier is reasonable to low-intricacy information and that convolutional brain organization and profound conviction network fit well in high-intricacy information, likethe genuine information.

Keywords: machine learning; benchmarking; fault prediction; scheduling.

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Impacts of injection forming parameters on pattern execution of in-shape improvingitem

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Because of the beautifying patterns of in-shape decoration (IMD) items that effectively tumbles off and worn, the impacts of injection molding parameters on the film wear execution and thebonding strength were investigated in light of the Taguchi symmetrical test technique in this paper. Polyethylene terephthalate (PET) films with printed patterns were bonding with injected PC/ABS plastics substrate plates through various processing parameters. Research results showthat the liquefy temperature has the main influence to the wear execution of the hardening layerand the pattern layer. Be that as it may, the holding pressure dominates the bonding strength between pattern layer and substrate. With the increase of the dissolve temperature, the wear execution of the pattern increases altogether yet the film bonding strength diminishes. The rough obstruction changes alongside the processing parameters, however doesn't submit to similar standards. It upgrades fundamentally as the dissolve temperature is raised, however increases first and afterward diminishes as the injection time is stretched out, while diminishesquickly while the holding time endures excessively lengthy. The bonding strength progressively diminishes with the raised liquefy temperature, notwithstanding, increases with the injection time. However, by and large the injection molding parameters significantly affectthe bonding strength

Keywords: in-mould decorative; processing parameters; wear performance.

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Integrating FEM and NSGA-II to achieve multi-objective optimisation of friction stirwelding parameters

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In this examination, the friction stir welding (FSW) boundaries were streamlined by coordinating the limited component examination and non-overwhelmed arranging hereditary calculation II. A thermo-Mechanical Engineering limited component model to foresee the pinnacle temperature and stream stresses during welding were created utilizing Hyper Weld® FEM device. The legitimacy of the FE model was approved through exploratory outcomes. Utilizing the approved FE model the cycle responses were anticipated for changing states of welding speed, device rotational speed, slant point, and shoulder width as per the plan of examinations. The quadratic models for the cycle responses were hypothesized utilizing response surface technique and their sufficiency was confirmed through investigation of fluctuation. The issue was treated as multi-response enhancement because of the clashing idea of the interaction responses and formed to amplify the pinnacle temperature and limit the stream pressure all the while. NSGA-II was then executed to determine the Pareto-ideal arrangements and revealed.

Keywords: friction stir welding; FSW; thermo-Mechanical Engineering modelling; peak temperature; flow stress; response surface methodology; multi-response optimisation; non-dominated sorting genetic algorithm-II; NSGA-II.

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Experimental and Computational Analyses of Structural and Mechanical EngineeringDeviations in Magnesium Alloy Manufacturing with Selective Laser Melting

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Presently, the expected utilization of selective laser melting (SLM) innovation to create and streamline the exhibition of human bone inserts with functionally graded scaffold (FGS) structures has drawn a rising measure of consideration. Magnesium composite is a top notch light metal that shows great likely in bioengineering; hence, it is picked in this review. In any case, the imperfections that happen in magnesium during assembling might create startling Mechanical Engineering contrasts between the items and the best items, so there is a need to decide a proficient method for displaying real items. In this article, tests were fabricated with various laser energy densities and exposed to pressure tests. The arrangement of circular imperfections was examined by the rule of added substance fabricating. Subsequently, in viewof the noticed attributes, finite element (FE) models with various calculations were assembled,and changes in the pressure dispersion during pressure were talked about. By looking at the Mechanical Engineering properties acquired from pressure tests and FE demonstrating, the reproduction exactness of each model was additionally assessed, from which the model that featured the stacking relationship was eminent. Additionally, the extended Hertzian contact pressure hypothesis checked the impact of circular deformities on the compressive way of behaving of the example. The exactness of the FE results was clearly improved by amending the same bearing region.

Keywords, Selective laser melting, AZ91D, Compression performance ,Finite element analyses, Deviations

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Streamlining and expectation of hardness, wear and surface roughness on age solidifiedstellite 6 alloys

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Developing interest for Stellite 6 alloys because of its appealing properties such as superior strength, toughness, wear resistance, crack resistant characteristics, and their excellent resistance to corrosion has made them material in industrial as well as business applications, such as aerospace industries, nuclear waste storage, automobile industries and surgical implantation. In any case, in spite of these applications, auto part manufacturers principally (Bearing Materials) are searching for a comprehensive study, such as mechanics of grating and the relationship among contact and wear. Consequently in this paper, an endeavor has been made to study the tribological conduct such as wear portrayal and surface roughness old enoughsolidified Stellite 6 alloys. The primary goal of the research is to decide the positive tribological conditions for further developing wear resistant properties and surface roughness on age solidified Stellite 6 alloys. Subsequently two body wear study and surface roughness study during Wire Electric Discharge Machining (WEDM) old enough solidified Stellite 6 alloys based on Analysis of Variance (ANOVA), Taguchi's Design of Experiment (TDOE), Response Surface Methodology(RSM) and Desirability Functional Analysis (DFA) have been used to accomplish this objective. From the study it is observed that ideal values for further developing hardness, wear and surface roughness values can be easily accomplished with less time and cost by embracing the said techniques. •From microstructural observation, as the pinnacle flowincreases there is bigger measure of dendritic carbides and breaking of carbides because of high plastic distortion resulting in warm softening of Stellite 6 composite during wire electric discharge machining resulting in better surface roughness values. The second-request model for hardness, wear and surface roughness using response surface system can be taken on for anticipating for hardness, wear and surface roughness in any experimental area.

Key words: Stellite 6 alloys / hardness / wear / surface roughness / WEDM / ANOVA / TDOE
/ RSM / DFA

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Energy Auditing of Thermal Boundary Conditions Using an Extended Rosenthal'sModel for Laser Powder-Bed Fusion Additive Manufacturing

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Laser Powder-Bed Fusions (LPBF), a class of additive manufacturing (AM), is a promising method for delivering parts with complex calculation plan. Be that as it may, parts manufactured by LPBF experience the ill effects of lingering stresses emerging because of significant temperature slopes inborn to the interaction. Mathematical models can't give a thorough thermal history of the fabricated materials productively because of the confuse between the trademark length scales and tiny time steps required for complete reproductions. In the current work, a lengthy Rosenthal's model is introduced by thinking about the impacts of different intensity dispersal/utilization components. The modeling aftereffects of energy inspecting of thermal limit conditions for stainless steel (SS17-4PH) laser dissolving showed that the all out energy misfortunes by convection, radiation, and softening are under 20% among which, radiation is the most prevailing part. An examination of the outcomes got by the drawn out Rosenthal's situation with limited component mathematical expectations and trial information shows a decent understanding. Likewise, a parametric report has been directed todistinguish the impact of laser examining speed, bar sweep, and power on the general temperature dispersions and dissolve calculation. The current review can prepare for the planned utilization of this methodology to direct further examination, for example, microstructure analysis and thermo-Mechanical Engineering modeling which are expected to anticipate leftover burdens and bends.

Keywords, Rosenthal equation, Additive manufacturing, Analytical modelling, Stainless steel,Laser powder-bed fusion, Temperature distribution

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The effects of laser surface structuring on the Mechanical Engineering characteristics ofelectrodeposited ZnNi coatings on steel sheets

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The influence of laser surface structuring on the arrangement and the inward strength of electrodeposited ZnNi coatings on steel sheets was examined. Surface structuring by extended direct laser interference patterning (xDLIP) was utilized to adjust the strong strength in the ZnNi layer. A SEM examination of the gem structures shows opposite nucleation during ZnNi layer development and areas of crosslinked crystalline structures, which brings about an interlocking of gem structures inside the layer. The interlocked crystalline design prompts an increment of the firm strength in the ZnNi layer, which was seen in roller strip tests as per DIN1464 for adhesively bonded joints.

Key words: Laser structuring / ZnNi coating / layer structure / adhesive bonding / roller peel test

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Experimental Investigation of Thin Walls during Direct Metal Deposition of 316L Stainless Steel Powder and Numerical Simulation of Thermal Behavior

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Direct metal deposition (DMD) is a strategy for added substance producing in what parts are made by softening powder particles that arrive at the functioning region, layer by layer, utilizing a laser beam. Slender dividers are worked by the method for direct metal deposition (DMD) from 316L hardened steel powder. A multi-layer finite element model (FEM) is utilizedto foresee the warm cycles, most extreme temperatures, and volume of the liquid pool during DMD. The trial strategies and the reproduction processes show impacts of intensity collection with the expansion of new layers, particularly toward the start and toward the finish of each layer. The microstructure of the examples is inspected by an optical magnifying instrument. The exploratory outcomes demonstrate that microstructure has a confused structure in the external districts that are nearer to the encompassing air, and that grains fill in bunches in the inward pieces of the examples.

Keywords, Direct metal deposition, Numerical simulation, Stainless steel 316L, Microstructure, Dimensions of molten pool, Thin-wall structure

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Optimisation and prediction of surface roughness during AWJM of DRCUFP composites using a Taguchi-based fuzzy logic model

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From most recent twenty years, plant fiber reinforced polymer/polyester composites have been successfully utilized in primary and car applications. Specialists and makers are looking forward for a compelling usage of these composites. Nonetheless, regardless of the extraordinary properties as far as burden bearing limit and natural maintainability of plant fibers the take-up of these composites are restricted because of its unfortunate machinability qualities. Consequently in this paper, Taguchi based fuzzy logic model for the streamlining andexpectation of cycle yield variable, for example, surface roughness during Abrasive Water Jet Machining (AWJM) of new class of plant fiber reinforced polyester composites i.e., Discontinuously Reinforced Caryota Urens Fiber Polyester (DRCUFP) composites has been investigated. At first machining tests has been done utilizing L27 symmetrical cluster got from Taguchi Design of Experiments (TDOE). At last, Taguchi based fuzzy logic model has been produced for streamlining and expectation of surface roughness. From the broad trial and errorutilizing TDOE it was seen that the ideal cutting circumstances for getting least surface roughness esteem, water pressure (A): 300 bar, navigate speed (B): 50 mm, stand of distance:1 mm, abrasive flow rate: 12 g/s, profundity of cut (C): 5 mm and Abrasive Size:200 microns. Further from FLM, it is seen that base water pressure (A): 100 bar, navigate speed (B): 50 mm,stand of distance: 1 mm, abrasive flow rate: 8 g/s, profundity of cut (C): 5 mm and abrasive size:100 microns gave higher surface roughness values (3.47 microns) than that at most extreme water pressure (A): 300 bar, navigate speed (B): 150 mm, stand of distance: 4 mm, abrasive flow rate: 12 g/s, profundity of cut (C): 15 mm and abrasive size:200 microns the surface roughness values (3.25 microns).

Key words: DRCUFP composites / AWJM / surface roughness / TDOE / fuzzy logic model (FLM)B

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Welding of magnesium and related alloys: an overview of techniques and processparameters and their influence on weld Mechanical Engineering behaviour and structural integrity

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An overview of welding methods and process parameters and its effects on Mechanical Engineering behaviour and structural integrity of magnesium and its alloys are discussed. These alloys are less dense and beneficial structural alloys for improved energy efficiency, eco- friendliness and driver of circular economic model for sustainable design and innovative ecosystem. While the application of Mg-alloys is projected to increase, understanding the Mechanical Engineering behaviour and structural integrity of welded joints are critical. Thus, fusion and solid-state welding processes of these alloys are discussed with emphasis on Mechanical Engineering characterization. Laser welding is the most effective fusion welding technique for most Mg alloys whereas, the predominant solid-state method is friction stir welding. The importance of process variables such as heat inputs, welding velocity (speed) andpost weld treatments on the microstructural evolution, on Mechanical Engineering and physical properties of the distinct zones of the weld joints are described. The weldment is the most susceptible to failure due to phase transformation, defects such as microporosity and relatively coarse grain sizes after solidification. The implication of the design of quality weld joints of Mg alloys are explored with areas for future research directions briefly discussed.

Key words: Welding metallurgy / magnesium and its alloys / Mechanical Engineering and microstructural characterization / fusion welding / weld defects / post weld treatment

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Examination on Laser Beam Weldability of AISI 304L Plates Based on Thermal FieldSimulation by Experimentally-Fitted Analytical Modeling

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The goal of the work is to introduce another way to deal with the simulation of the thermal field in laser beam welding, in light of a tentatively fitted scientific model, applied to research the weldability of AISI 304L austenitic steel. Reference is made to the welding preliminary in a solitary pass of two 10 mm thick butt-situated plates. Welding was performed under the keyhole full entrance mode, which is normal for high-power laser beam, and reproduced by a scientific model in light of a multipoint-line thermal source framework and fitted on the trial combination zone profile. The model was applied to reenact the impacts of welding speed changes on thermal fields and cooling rates, to decide what they can mean for the weld structure, the hardening mode and the conceivable development of a sharpened zone in the intensity impacted zone. A breaking point benefit of welding speed, which permits the weld development without absence of combination, was distinguished. For all the welding speeds considered, the development of a sharpened zone can be barred. The commitment of welding speed on cooling rate, not huge close to the welding pivot, results to be determinant at the limitof the melded zone with base metal. The consolidated decision of the filler material and the welding speed, which in all cases brings about essential ferrite hardening modes, influences the substance of remaining ferrite, which should be adjusted to improve the protection from cementing breaking, keeping away from the unfavorable impacts because of too high items. Asan end, the model ends up being a substantial help in exploring the thermal impacts, which result from the arrangement of welding boundaries, on the weldability of the base metal-filler framework.

Keywords, Laser beam welding, Analytical modelling, Cooling rate, Weldability, AISI 304L steel.

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Experimental Investigation and Optimization of Wall Deflection and Material Removalrate in Milling thin-wall Parts

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The selection of optimal process parameters is essential while machining thin-wall parts sinceit influences the quality of the product and affects productivity. Dimensional accuracy affects the product quality, whereas the material removal rate alters the process productivity. Therefore, the study investigated the effect of tool diameter, feed per tooth, axial and radial depth of cut on wall deflection, and material removal rate. The selected process parameters were found to significantly influence the in-process deflection and thickness deviation due to the generation of unfavorable cutting forces. Further, an increase in the material removal rate resulted in chatter, thus adversely affecting the surface quality during the final stages of machining. Considering the conflicting nature of the two performance measures, Non- dominated Sorting Genetic Algorithm-II was adopted to solve the multi-objective optimization problem. The developed model could predict the optimal combination of process variables needed to lower the in-process wall deflection and maintain a superior surface finish while maintaining a steady material removal rate.

Key words: Thin–wall milling / part deflection / material removal rate / aluminum alloy 2024-T351 / surface roughness / multi-objective optimization / NSGA-II

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Mechanical Engineering and damping behaviour of Al-Zn-based compositessupplemented with Cu and SiC particles

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The structural characteristics, Mechanical Engineering and damping properties of stir-cast Al- 10 wt.% Zn based composites developed using 6 and 8 wt.% Cu, and 8 wt.% SiC particles as reinforcements, were investigated. The low porosity (<4%), near absence of dissolved Cu in the Al-Zn matrix, and marginal presence of melt reaction-induced intermetallic phases, attest to the soundness of the castings. Besides hardness, the strength parameters − ultimate tensile strength (149.33 MPa and 138.64 MPa) and specific strength (54.3 MPa cm^3 g^{-1} and 51.16 MPa cm^3 g^{-1}) − of the Al-Zn composites reinforced with 6 and 8 wt.% Cu, were superior to that of the unreinforced Al-Zn alloy (103.47 MPa) and the 8 wt.% SiC reinforced composite(130.5 MPa). The fracture toughness (17.32 MPa $m^{1/2}$ and 13.66 MPa $m^{1/2}$) and percentage elongation (15% and 12.5%) of the 6 and 8 wt.% Cu reinforced Al-Zn composites, also surpassed that reinforced with SiC (K_{IC} − 12.28 MPa $m^{1/2}$; % ε_f − 9.5%). Improved matrix/particles interphase bonding and the inherent ductile and tough nature of Cu over SiC, were cited responsible for the improved strength-ductility-toughness balance of the Al-Zn/Cu composites over that reinforced with SiC. The damping properties were generally temperature sensitive, with all compositions exhibiting increase in damping capacity at test temperatures 100–200 °C.

Keywords: Al-Zn/Cu_p composite / interface bonding / metallic reinforcement / Mechanical Engineering properties / damping capacity / microstructure

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Additive Manufacturing Towards Product Production: A Bibliometric Analysis

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Additively manufactured products offer extensive variety to consumers than many forms of production. Additive manufacturing (AM) production system allows consumer involvement, which has created a huge but largely untapped market. However, there is a gap between production and the market. Therefore, AM towards product production which focuses on the Commercialization of Additive Manufactured Products (CAMPs) is imperative. Despite the importance of CAMP, specific focus of research on the commercialization of additively manufactured products are scanty. There is also a lack of knowledge about the conceptual structure, intellectual structure, research trends, and the thematic structure of CAMP research. To contribute to this stream of research, this study takes an exploratory dimension by conducting a bibliometric analysis of publications on the CAMP. The R package and its associated biblioshiny were the software used. The study reveals that studies on CAMP started in 2007 with renewed interest starting from 2012. Importantly, it was found that the most cited articles focused on the economic potential of AM products in the home and specific industries. Also, there is an increasing focus on the business models that are necessary for the commercialisation of AM products. Generally, there is a shift in focus from the firm to the market. However, this is a niche area and requires more attention. Themes such as commercialization are just emerging, and researchers need to devote more time and effort to the consumer side of the commercialization of AM products.

Keywords: Commercialization / 3D printing / additive manufacturing / bibliometrics / intellectual structure / conceptual structure / content analysis / market

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Multi-models decision making under the MARCOS technique and the weighting strategies: applied to processing, crushing and turning processes

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The efficiency of cutting machining methods is generally evaluated through many parameters such as surface roughness, material removal rate, cutting force, etc. A machining process is considered highly efficient when it meets the requirements for these parameters, such as ensuring small surface roughness, high material removal rate, or small cutting force, etc. However, for each specific machining condition, sometimes the objective functions give contradictory requirements. In this case, it is necessary to implement multi-criteria decision making, i.e., make a decision to ensure harmonization of all required objectives. In this paper, a multi-criteria decision-making study is presented for three common machining methods: milling, grinding, and turning. In each machining method, the weights of the criteria were determined by four different methods, including Equal weight, *ROC* weight, *RS* weight and Entropy weight. The *MARCOS* method was applied for multi-criteria decision making. The best alternative was found to be the same as the weights were determined using the Equal weight and Entropy weight methods. In the remaining two weighting methods, the best alternative found depends on the order where the criteria were arranged, not these methods themselves. Direction for further research has been suggested in this study as well.

Key words: Multi-criteria decision making / MARCOS method / multi-criteria / weight

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Late advances in tribological conduct of practically evaluated composites: A review

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The tribological execution of functionally graded composites (FGCs) under grating and responding test conditions are surveyed, from the various investigations performed throughoutrecent many years. FGCs created contrasting wear investigation patterns under differing process conditions and boundaries. An overall system recognizing the cycle boundaries as wellas surveying the wear execution through wear modes and instruments is introduced. The tribo-framework material misfortune is decreased by upgrading the cycle boundaries autonomously, for explicit designing applications relying upon the modern requests. Besides, the various difficulties looked during wear examination were talked about and their possibilities in different logical and Mechanical Engineering fields are tended to.

Keywords, Functionally graded composites Abrasive wear Reciprocating wear Aluminium WearMechanism

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Surface morphology and optical properties of Ca and Mn doped TiO2 nano-organizedthin flims

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This study was led to explore the effect of Calcium (Ca) and Manganese (Mn) dopants on the optical and surface properties of Titanium dioxide (TiO2) nanomaterial. Ca and Mn doped TiO2 slender movies were created by sol-gel turn covering method. By keeping the doping proportion of Ca consistent, Mn was doped at the proportions of 1, 3, and 5%. The morphological, primary and optical properties of the created tests were taken by Atomic Force Microscope (AFM), Scanning Electron Microscope (SEM), Energy Dispersive X-Ray Analysis (EDX), X-Ray Diffraction Method (XRD) and UV-VIS spectroscopy. AFM and SEM analysis uncovered that the morphological properties of TiO2 changed relying upon the expansion in doping proportion of Mn. XRD values got from the examples showed that the increments of crystallite size with manganese particles doping into the TiO2 the optical band hole of the examples expanded with Ca and Mn dopants. Because of the examinations, it was resolved that Mn doping fundamentally affects the morphological and optical properties of TiO2 films and the created tests can be utilized in straightforward conductive cathode applications, optoelectronic gadgets, and sensor creation.

Keywords, TiO2Ca-MnThin filmSol gel-spin coatingNanomaterials

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Opposition end adjustment variable of microperforated board made utilizing additivemanufacturing

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Creation of microperforated panel (MPP) utilizing an additive manufacturing (AM) process delivered defective holes with an unpredictable shape, conflicting size, and unpleasant inwardsurface (because of burr arrangement). This defective opening condition prompts a critical deviation among estimated and displayed acoustic properties. This study intends to present the opposition end revision factor (α) for measuring this deviation. The MPP model's ongoing advancement avoids the unpredictable and conflicting openings from the real MPP. The superior opposition end revision factor (α) is resolved in view of the genuine MPP tests. The MPP's acoustic properties created utilizing AM process (3D Printing - PolyJet technology) areestimated. The better opposition end revision factor (α) is introduced in surface plots for various mathematical boundaries, hole width (d), plate thickness (t), and hole proportion (σ). The interjection technique is utilized to anticipate the "" esteem in light of the surface plot. Thebetter relative acoustic obstruction an incentive for the genuine MPP test with defective hole condition (with recorded least opening roundness esteem at 0.207) is determined utilizing the anticipated " α " esteem. Near results showed that the better relative acoustic opposition decidedin view of the added " α " concurred well with the trial estimation results. The relationship coefficient for every correlation shifted from 0.885 to 0.987. This finding is superior to looking at determined relative acoustic obstruction values by utilizing Maa's hypothesis and other MPP models with various proposed opposition end adjustment factors (α). Subsequently, the proposed method can mirror the defective hole condition in real MPP tests.

Keywords, Sound absorption, Micro-perforated panel, Additive manufacturing, Resistance endcorrection factor, Interpolation method.

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Evaluation of machine learning methods in predicting optimum tensile strength ofmicrowave post-cured composite tailored for weight-sensitive applications

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The study evaluated the performance of various machine learning methods in predicting tensile strength of microwave post-cured composite tailored for weight-sensitive applications. Using forty six training data pairs from the Box-Behnken design plan, an Adaptive Network-based Fuzzy Inference System (ANFIS) and Artificial Neural Networks (ANN) were built to predict the optimum tensile strength of polyurethane wood ash composite. Numerical optimization wasdone using the graft of ANFIS-MOGA method. The process control factors considered were particle size, curing time, power level, volume fraction and curing angle. The predictive accuracy of the evaluated machine learning methods were assessed using Coefficient of Determination (R2), Root Mean Square Error (RMSE), Mean Average Error (MAE) and Standard Error of Prediction (SEP). RSM (RMSE = 0.0339, MAE = 0.0002, SEP = 0.0295, R2 = 0.994) and ANFIS (RMSE = 0.0307, MAE = 0.0098, SEP = 0.0267, R2 = 0.995) models

gave higher degree of accuracy than ANN model (RMSE = 0.0827, MAE = 0.0124, SEP = 0.0719, R2 = 0.988). The optimization exercise gave optimal tensile strength of 2.27 MPa at optimum process setting of 177µm particle size, 33 min of curing time, power level at411 Watt, 42% volume fraction and 11° curing angle. Complementary trial at the named optimum process setting conveyed workable results. Furthermore, selecting microwave post- cured composite for weight-sensitive applications was justified considering that the desirability factor for polyurethane (42% wood ash) is fairly higher than other material in the same class, this points to the fact that deployment of the microwave post-cured composite in weigh- sensitive applications could benefit weight reduction.

Keywords, Microwave, ANFIS, ANN, RSM, Optimization

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Impact of Rotation Speed and Steel Microstructure on Joint Formation in Al Alloy toDP Steel Friction Stir Spot Welding

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In this work, friction stir spot welding of 5754 aluminum alloy to dual phase steel was investigated using two different ratios of martensite and ferrite (0.38 and 0.61) for steel sheet initial microstructure and varying tool rotation speed (800, 1200 and 2000 rpm). The effect of these parameters on the joint formation was evaluated by studying the plunging force responseduring the process and the main characteristics of the joint at (i) macrolevel, i.e., hook morphology and bond width, and (ii) microlevel, i.e., steel hook and sheet microstructure and intermetallic compounds. The plunging force was reduced by increased tool rotation speed while there was no significant effect from the initial steel microstructure ratio of martensite and ferrite on the plunging force. The macrostructural characterization of the joints showed that the hook morphology and bond width were affected by the steel sheet initial microstructures as well as by the tool rotation speed and by the material flow driver; tool pin or shoulder. At microstructural level, a progressive variation in the ratio of martensite and ferrite was observed for the steel hook and sheet microstructure. The zones closer to the tool presented a fully martensitic microstructure while the zones away from the tool showed a gradual increase in the ferrite amount until reaching the ratio of ferrite and martensite of the steel sheet initial microstructure. Different types of FexAly intermetallic compounds were found in three zones of the joint; the hook tips, in the hooks close to the exit hole and in the corner of the exit hole. These compounds were characterized by a brittle behavior with hardnessvalues varying from 456 to 937 HV01.

Keywords*:* friction stir spot welding; material flow; dissimilar; dual-phase steel; hook characteristic; intermetallic compounds

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Mathematical and Experimental Study of AlSi Coating Effect on Nugget Size Growth inResistance Spot Welding of Hot-Stamped Boron Steels

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In recent years, increasing automotive safety by improving crashworthiness has been a focal point in the automotive industry, employing high-strength steel such as press hardenable steel(PHS). In addition to the improved strength of individual parts in the body of the vehicle, the strength of the resistance-spot-welded joints of these parts is highly important to obtain a safestructure. In general, dimensions of weld nuggets are regarded as one of the criteria for the quality of spot-welded joints. In the presented research, a three-dimensional axisymmetric finite element model is developed to predict the nugget formation in resistance spot welding (RSW) of two types of PHS: the uncoated and AlSi-coated 1.8 mm boron steel after hot stamping. A fully coupled electro-thermo-Mechanical Engineering analysis was conducted using the commercial software package Abaqus. The FE predicted weld nugget development is compared with experimental results. The computed weld nugget sizes show good agreementwith experimental values.

Keywords*:* hot stamping; resistance spot welding; AlSi coating; nugget size; coupled electro- thermo-Mechanical Engineering analysis

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Expectation of Shearing and Plowing Constants in Milling of Inconel 718

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The present study proposes an integrated prediction model for both shearing and ploughing constants for the peripheral milling of Inconel 718 by using a preidentified mean normal friction coefficient. An equation is presented for the identification of normal mean friction angle of oblique cutting in milling. A simplified oblique cutting model is adopted for obtainingthe shear strain and shearing constants for a tool of given helix angle, radial rake angle, and honed edge radius. The shearing and ploughing constants predicted from analytical model using the Merchant's shear angle formula and the shear flow stress from the selected Johnson–Cook material law are shown to be consistent with the experimental results. The experimentally identified normal friction angles and shearing and edge ploughing constants for the Inconel 718 milling process are demonstrated to have approximately constant values irrespective of the average chip thickness. Moreover, the predicted forces obtained in milling aged Inconel 718 alloy are in good agreement with the experimental force measurements reported in the literature. Without considering the thermal–Mechanical Engineering coupling effect in the material law, the presented model is demonstrated to work well for milling of both annealed and aged Inconel 718.

Keywords: milling; friction coefficient; shearing constants; ploughing constants; Inconel 718

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Advancement of Thin Walls with Sharp Corners in SS316L and IN718 AlloysManufactured with Laser Metal Deposition

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In this work, the manufacture of thin walls with sharp corners has been optimized by adjustingthe limits of a 3-axis cartesian kinematics through data recorded and analyzed off-line, such as axis speed, acceleration and the positioning of the X and Y axes. The study was carried out with two powder materials (SS316L and IN718) using the directed energy deposition process with laser. Thin walls were obtained with 1 mm thickness and only one bead per layer and straight/sharp corners at 90°. After adjusting the in-position parameter G502 for positioning precision on the FAGOR 8070 CNC system, it has been possible to obtain walls with minimal accumulation of material in the corner, and with practically constant layer thickness and height,with a radii of internal curvature between 0.11 and 0.24 mm for two different precision configuration. The best results have been obtained by identifying the correct balance betweenthe decrease in programmed speed and the precision in the positioning to reach the point defined as wall corner, with speed reductions of 29% for a programmed speed of 20 mm/s and 61% for a speed of 40 mm/s. The walls show minimal defects such as residual porosities, and the microstructure is adequate.

Keywords*:* additive manufacturing; laser metal deposition; thin walls; sharp corner; cartesian kinematic; FAGOR 8070 CNC

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Experiment on the performance of single slope solar still integrated with sand troughs

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Abstract: In this paper, another technique for consolidating sand box is proposed to upgrade the exhibition of a single slope solar still sun execution with 1.5 m^2 gap region. Tests are performed in mornings of the sky for 1 cm, 2 cm, and 3 cm of water levels at the bowl. The most extreme yield is gotten for 1 cm water level at 2 PM for both the instances of sun-based still with and without sandbox are 0.453 L/m^2 and 0.2 L/m^2, individually. Sun-based still gives improved yield with the low depth of water level even at less sun-oriented radiation. The water level and utilization of the sandbox expanded the vanishing rate and yield of the sun-oriented still. The still with sandbox shows the most extreme day-to-day efficiency ascent of 71.4% for 1 cm water level when saline water is utilized. For a considerable length of time of still life, the yearly expense of created unadulterated water in changed still with sandbox is determined as ₹0.801 per liter. Water level assumes a significant part in the efficiency of the sun-orientedstills. The proficiency of sun-based still with sand box at 1 cm water profundity is acquired as 65.08% though still without S.T at 1 cm water profundity is restricted to 37.9%.

Keywords: Desalination, sand trough, solar still,

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Enhancement of the Heat Dissipation Performance of a Lithium-Ion Battery ThermalManagement System with Composite phase change material /Liquid Cooling

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Abstract: An original warm administration framework was proposed in light of paraffin /extended graphite (EG) composite stage change material (CPCM) combined with fluid cooling to keep up with the temperature climb and distinction inside a positive scope of lithium-particlebatteries at a release pace of 3C. A mathematical exploration was directed by computational liquid elements to research the impacts of the battery's warm qualities at a surrounding temperature of 40 °C at different stream speeds, channels and composite phase change material with a various mass fraction of EG. Moreover, the warm way of behaving of the coordinated warm administration framework integrated thermal management system in a charge-release cycles was broke down. The outcomes demonstrate that the intensity dispersal of the battery pack is upgraded with an increment of the stream speed, yet when the stream speed is more noteworthy than 0.08 m/s, the increment of the stream speed forces little impact on additionalfurther developing intensity dissemination execution of the ITMS. The channel design of TypeI shows the ideal cooling execution at different stream speeds. Compare to with the pure paraffin change material the greatest temperature is decrease by 2.1 °C, and the temperature distinction is just 2 °C in the integrated thermal management system, with an EG of 6 wt%. On charge-release obligations, the greatest temperature and the underlying temperature are consistent at the lower fluid stream speed of 0.04 m/s, and the ITMS with an EG of 6 wt% meets the necessities for heat dispersal.

Keywords: Batter module, cpcm, Thermal performance,

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Effect of Fin Length on Magneto-Combined Convection Heat Transfer Performance ina Wavy Lid Cavity

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Abstract: In the existent review, the combination magneto-convection exchange of heat in a driven enclosure nook having vertical fins was examined mathematically. The finite element method based GWR strategy was used to the stream model's administering conditions. A parametric request was executed to survey the impact of Richardson and Hartmann numbers on stream shape and intensity expulsion highlights inside a casing. The issue's subsequent mathematical results were exhibited graphically concerning isotherms, stream lines , speed , Nusselt number, liquid temperature. Variable fin surface lengths were discovered to have a significant impact on flow building and heat line sketch. Further, it was likewise seen that a generally fin length is expected to raise the rate of heat transfer on the right cool wall at a high Richardson number. The fin can altogether increase heat removal performance rate froma enclosure to adjacent liquid.

Keywords: Lid driven cavity, fins, mixed convection,

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Nanofluid conjugate buoyant convective transport in an enclosed annular geometry

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Abstract: An upward annular setup with diversely warmed tube-shaped surfaces and even adiabatic limits is efficiently concentrated on in view of their modern applications. In this paper, we explore the impacts of form light intensity transport in water-based nanofluids with various nanoparticles like alumina, titania, or copper, and is filled in the encased annular hole.The annulus space is shaped by a thick inward chamber having a uniform high temperature, an outside round and hollow cylinder with a steady lower temperature, and thermally protected upper and lower surfaces. By exploring heat transport for a wide range of Rayleigh number, strong divider thickness, warm conductivity proportion and nanoparticle volume part, we foundthat the impact of divider thickness on warm dispersal rate along divider and connection pointenormously relies upon conductivity proportion as well as the other way around. Specifically,we reveal that the decision of nanoparticle in a nanofluid and its focus are key elements in improving the warm vehicle along the connection point. Uniquely, copper based nanofluids produces higher intensity transport among other nanoparticles, and for the scope of nanoparticle focus picked in this examination, upgraded warm dispersal along the connection point has been recognized as nanoparticle volume part is expanded. Our outcomes are relevant to pick nanofluids alongside other basic boundaries for the ideal intensity transport.

Keywords: Nano fluids, dimensional less numbers ,

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Numerical Study on Pool Boiling of Hybrid Nanofluids Using RPI Model

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Abstract: The exhibition of deionized (DI) water and cross breed nanofluids for pool bubbling from an even copper warmer under air pressure conditions is mathematically inspected in the flow study. The Eulerian conspire is taken on with a Rensselaer Polytechnic Institute (RPI) sub-bubbling model to reenact the bubbling peculiarities and foresee the intensity and mass exchange in the inside of the pool bubbling vessel. This paper endeavors to address the coefficient of the air pocket holding up time (BWTC) in the extinguishing heat transition segment as an extent of the complete intensity motion and afterward connect this coefficient tothe superheat temperature. The pool bubbling bend and pool bubbling intensity move coefficient (PBHTC) got for the current model are checked against trial information from the writing and show great understanding. Also, this work extensively examines the transient investigation of the fume volume portion forms, the fume speed vectors, and the smoothes outof water speed at various superheat temperatures. At last, for BWTC, new proposed relationships with high coefficients of assurance of 0.999, 0.932, and 0.923 are presented for DI water and 0.05 vol.% and 0.1 vol.% half breed nanofluids, individually.

Keywords: Hybrid nano fluids, heat flux , pool boiling

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Internally Switchable Thermosiphon Improvement and Evaluation

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Abstract: Heat pipes add to productive and safe thermal management of parts of various thermal management systems such as in spacecraft or consumer electronics thermal control. Heat pipes are passive heat transfer devices constituting an integral part of various thermal management systems such as in spacecraft or consumer electronics thermal control. Heat pipeslikewise structure a promising methodology for warm switches because of their high powerful warm conductivity. In this paper, a wickless copper-water heat pipe-based warm switch with an electromagnetic straight actuator is introduced. The attractively impelled movement of a plunger coordinated into the intensity pipe influences the inactive intensity transport cycle prompting a switchable intensity move. Warm estimations led to deciding the absolute warm opposition of the intensity pipe exhibit the adequacy of the warm switch. It was found that thewarm opposition of the intensity pipe was expanded by up to 53% in the off state while the intensity pipe execution in on state was not fundamentally impacted by the coordinated system.

Keywords: Heat pipe, thermosiphon,

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Nanoparticles Improve Phase Change Material Melting Performance for ThermalEnergy Storage

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Abstract: The phase change material (PCM) is proposed as a thermal energy storage unit in the current study to ensure the stability and flexibility of solar-energy-based heating and cooling systems. The effect of nanoparticles on heat transfer is taken into account in the development of a mathematical model to evaluate the PCM melting process. We investigate the role of nanoparticles (Al2O3-, copper-, and graphene-based nanofluids) in improving phase change material melting performance. The results show that natural convection dominates the flow behaviour even in the early stages of the PCM melting process due to the buoyancy effect.The melted PCM is moved upward from the lateral by high natural convection at the bottom of the annular tube, which pushes the liquid–solid interface downward. The addition of Al2O3nanoparticles at a concentration of 3% volume PCM melting performance is improved by reducing the time it takes for PCM to melt by about 15%. Higher thermal conductivity, ranging from 36 to 5000 W/m k, does not contribute to a significant improvement in the melting performance of PCMs, according to a comparison of Al2O3, copper, and graphene nanoparticles.

Keywords: Heat transfer, Energy storage, pcm

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An Experimental Study of Heat Storage and Discharge Performance, as well as anEconomic Performance Analysis of PCM storage tank

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Abstract: Solar heating technology has the benefits of being high efficiency, energy-saving, and eco friendly; however, the inconsistency of solar energy and its mismatch with thevarious characteristics of developing heat load have caused significant difficulties in solar system design and operation. In a solar hot water system, a heat storage tank is crucial. This paper proposes a flat plate PCM storage tank, develops a theoretical formulation, and conductsvalidation under variable conditions in order to improve system efficiency. Experiments showthat the phase change material takes up less than 20% of the space in the phase change materialstorage tank during the heat storage process, but it can store up to 50% of the total heat storage tank. During the discharge process, the water temperature in the ordinary tank drops by 20 degrees Celsius in 1.5 hours, and the phase change takes about 3 hours, with the water temperature remaining at 45 to 50 degrees Celsius. The heat discharge of the two water tanks was similar at night during the natural cooling process, while the temperature of the ordinary water tank decreased by 12 °C and that of the phase change water tank decreased by 7 °C. Theresults of simulating the dynamic simulation model of a composite solar phase change thermalstorage combined with an air-cooled heat pump system show that a solar heating system with a PCM storage tank saves 34% more energy than a solar heating system without a PCM storagetank. Saves 34% more energy than a solar heating system with a standard tank (SHS-without PCM), and the PCM storage tank is only 1/5 the size of a standard tank.

Keywords: Analysis , phase change material storage tank

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Pineapple (Ananas comosus) GC-MS Metabolite Profiling to Monitor Ripening-SpecificMetabolites

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Abstract: Due to its high market value and production volume, pineapple is one of the most widely cultivated tropical, non-climacteric fruits in the world. Because non-climacteric fruits do not ripen after harvest, the ripening stage at harvest is a critical factor in sensory quality and shelf life. The goal of this study was to use a metabolite profiling approach to look into metabolite changes in the pineapple ripening process. GC-MS analysis was performed on pineapple (Queen variety) samples from Indonesia. The crown, flesh, and peel parts yielded atotal of 56, 47, and 54 metabolites, respectively. Separation of samples based on ripening stages from C0–C2 (early ripening stages) to C3–C4 (late ripening stages) was observed in the principal component analysis (PCA) plot for flesh. For the flesh and peel parts, there was a clear separation based on ripening stages from C0–C2 (early ripening stages) to C3–C4 (late ripening stages), but there was no clear separation for the crown part. Furthermore, metabolites associated with the ripening stages in pineapple flesh and peel were discovered using orthogonal projection to latent structures (OPLS) analysis. This research identified potentially important metabolites linked to pineapple ripening, laying the groundwork for further researchinto the ripening process.

Keywords: pineapples, ripening, metabolomics,

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Errors in Penetrometer Measurements of Mechanical Compression Properties of AppleFruit

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Abstract: The purpose of this study was to see how the type of instrument and technique affected the firmness measurements. The FT327 Penetrometer or a texture analyzer can be usedto determine the firmness of apples. For quality control, the FT327 with 11 mm probe is a standard instrument found in orchards and cold storage units. Texture analyzers are costly and require a sophisticated laboratory environment as well as qualified laboratory personnel. There are three types of errors that can occur when using a penetrometer. The first error is non- uniform application of hand pressure during plunger penetration into the fruit, the second is penetration depth, and the third error is penetration rate. The tests for this study are being carried out in a laboratory attached to a controlled atmosphere apple storage plant in Rai, Haryana. Each lot of apples is checked for firmness when they arrive at the store. It is decided whether to store the produce or market it immediately based on minimum specifications. The firmness of apples is measured using two different methods. (a) Penetrating the instrument probe with one hand while holding fruit in the other; (b) Mounting the Penetrometer on a mechanical test stand. In comparison to the other two techniques, the results showed that using a mechanical jack with a hand lever is a better technique for checking a large number of samples accurately. With larger sizes, there was a higher measurement error. The amount of error discovered was as high as 1.5 pounds. The percentage of error with the highest percentagewas 7.5.

Keywords: Penetrometer, fruites, Mechanical properties,

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Double Corrugated Tube Performance in a Tube-In-Shell Heat Exchanger

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Abstract: The performance of double corrugated tubes used in a tube-in-shell heat exchangeris analysed and compared to that of a heat exchanger with straight tubes in this article. A turbulent flow regime was considered in the CFD (computational fluid dynamics) analysis at various mass flow rates. The double corrugated geometry has been found to have no significantimpact on the pressure drop inside the investigated heat exchanger, despite the fact that it has the potential to improve its thermal performance by up to 25%. The number of transfer units relationship also demonstrates the benefit of double corrugated tubes over straight tubes in tube-in-shell heat exchangers.

Keywords: Computational fluid dynamics, Trasfer of heat, zig- zag flow,

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Microstructured corrugated plate heat exchangers for enhanced two-phase heattransfer

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Abstract: Experimental studies were conducted on the thermohydraulic effect of the microstructure of heat transfer surfaces of plate heat exchangers. The objective of this enhancement strategy is to increase the evaporation and condensation heat transfer coefficients of the refrigerant with a vapor compression cycle to the same level as the standard single-phaseheat transfer coefficients when water is used as a secondary fluid. As a result, heat would be transferred more efficiently. During the study, titanium plates with no microstructure as well as plates with microstructures created through pressing and microstructures created with femtosecond lasers were analyzed. In the initial studies, corrugated plates segments of 380 * 380 mm were used for visualization of the microstructured plates. We measured heat transfer coefficient and pressure drop for liquid single-phase flow and for evaporation with low vapor quality ($x < 0.1$). The heat transfer coefficient of the microstructured plates decreased by up to5%, depending on the flux, but not the pressure drop. For evaporation, the heat transfer coefficient increased by about 25%, while the pressure drop remained unchanged within the measurement uncertainty range. In a second set of experiments, R134a was used with a 100 kw plate evaporator and a 150 kwplate condenser in an industrial-sized vapor compression cycle. Comparing the smooth and microstructured plates, the microstructured plates gave a very moderate increase of less than 10% in heat transfer within the condenser, but a strong increase of about 40% in the evaporator.

Keywords: Plate heat exchanger, Enhancement of heat transfer, condensation,

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Combustion and Emission Characteristics of a Four-Stroke Dual-Fuel Marine Enginewith Various Fuels

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Abstract: The effects of methane (CH4), ethane (C2H6), propane (C3H8), butane (C4H10), and dimethyl ether (DME) on the combustion and emission characteristics of a four-stroke gas- diesel dual-fuel (DF) marine engine at full load were investigated using a numerical model. To analyse the in-cylinder pressure, temperature, and emission characteristics, the AVL FIRE R2018a simulation software was used to run three-dimensional simulations of the combustion process and emission formation inside the engine cylinder in the diesel and DF modes. The simulation results matched the measured values in the engine shop test technical data very well.In comparison to the diesel mode, the simulation results showed that the DF modes had lower in-cylinder peak pressure and temperatures, as well as lower-emissionemission formations. When varying the injection timing, the engine's combustion and emission characteristics were investigated; the results revealed that using the injection timing adjustment method could further reduce NO emissions while reducing engine power. As a result, in order to address certain engine emission issues, it is necessary to weigh the advantages and disadvantages of using the injection timing adjustment strategy. The benefits of using various gas fuels as alternative fuels and the injection timing adjustment method in DF marine engines to meet the International Maritime Organization (IMO) emission regulations without the use of any emission after-treatment device were successfully analysed in this study.

Keywords: Emission, combustion, DF engine,

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Modeling Diesel Particulate Filter Differential Pressure in Marine Engines

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Abstract: To keep the engine's performance and durability, the captured particulate matter (PM) in diesel particulate filters (DPF) must be burned on a regular basis. To determine an appropriate regeneration period, the amount of PM in the filter must be monitored. The modelling parameters of the DPF for marine diesel engines were optimised using experimental data in this study to determine a suitable regeneration period for the DPF. A new DPF was usedto measure the differential pressure over the exhaust gas mass flow rate and temperature. The experimental data was used to optimise the Darcy's law modelling parameters. Finally, differential pressure data from a DPF containing PM was used to validate the model parameters. The proposed model, which is a function of the gas flow rate, temperature, and amount of collected PM, was created to simulate the differential pressure of DPFs and shows promise for use in developing regeneration logic for marine DPFs.

Keywords: Particulate matter, marine diesel engine, regneration

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Evaluation and development of a cleaner locomotive propulsion system based onalternative fuels

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Abstract: Transportation research is essential in all aspects of the transportation industry, including rail. Alternative/cleaner powering options are desperately needed for sustainable rail transportation, which can only be achieved with cleaner fuels. A proposed hybrid combined engine system combining a gas turbine and a molten carbonate fuel cell with an internal combustion engine is presented in this paper. The proposed system makes use of environmentally friendly fuels to improve engine performance while lowering carbon emissions. The hybrid combined engine is modelled and thermodynamically analysed using Aspen Plus. Hydrogen, methanol, ethanol, and dimethyl ether were chosen as alternative fuelsfor this study. The proposed powering system can produce 4200 kW, which is double the powerof an internal combustion engine, with thermal and exergetic efficiencies of 43 and 55 percent,respectively. The absorption refrigeration system's cooling load ranges between 442 and 615 kW, with maximum energetic and exergetic co-efficients of performance of 18.29 and 9.54 percent, respectively. Using alternative fuels, CO2 emissions were reduced by more than 60%.Furthermore, parametric studies in the operating pressure of the molten carbonate fuel cell (MCFC) and gas turbine are carried out (GT). The MCFC's best performance is at 200 kPa, while the GT's best performance is at 900 kPa. As a result, the hybrid combined engine can deliver high power while emitting less CO2 and delivering high performance.

Keywords: Alternative fules, Energy, Efficiency,

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A thorough examination of solid oxide fuel cells that run on a variety of promisingalternative fuels.

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Abstract: Solid oxide fuel cells (SOFCs) are promising power generation devices that are bothclean and efficient. SOFCs, unlike low-temperature fuel cells, can run on a variety of alternative fuels, including hydrocarbons, alcohols, solid carbon, and ammonia. Several excellent reviews on SOFC developments are currently available in the literature, but there isn't one dedicated to alternative fuels-fed SOFCs. The electrochemical performances and stabilitiesof SOFCs operating on various fuels are reviewed in depth in this paper. Although comparable maximum power densities to hydrogen were frequently achieved, some degradation issues caused by these fuels have an impact on SOFCs' long-term stability. As a result, degradation mechanisms are first demonstrated, followed by potential strategies for resolving degradation issues from three perspectives: thermodynamics, kinetics, and structure. Appropriate operating conditions, advanced anode materials, or optimised anode structures have been discovered to improve cell life span and performance. Furthermore, for future improvements, the remaining challenges and future prospects of SOFCs fed by each fuel are separately elaborated. In general, the new engineering designs, material developments, and current knowledge presented in this review could be helpful in the development and practical commercialization of SOFCs that usepromising alternative fuels.

Keywords: Power generation, solid oxide fuel cell, Degradation,

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Analyzie the natural convection is an enclosure with discrete heat sources on it's vertical wall

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Abstract: Natural convection occurs in a dielectric liquid called FC-75. An array of rectangular protrusions are attached to one of the enclosure's vertical walls, each representing computer chips mounted on a printed circuit board. The nominal power consumption of each chip is 0.35, 1.07, 1.65, and 2.35 W, respectively. This is identical to the values used in the experiments, which were carried out only once by the study's author. Nusselt numbers vs. Rayleigh numbers, the most important dimensionless parameters of natural convection, are shown as the results of the experiment and the numerical study. A comparison of the results demonstrated that they achieve reliable results in similar problems without the need for expensive experimental setups or time spent conducting experiments. The simulation results will be applied to similar electronic circuit designs in confined spaces.

Keywords: free convection, Transfer of heat, enclosure,

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Natural convection and exponential nonuniform wall heating of a square cavity

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Abstract: The present work numerically analyses the process of nonuniform wall heating of a square cavity and the resulting natural convection phenomenon. While the cavity's left vertical wall is exposed to a nonuniform heating source, the cavity's right opposite wall is uniformly cooled, and the remaining horizontal walls are kept adiabatic. The problem's most critical aspect is the heat transfer and mixing that occurs as a result of the triggered fluid convection through the cavity. The simulation of thermally driven flow is done using a finite element method. The method's numerical accuracy is initially justified by the benchmark results of traditional natural convection due to a constantly heated wall. Then a nonuniform wall heating system is used, with the heating position centre varying along the vertical wall as a function of a position parameter. With changing position parameter and Rayleigh number, numerical heatflows and stream flows, as well as local/average values of Nusselt number, are graphically displayed. The heat transport and mixing via natural convection are visually analysed. If the centre of heating is closer to the upper horizontal wall, it is expected that the heating position will improve heat transfer. Because of the formation of a thinner boundary layer and thermal layer as a result of nonuniform surface heating, streamlines and temperatures are redistributed. When the heating occurs near the top wall, the best heat transfer rate is obtained.

Keywords: Square cavity, free convection,

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Estimation of Heat Transfer Coefficients and Performance of Shell and Tube HeatExchangers Using Flue Gas

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Abstract: Water and air have been widely used as working fluids to evaluate the performanceof shell and tube heat exchangers (STHEs) in recent decades. The goal of this study was to estimate heat transfer coefficients and evaluate performance in a pilot-scale twisted tube-based STHE with biomass co-combustion flue gas as the working fluid. The specific heat of flue gaswas calculated using a combination of theoretical and experimental calculations. After that, a simplified model was created by combining two heat transfer methods in order to predict the overall heat transfer coefficient without having to calculate individual heat transfer coefficients and fouling factors manually. Under a variety of operating conditions, the performance of the water and trailer, as well as the heat load, effectiveness, and overall heat transfer coefficient, was examined. The specific heat of flue gas from co-combustion was found to range between
1.044 and 1.338 kJ/kgK, with specific heat increasing as flue gas temperature and excess air ratio decreased. The developed mathematical model was validated to predict the overall heat transfer coefficient with relatively small errors. The optimal conditions for space heating werefound to be a flue gas mass flow rate of 61.3–98.8 kg/h, a water flow rate of 13.7–14.1 L/min,and a parallel arrangement of two water-to-air heaters in an empty trailer. Furthermore, a lower poultry litter feeding rate reduced flue gas heat loss and increased water heat gain, while a lower water flow rate provided a lower maximum possible heat transfer rate. Furthermore, a lower poultry litter feeding rate reduced flue gas heat loss and increased water heat gain, while a lower water flow rate resulted in a lower maximum possible heat transfer rate but a higher actual heat transfer rate, allowing for a faster heat equilibrium and improved performance. This research shows how the pilot-scale STHE system can collect residual heat from flue gas whilealso laying out a systematic approach and process for assessing its performance.

Keywords: Shell and tube heat exchanger, fuel gas, OHTS

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Investigation of Glass Fiber Reinforced Epoxy–MgO Nanocomposites Electrical andThermal Performance

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Abstract: To improve the electrical and thermal performance of epoxy nanocomposites reinforced with glass fibre, different weight percentages (1, 3, and 5 wt. percent) of MgO nanofillers were used. Surface discharge and corona inception voltages measured using fluorescence and UHF methods, under both AC and DC voltage profiles, tend to improve with a 3 wt. percent increase in MgO nanofiller content. The addition of MgO nanoparticles results in a lower initial surface potential and a faster decay rate. Heterocharge formation is observedin the majority of test specimens both before and after the polarity reversal phenomena. The 3 wt. % sample had a lower electric field enhancement factor when compared to other test samples. The coefficient of thermal expansion (CTE) of glass fibre reinforced polymer (GFRP)composites decreased after MgO filler was added, with the 3 wt. percent specimen having the lowest CTE value. TGA measurements revealed that adding MgO nanofillers to the GFRP nanocomposites improved their thermal stability. In terms of electrical and thermal performance, the GFRP nanocomposite sample filled with 3 wt. percent nano-MgO outperformed the other test samples.

Keywords: Nano composites, Mgo, TGA,

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Effect of Fuel Injector Nozzle Port Shape on Mixture Gas Formation for Combustion inMicro Gas Turbine Engine Combustor

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Abstract: The aim of the research was to improve the design of the injection nozzle hole in a model MGT engine's fuel injector. To improve the mixed gas combustion efficiency in the combustion chamber, a well-mixed homogeneous gas should be formed first to speed up flamepropagation in the chamber and reach a higher combustion temperature and pressure. Four different shapes of the fuel injector's nozzle hole were designed in this study, and the mixed gas formation characteristics in the chamber were numerically analysed. The penetration, diffusivity, and amount of fuel injected were all analysed and compared to determine the best nozzle hole shape for the best combustion efficiency in the chamber. The penetration length (lp), diffusion angle (θ), and volume flow rate (Qf) of Model 3 injected fuel had the best injection characteristics for the well-mixed gas formation condition in the combustion chamber, according to the analysis results. The volume flow rate of the injected fuel in the Model 3, which directly affects the engine's output power, increased by more than 5%. This information can be used to create a sample combustor for a model gas turbine engine's combustion performance test.

Keywords: Gas turbine engine,computational fluid dynamics, efficiency,

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Near-Pseudocritical Nitrogen Heat Transfer in a Helically Coiled Tube for CryogenicEnergy Storage

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Abstract: The effects of pseudocritical conditions, buoyancy, and coil curvature on the cryogenic heat transfer phenomena of nitrogen flowing in helically coiled tubes are investigated in this paper. The ultimate goal was to create the best heat exchangers for storingliquid air energy. Heat transfer coefficients were measured in the periphery of tube cross sections to determine local heat transfer coefficients. The effects of pressure, mass flux, and heat flux on heat transfer were investigated. A dimensionless number, which denotes a ratio between the two effects, was used to interpret the dual effect of buoyancy and coil curvature on heat transfer coefficients. The heat transfer coefficients increase with increasing mass flux but decrease with decreasing pressure and heat flux, according to the findings. At fluid temperatures below the pseudocritical temperature (e.g., 146.3 °C at 35 bar), the buoyancy effect dominates heat transfer, whereas at higher temperatures, the coil curvature-induced centrifugal effect dominates. At fluid temperatures below the pseudocritical temperature, the heat transfer coefficients of the helical coil were approximately 13% lower than those of the straight tube, but the difference shrinks (6%) at higher temperatures. The reason for this is thatthe benefits of coil curvature and improved turbulent mixing on heat transfer are offset by variations in thermophysical properties and the buoyancy effect.

Keywords: Buoyancy,convective heat transfer, helical coil,

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An investigation into the use of fly ash as a reinforcement material in syntactic foamsmade of aluminium and magnesium

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Abstract: Syntactic foams outperform open-cell and closed-cell foams in the ongoing development of light-weighted materials. Syntactic foams use the least amount of material andare relatively porous among metal-based foams. One of the most serious side effects of burningfossil fuels is the formation of fly ash. Fly ash's low density, combined with the tough properties of aluminium and magnesium, can result in light-weight, high-strength syntactic foams. On the basis of ongoing investigations conducted around the world, this paper discusses the preferred characteristics, beneficial effects, and outcomes of composite syntactic foams fabricated usingfly ash as a reinforcing material within the aluminium and magnesium matrices. Inhomogeneity, sudden deleterious reactions, change in alloy chemistry, and reinforcement gradients can all be avoided by using fly ash as a reinforcement material. As a result, syntactic foams reinforced with fly ash have a wide range of applications in compressive and high- temperature environments. The impact of using fly ash in aluminium and magnesium syntactic foams on mechanical and thermal properties has been summarised, taking into account changes in alloy matrix and dimensional changes in reinforcement. Additional potential applications have been enlisted in addition to those that have already been evaluated.

Keywords: Reinforcement, properties, ASF,

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Performance of Pin Fin-Modified Surfaces with Geometrical Shape Variation in PoolBoiling Heat Transfer and Bubble Dynamics

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Abstract: The effect of the geometrical shape of the circular and rectangular pin fins on heat transfer performance and the boiling phenomenon is investigated in this paper through an experimental study. Under atmospheric pressure, a pool boiling experiment was performed inthe HFE-7100 dielectric working fluid. The heat transfer performance, as well as the capturedimages of the boiling phenomenon on the test samples, were evaluated using boiling curves and boiling heat transfer coefficients from various test cases. To understand the behaviour of the boiling physics as a result of variations in fin geometrical shape and, thus, their effect on heat transfer performance, two quantities, flow resistance and wetted perimeter, were calculated. Despite having a slightly higher flow resistance of 4% and 7%, respectively, the cooling performance of rectangular pin fins was found to be higher than that of circular pin fins. This is thought to be due to a 27 percent longer wetted perimeter, which means the nucleation site has a better chance of generating more bubbles in the same boiling surface area.The average heat transfer performances of the modified boiling surface with 196 and 144 pin fins were found to differ by up to 3.54 and 1.58 times, respectively.

Keywords: Pool boiling, properties, bubble dynamics, heat transfer

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Under magnetic excitation, the heat transfer and flow properties of Fe3O4-waternanofluids

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Abstract: Under different magnetic field intensities, volume fractions, and magnetic field directions, numerical simulations were used to investigate the heat transfer and flow characteristics of magnetic nanofluids. A turbulent model of Re-normalization group (RNG) k- ε is used to analyse the variation of thermal boundary layer and particle motion because these parameters have a significant effect on thermal hydraulic performance and the mechanism for this enhancement is not yet clear. The obtained results revealed that under a weak magnetic field, the effect of heat transfer enhancement was small, but it increased significantly under a strong magnetic field. Additionally, as the volume fractions of magnetic nanoparticles increased, the convection heat transfer coefficient increased at first, then decreased. Furthermore, the direction of the magnetic field has a significant impact on the convective heat transfer coefficient, which improves by 8% when the direction is perpendicularto the flow direction.

Keywords: Volume fraction, Magnetic field direction, heat transfer

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Heat transfer and flow behaviours of nanofluids in nanochannels: atomic insights

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Abstract: Nanofluids have been shown to be novel work fluids with superior thermophysical properties for improving micro/nanochannel heat dissipation. Using molecular dynamics simulation, we provide atomistic insights into heat transfer and flow behaviours of nanofluids in nanochannels. During the flow process in the nanochannel, nanoparticles are discovered to have suspension and deposition statements. In nanofluids, temperature development can be accelerated, and a temperature jump can occur at the wall-fluid interface. The near-wall fluid's velocity is disrupted by deposited nanoparticles. Nanofluids can promote heat transfer when compared to the base fluid, and the nanofluid with the highest nanoparticle volume concentration has the best convective heat transfer performance. It has been discovered that nanoparticles with irregular Brownian motion and spinning motion disrupt fluid flow and intensify collisions between fluid atoms, thereby improving nanofluid heat transfer. Nanoparticles deposited in the nanochannel act as nano fins, increasing heat transfer areas and disrupting near-wall fluid flow, improving convective heat transfer of nanofluids in thenanochannel.

Keywords: Heat transfer, Nano fluid, heat transfer

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Thermal conductivity in composites can be controlled by constructing thermalconduction networks

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Abstract: Thermal conduction networks formed by thermally conductive fillers are critical for composite thermal conductivity coefficients (λ). In this paper, instantaneous cooling granulation technology is used to create paraffin wax (PW) spheres of various sizes. The graphite/PW thermally conductive composites are then hot pressed after being micro-clad with graphite on their surface. The process of forming graphite thermal conduction networks at interfaces between the PW phases, as well as the effects of network density, distribution, and integrity on the λ of graphite/PW composites, are thoroughly investigated. Furthermore, a novel concept of "Density of Thermal Conduction Networks (DTCN)" is proposed to explain the λ differences between various graphite/PW composites. The graphite/PW composites' DTCN has the best value for the given graphite loading. The λ of graphite/PW composites with the same size PW spheres increases as DTCN increases. When the amount of graphite is 10%, the moulding pressure is 200 MPa, and the PW sphere size is 2.08 0.08 mm, the graphite/PW composites have the maximum λ (1.81 W/(mK), the enhancement rate per unit mass fraction (Eλ/wt) of graphite is 45, about 6 times that of pure PW (0.33 W/(mK)), and obviously higher than that of the freely dispersed R-graphite/PW composites The greater the DTCN, the more uniform the distribution and integrity of the thermal conduction networks, and thus the higher the of graphite/PW composites.

Keywords: Thermal conductivity , phase change material,

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Material Compatibility Analysis for a Thermal Energy Storage System Using PhaseChange Material

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Abstract: The suitability of stainless steel 316 L and Inconel 625 for use in a thermal energy storage (TES) system with latent heat was investigated. The phase change material was a NaCl–NaF eutectic mixture with a melting temperature of 680 °C (PCM). Containers were filled with PCM before being heated to 750 °C, and the material surface and cross-section areas were analysed after 100 and 2500 hours of high-temperature exposure. After 100 hours, there was some corrosion in both samples. After 2500 hours, neither sample had sustained significant damage. The undesirable inter-granular grain boundary attack found in SS316L samples was 1–2 m deep. An oxide complex formed on the surface of the Inconel 625 sample, preventing material dissolution. After 2500 h, the surface morphology of tested samples remained largely unchanged, but the corrosion pattern changed from a localised to a more uniform type. The corrosion depth of Inconel 625 remained around 1–2 m after 2500 h, indicating that the corrosion rate had slowed. Both materials showed good compatibility with the chosen NaF– NaCl eutectic salt, but the low corrosion activity in Inconel 625 samples indicates a performance advantage for long-term operation.

Keywords: Phase change material, molten salt, CSP,

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A hexapod robot's dimensioning is based on its ability to climb stairs.

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Abstract: The design of robot dimensions based on stair climbing is critical, but it is rarely studied for legged robots. The use of stair climbing in design is both novel and timely. The ability to climb stairs is affected by the robot dimension, which includes the leg and body dimensions. The dimension design for a novel hexapod robot is investigated in this paper. The critical problem in dimension design for leg mechanisms is dealing with interferences between the leg mechanism and the staircase. To begin, all obstructions encountered while climbing a staircase are divided into three categories. Originally, the three conditions for avoiding the three interference cases were proposed. Second, under the premise of avoiding the three interference cases, the dimension of a single leg mechanism is calculated analytically based on the staircase size. The leg mechanisms are coordinated by the robot body, which affects the ability to adjust the tilting angle when climbing a staircase. With the constraints of leg workspace, leg-staircase interferences, and the static stability margin, the body dimension is calculated analytically. Simulations and experiments are used to verify the design of a hexapodrobot climbing 35-degree and 45-degree staircases.

Keywords: Hexa pod robot, DOF,

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Multi-robot navigation is designed and evaluated using a modular functionalframework

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Abstract: We look at how to design tightly integrated control, estimation, and allocation algorithms that allow a group of robots to move together in this paper. We accomplish this byutilising a modular framework that allows us to precisely define the required functional components and, as a result, consider and compare multiple algorithmic solutions for the samemodule. Multiple spatial coordination challenges, both in simulation and in reality, are used to demonstrate the effectiveness of such a framework, utilising various distributed control laws (graph-based and behavior-based controllers). We also look into the effects of various localization and communication constraints, as well as real-time control law switching, on selected coordination metrics. Finally, we introduce additional algorithmic components to further demonstrate the framework's modularity. We discovered that defining modularity basedon functionality is a very effective way to enable algorithm benchmarking and discover possible software stack improvements while remaining agnostic to the underlying hardware and middleware resources. This is particularly useful in multi-robot systems with limited resources. Furthermore, the resulting distributed control algorithms are very robust to the noise sources and amplitudes considered, as well as the various types of challenges considered, whichis an important benefit of such a design process.

Keywords: Robot systems, multi robot, Algorithms,

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MechCleanBot is a cost-effective autonomous window cleaning robot made fromMechatronic Scrap

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Abstract: The rapid advancement of technology has resulted in a rise in the standard of living. As engineers, we must think of new, unique projects that will improve the quality and safety of our daily lives by building robots. In this paper, we present MechCleanBot, a Cost-OrientedAutonomous Window Cleaning Robot made from Mechatronic Scrap that can be used not only in the home but also in skyscrapers, offices, and other objects to clean windows without exerting any effort, without becoming tired, and in many cases without endangering anyone's life. All of this will be possible thanks to the Bluetooth module HC-06, which is designed for clear wireless communication up to 9 metres away. The Arduino Uno R3, Bluetooth HC-06, Gear motors, Motor Shield L298, Neobidium Magnet, Resistor, Servo motor SG9, and Transistor IRFZ44N were used to create this MechCleanBot. The idea of a compact robot that can clean the windows of a house or a building is quite appealing, so the main goal has been torealise the robot that can clean windows, but also to realise the robot with minimal costs of
16.06 euro, in order to be practical, to reuse e-waste, and at the same time to be environmentallyfriendly.

Keywords: Cleaning robot, Recycle, Mechatronics,

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Design of a train cleaning robot for the interior of the train carriage

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Abstract: The design of a robot platform that can collect and dispose of waste in passenger trains is described in this paper. It includes an examination of the key design considerations for success in a train environment, as well as considerations for waste manipulation in a frequently confined space. The importance of design constraints in the successful development of a traincleaning robot is examined. Three robot designs are being developed as a result of the analysis.These designs are compared to a baseline design that uses readily available parts to determine their suitability for development. One of the three designs developed uses a vacuum-powered arm similar to those used in manufacturing plants, another is based on a dustpan and brush usedin household cleaning, and the third is based on a conveyor belt. The suitability of these designs for use in the automated train carriage cleaning system is determined by a percentage. A systematic investigation is carried out using the key values and requirements that the design should meet. The conveyor belt design is found to be the most appropriate for application dueto its sustainable design and effective cleaning that can be done without the use of additional tools.

Keywords: Design of robot, cleaning robot,

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Method for maintaining consistency in a digital twin model of a CNC machine tool

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Abstract: The Digital Twin (DT) model of the Computer Numerical Control Machine Tool (CNCMT) is a carrier for complex, time-varying, coupled data of CNCMT that can theoretically provide a time-varying high-fidelity model. However, many obstacles remain in the way of its implementation. The key issue is how to implement and validate the updated DTmodel with performance attenuation. In order to address this issue, this paper investigates andproposes a model consistency retention method for the CNCMT DT model. To begin, the framework for the DT model's consistency retention method is created, which includes both digital and physical space. In this paper, the principles of data management and performance attenuation update in digital space are discussed. Then, in terms of performance attenuation update workflow for wear and other damage separately, the implementation method for consistency retention of CNCMT DT model is investigated. Finally, a case study for the creation and application of a high-fidelity test bench DT model focusing on rolling guide-rail is performed to demonstrate the proposed method's implementation flow and verify its operability and effectiveness.

Keywords: Digital twin, Rolling guide rail, CNC,

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Exploratory examination and enhancement of α-β metal at raised temperatures utilizing Taguchi approach

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Abstract: Brass is a copper-zinc alloy used in a variety of engineering applications such as gears, bearings, locks, plumbing, hinges, hose coupling valves, and so on. Due to various properties such as electrical and thermal conductivity, workability, low melting point durability, good corrosion resistance, and low friction, it is most commonly used for all types of household utensils. Tensile testing for alpha–beta brass was carried out in this study using a Universal Testing Machine (UTM). Mechanical properties such as Ultimate Tensile Strength (UTS) and Strength Coefficient (K) have been calculated using parameters such as temperature $(600,700,800)^0$C, orientation (0, 45, 90)°, and strain rate (0.1,0.01,0.001) mm/min. To determine the extent of a parameter's effect on individual execution trademarks, the ANOVA technique in taguchi robust design is used in each procedure under UTS and strength coefficient conditions. At level 1 of temperature, level 2 of orientation, and level 3 of strain rates, mechanical conductivity of brass has improved in strength coefficient and ultimate tensile strength. The obtained test data results were found to be within the acceptable range.

Keywords: UTS, Taguchi, Anova,

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Machine Learning-Based Antifraud Model For Internet Loan

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Abstract: Everyone has gone online these days. On the other hand, online fraud is on the rise.Although there are numerous methods for detecting these types of frauds, none of them are 100% accurate. This needs to be improved. Random forest and XGBOOST algorithms are usedin this study. This study detects fraud using a large public loan dataset, such as that from Lending Club. Initially, a random forest is used to fill in the missing values. The XGBoost algorithm is then used to select the most discriminating features. Such a simple and effective model could improve the use of machine learning to detect fraud in Internet loans, which wouldbe beneficial to financial engineers.

Keywords: Machine learing, Deep learning,

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Recent Developments in Bio-Inspired Fish Robot Control and Modeling

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Abstract: Bio-inspired fish robots have a number of advantages over traditional underwater vehicles, including increased efficiency, controllability, low noise, and minimal fluid disruption. As a result, they have attracted a growing amount of research attention, resulting in significant theoretical and practical progress in recent years. We present the research progress and performance characteristics of different bio-inspired robot fish, classified by propulsion method, in this review. Different types of bionic fish, like the natural fish species they mimic,have different morphological structures and hydrodynamic properties. We also choose two cutting-edge research areas: soft robotic control and multi-phase robotics. Hybrid dynamic control of soft robotic systems combines the accuracy of model-based control with theefficiency of model-free control, and is thought to be the best way to optimise the classical control model by combining multiple machine learning algorithms. When compared to ordinary bionic robot fish, multi-phase robots have a wider range of applications because theycan operate in the air or on land outside of the fluid. We summarise the benefits and challenges of soft robotic control and multi-phase robotics, guiding the development of bionic aquatic robots in the future, by introducing recent progress in related fields.

Keywords: Bionic robitcs, flow sensing,

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Shoe Manufacturing: Robot-Based Automation for the Upper and Sole

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Abstract: Because of the loud noises and hazardous working conditions, most workers avoid traditional shoe manufacturing. To implement an automated process, a robot-based shoe manufacturing system is required. (2) Objective: We propose a new robot-based shoe manufacturing automation system that includes an automatic robotic solution to replace manual upper and sole manufacturing processes. (3) Techniques: A new trajectory acquisition system with a digitizer and a shoe last turning device is proposed for the upper manufacturing process. Also presented is a method for planning the robot's tool path for roughing and cementing by industrial robot manipulators. We used an industrial robot manipulator with a 3-D scanning system and a cementing tool for the sole manufacturing process. A trajectory generation algorithm is proposed for cementing the outer and inner sides of the sole by transforming 3-D information from the sole into a 6-D robot posture. All developed systems and proposed algorithms are put through their paces on an automated production testbed, and their results are verified experimentally. According to evaluation experiments in a demonstrative production line, the proposed system and methods can be used for upper and sole manufacturing processes.

Keywords: robot based Shoe manufacturing, smart manufacturing,

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Screwdriving Gripper Modeled After Human Two-Handed Assembly

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Abstract: In traditional robot assembly methods, end-effectors must be changed or two robotarms must be operated for assembly. In this paper, we propose a screwdriving gripper that can perform all of the assembly tasks with just one robot arm. The proposed screwdriving gripper has three features: (1) it performs pick-and-place, peg-in-hole, and screwdriving tasks requiredfor assembly with a single gripper; (2) it employs a flexible link that complies with the contactforce in the environment; and (3) it employs the same joints as the pronation and supination ofthe wrist, which aid the manipulator in creating a path. To implement these features, we propose a new gripper with three fingers and 12 degrees of freedom. One finger with a roll-pitch-pitch joint configuration and a flexible link that can comply with the environment are included in the screwdriving part; this facilitates compliance based on the direction of the external force. A motor with a hex key is attached to the end of the screwdriving finger, and an insert tip is attached to the back of the motor. A prototype of the proposed screwdriving gripper is made, and an assembly strategy based on the prototype is proposed. Screwdriving task experiments with a cooperative robotic arm are used to verify the features of the proposed gripper. The experiments revealed that the screwdriving gripper can perform tasks such as pick and place, peg-in-hole, and screwdriving, which are all required for assembly.

Keywords: Gripper, assembly task, assembly robot,

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A Compliant 3PRS Parallel Manipulator Mechatronic Model

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Abstract: Because of their precision and high bandwidth, compliant mechanisms are commonly used in instrumentation and measuring devices. The mechatronic model of a compliant 3PRS parallel manipulator is developed in this paper, integrating inverse and direct kinematics, the manipulator's inverse dynamic problem, and the dynamics of the actuators and control. The kinematic problem is solved using a pseudo-rigid model of deflection in compliantrevolute and spherical joints. The principle of energy equivalence is used to solve the inverse dynamic problem. The mechatronic model can predict the bandwidth of manipulator motion inthree degrees of freedom for a given control and set of actuators, assisting in the development of the best solution. A prototype is created and tested by comparing experimental signals to those generated by the model.

Keywords: Complaint mechanisms, 3PRS Parallel kinematics,

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Design approach for a passive mechatronic vibration absorbers

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Abstract: Previous studies have shown that passive mechatronic vibration absorbers have a lot of potential. The optimal design of the electrical circuits in such devices is critical, but difficult, because existing techniques have obvious limitations: those investigating a few specific circuits leave huge possibilities unexplored; those optimising circuit impedances may result in circuitsthat are physically impossible to implement. Another issue is the need to account for device parasitic effects (e.g., transducer1 resistance) in order to ensure predicted performance accuracy this can be time-consuming, especially when experimenting with a variety of designoptions (e.g., circuits, transducers). To resolve these two issues, this paper proposes a novel design methodology that (1) identifies the best and most practical circuit among all layouts of a predetermined complexity; and (2) considers device parasitic effects where necessary to efficiently explore various options. An automotive suspension design case study demonstrates the validity of this methodology, with the obtained significant performance improvement beingsuccessfully verified through experiments. This methodology can be used to suppress vibrations in other engineering structures as well as other mechatronic absorber types.

Keywords: Vibration absorbers, Roboat, Optimal design,

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Pumps for soft robotics with electro-pneumatic technology

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Abstract : Soft robotics has a wide range of applications, from assistive wearables to self-exploration. Many devices' portability and performance are now limited by their pneumatic energy source, which necessitates either large, heavy pressure vessels or noisy, inefficient air pumps. We present a portable, local energy supply for soft robots using a lightweight, flexible electro-pneumatic pump (EPP) that can silently control volume and pressure, overcoming the limitations of existing pneumatic power sources. Despite only having a thickness of 1.1 millimetres and a weight of 5.3 grammes, the EPP can exert pressures up to 2.34 kilopascals and deliver volumetric flow rates up to 161 millilitres per minute while using less than 0.5 watts of power. A typical soft robotic actuator was able to achieve a maximum contraction change of 32.40 percent and actuation velocity of 54.43 percent per second when driven by an EPP. We demonstrate the technology's versatility by demonstrating three EPP-driven embodiments: an antagonistic mechanism, an arm-flexing wearable robotic device, and a continuous-pumping system. This research demonstrates how the EPP can be used to enable advanced wearable assistive devices as well as lightweight, mobile, multifunctional robots.

Keywords: Pneumatic pumps, Roboat,

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Language-conditioned robot behaviour can be learned from offline data and crowd-sourced annotation

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Abstract : The problem of learning a variety of vision-based manipulation tasks from a large offline dataset of robot interaction is investigated. To accomplish this, humans require simple and effective methods for specifying tasks to robots. Because they are already grounded in therobot's observation space, goal images are a popular form of task specification. Goal images, on the other hand, have a number of drawbacks: they are inconvenient for humans to provide,they can over-specify the desired behaviour, resulting in a sparse reward signal, or they can under-specify task information in the case of non-goal reaching tasks. Natural language provides a convenient and flexible alternative for task specification, but it faces the challenge of being grounded in the robot's observation space. We propose combining offline pre- collected robotic datasets (including highly sub-optimal, autonomously-collected data) with crowd-sourced natural language labels to learn this grounding on a large scale. We train a simple classifier using this data to predict whether a change in state completes a language instruction. This yields a language-conditioned reward function, which can then be applied to offline multi-task RL. In our experiments, we find that our approach outperforms both goal- image specifications and language conditioned imitation techniques on language-conditioned manipulation tasks by more than 25%, and that it can perform a variety of visuomotor tasks from natural language, such as "open the right drawer" and "move the stapler," on a Franka Emika Panda robot.

Keywords: Offline RL, Natural language,

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Thermal Analysis Based on Rocker Arm Full-Type Needle Bearing DynamicPerformance

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Abstract : The equations for rocker arm full-type needle bearings were established based on a dynamic analysis of rolling bearings, taking into account the traction coefficients of FVA-M reference lubricating oil, and then solved by the GSTIFF (Gear Stiff) integer algorithm with variable steps. The effect of working conditions on friction power consumption and the convective coefficients of the lubricant was investigated. The frictional power consumption was then used as the boundary condition of the bearings' simulation model based on the heat generation and heat transfer mechanisms. Finally, the finite element method was used to calculate temperature fields. The results showed that as the radial load or rotation speed increased, so did the overall value of frictional power consumption.

Keywords: Dynamics performance, needle bearing, lubricate oil

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Control of steer-by-wire systems using event-triggered type-2 fuzzy-based sliding modecontrol

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Abstract : This paper proposes a higher-order sliding mode control for steer-by-wire (SbW) systems with limited communication resources and uncertain nonlinearity. To begin, the uncertain nonlinearities are approximated using an interval type-2 fuzzy logic system (IT2 FLS). The extended SbW system's unavailable states are estimated using a fuzzy-based state observer. The SbW system is then given an event-triggered higher-order sliding mode controlto save communication resources and eliminate chattering. The main benefit is that the proposed control scheme can compensate for both observation and event-triggering errors. Thepractical finite-time stability of the closed-loop SbW system is then demonstrated using Lyapunov theory. Finally, numerical simulations and vehicle experiments are presented to assess the effectiveness and superiority of the proposed scheme.

Keywords: SBW system, Experiment vechicle, State observer,

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Investigation into the theory of construction of a digital twin mechanism model formechatronics equipment

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Abstract : The digital twin (DT) technology is currently regarded as a critical technology for digitally representing real-world systems. Based on model simulations, the use of DT technology in smart manufacturing can provide accurate model support for the analysis of mechatronic equipment applications. However, how to quickly and effectively construct a consistent multi-domain DT mechanism model for such a mechanics-electric-hydraulic-control coupled complex system of mechatronics equipment has become the most significant barrier to the widespread application of DT technology in this field. As a result, this paper proposes multi-domain, multi-level, parametric, and consistent mechatronics equipment DT mechanismmodel construction guidelines based on the synthesis of existing model construction methods for mechatronics equipment. Simscape then constructs a consistent multi-domain DT mechanism model of computer numerical control machine tools (CNCMT) to validate the feasibility of the proposed method. The solutions presented in this paper provide a dependable, fast, and consistent mechanism model, as well as construction guidelines and theoretical systems for engineers or researchers who use DT technology to solve specific application problems. In addition, the implementation of the virtual commissioning application case in thispaper provides application guidance for DT-based service analysis.

Keywords: Mechatronic equipment, simscape, digital twin,

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Cat-Inspired Tilt-Rotor Gaits—From Symmetrical to Asymmetrical

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Abstract : Ryll's model with eight inputs (four thrust magnitudes and four tilting angles) has received a lot of attention among tilt-rotors (quadrotors) developed in recent decades. To stabilise this tilt-rotor, a typical feedback linearization manoeuvres all eight inputs with a single control rule. Instead of assigning tilting angles via the control rule, recent research predetermines tilting angles and only uses thrust magnitudes as control signals. These tilting angles are intended to simulate the cat-trot gait while avoiding feedback linearization's singulardecoupling matrix. Further modifications (scaling) are made to these three gaits to accommodate the use of feedback linearization; the acceptable attitudes, leading to an invertible decoupling matrix, are evaluated in the roll-pitch diagram for each scaled gait. The modified gaits with different periods are then applied to the tilt-rotor in tracking experiments with or without the modified attitude-position decoupler equipment, with the references beinguniform rectilinear motion and uniform circular motion. Simulink and MATLAB are used to simulate all of the experiments. The results show that, after modifications, these gaits are capable of tracking references, particularly in cases equipped with the revised attitude-positiondecoupler.

Keywords: Simulation, cat gait, tilt rotor,

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Robotics Soft Finger Development and Modeling Based on Force Distribution

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Abstract : Several grasping and manipulation algorithms have been introduced to manipulate an object using soft-fingered uses. A soft fingertip-like human skin was first developed for soft-fingered manipulations, and then a simple model of this developed soft fingertip was presented based on force distribution at the surface of contact. The proposed model of developed soft fingertip was compared to an earlier model. Finally, the force distribution results confirmed that the new mathematical modelling is more efficient than previous papers, because the radius of curvature can be kept fixed at the proposed model, whereas the radius of curvaturecan be changed at other fingertips, yielding the same contact conditions.

Keywords: Soft finger, mathematical modelling, Robotics

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A Study of the Performance and Repeatability of a Mobile Robotic System for 3DMapping

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Abstract : We present a quantitative performance investigation and repeatability evaluation ofa mobile robotic system for 3D mapping in this paper. A 3D laser scanner coupled with an inertial measurement unit is installed on a mobile platform and used to perform high-resolutionmapping of the surrounding environment in order to achieve a more efficient and automatic data acquisition process when compared to well-established manual topographic operations. The point clouds obtained with a mobile robot are compared to those obtained with a manuallycarried device as well as a terrestrial laser scanner survey that serves as a ground truth. Both mapping modes provide comparable accuracy and repeatability, while the robotic system outperforms the handheld modality in terms of noise level and point distribution. The findingsshow that the mobile robotic platform is a viable technology for automatic and accurate 3D mapping.

Keywords: 3D mapping, mobile robot, laser scanner