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Dr. J. Mahender Reddy
Vice-Chancellor, ICFAI Foundation for Higher Education

Message from the Vice-Chancellor

Greetings!

It is with great pleasure that I welcome you to the ICFAI Foundation for Higher Education (IFHE) declared as a Deemed-to-be University established under section 3 of the UGC Act, 1956.

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Dr M S Reddy
Director, IcfaiTech

Message from the Director

Greetings!

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Dr A.Vadivel
Dean, IcfaiTech

Message from the Dean

Greetings!

It gives me immense pleasure to greet and welcome you all on behalf of the IcfaiTech family. Your decision to join IcfaiTech is just the beginning of a highly rewarding professional career.

IcfaiTech is inherited with a rich experience in engineering education for about two decades. Over the years, it has established itself as a favorite destination for students across the country. It has state-of-the-art infrastructure, fully developed laboratories, a library with a wide range of collections and a large pool of highly qualified and experienced faculty.

IcfaiTech graduates are strong communicators and effective leaders with the adaptability and entrepreneurial drive to keep pace with evolving technologies and the demands of the marketplace. IcfaiTech faculty members are recognized for exemplary teaching and trailblazing research. As a community, we are collaborative by nature, innovative in spirit and focused on making a difference. Together, we have built an environment for learning and discovery unlike any other.

I welcome you to the IcfaiTech and invite you to be a proud member of this ever-growing fraternity.

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DESIGN AND ANALYSIS OF PERFORATED AUTOMOBILE SILENCER

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ABSTRACT

A muffler is a device for reducing the amount of noise emitted by an automobile. To reduce the noise, the engine drain is connected via output pipe to silencer called muffler. The muffler makes a major contribution to reduce the noise. Mufflers are connected to the exhaust pipe of internal combustion engine to suppress the acoustic flow of the engine in combustion process. Mufflers form an integral part of automobile. Mufflers are designed to increase the back pressure so as to reduce the noise level. In this study, attempt has been made to improve the design of muffler for reducing noise. The design of a muffler is to reduce the noise, for that an existed automobile muffler has modified and compared with the arrangement of plates inside the muffler where the noise emitted by the muffler gets changed and to improve the acoustic efficiency of the modified design. Modelling has performed by using CATIA V5.Analysis has to be performed in ANSYS Fluid Flow (Fluent)simulation, can be used to analyze the acoustic power level flow in the muffler, Pressure developed while air flows through the muffler, Velocity of air inside the muffler, Strain rate of the Muffler. By varying the muffler design parameters, the flow will be analyzed.

Keywords: *Muffler, Catia modelling, Acoustic Power level, Back Pressure.*

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DESIGN, MATERIAL TUNING AND PROCESS OPTIMIZATION OF 3D PRINTING USING MACHINE LEARNING

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ABSTRACT

Additive manufacturing is a low-cost and superior quality manufacturing process when compared to other processes in batch and mass production. Design and manufacturing workflow has improved with the application of CAD/CAM. However, there are some issues that still persist is how to avoid printing objects that don't meet expectations and thus can't be used, leading to waste in materials and resources. An application of machine learning allows us to predict certain behaviors and properties based on a large amount of data set provided. In this article, we have reviewed a large amount of data available for the design, material tuning, and process optimization of 3D printing.

Keywords- *Machine Learning, 3D printing, Design, material tuning for Additive Manufacturing, Process Optimization.*

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DESIGN OPTIMIZATION AND PERFORMANCE ANALYSIS OF AUTOMOTIVE MUFFLER

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ABSTRACT: Mufflers are important part of engine system and commonly used in exhaust system to minimize sound transmissions caused by exhaust gases. Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Therefore, muffler design becomes more and more important for noise reduction. The objective of the paper is to propose a design of simple reactive muffler for effective sound attenuation and for getting highest transmission losses. The paper contains two optimization problem to get optimize model which can further optimize by using Taguchi method. The problem were built and analyzed by using 'COMSOL MULTIPHYSICS' in pressure acoustic analysis domain for getting Maximum Transmission Losses and minimum Sound Pressure Level (SPL). First optimization problem contain muffler in which perforation diameter and pipe diameter are varied which again optimizes by eliminating perforation and by varying pipe lengths in second optimization problem. Among the best problem is further optimized by using Taguchi method. The effect of SPL on the walls of the muffler is not considered. The material of the muffler is also not considered. This optimized model of elliptical muffler is manufacture and then validate with the experimental analysis.

Keywords: *Transmission Losses, Sound Pressure Level, Acoustic, Optimization*

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RECONFIGURATION OF POWER FRAMEWORK AND MISFORTUNE MINIMIZATION USING BACTERIAL FORAGING ALGORITHM

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ABSTRACT

In this paper, a method based on bacterial foraging optimization algorithm (BFOA) is proposed for distribution network reconfiguration with the objective of loss minimization. A novel model to simplify a distribution network is presented. The feeder reconfiguration problem is formulated as a non-linear optimization problem, and BFOA is used to find the optimal solution. According to the characteristics of distribution network, some modifications are done to retain the radial structure and reduce the searching requirement. Test results of a 33 bus sample network have shown that the proposed feeder reconfiguration method can effectively ensure the loss minimization, and the BFOA technique is efficient in searching for the optimal solution.

Key words : Methods, BFO algorithm, Networks, feeder reconfiguration

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RAPID PROTOTYPING TECHNIQUES FOR FABRICATION OF BIO SENSORS: A REVIEW

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ABSTRACT

The use and application of rapid prototyping techniques in the production of biosensors create a new era in transforming the sensor sector in the bio industry. The research is based on the understanding of micro-molding, extrusion, 3D printing, stereolithography, and xurography in the prototyping of microfluidic biosensors. In addition, it introduces performance and pattern methods for adding bio-element substances and transducers to biosensors. Finally, presenting the future trends in biosensors and the ongoing and emerging role of rapid prototyping methods in their development.

Keywords: *biosensors, rapid prototyping, 3D printing, inkjet, biomaterial, microfabrication.*

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TORSEMIDE AND FUROSEMIDE INHIBITORS FOR THE CONSUMPTION OF MILD STEEL IN HYDROCHLORIC CORROSIVE MEDIUM

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ABSTRACT

The performance of torsemide and furosemide drugs as corrosion inhibitors for mild steel in 1 N HCl was thoroughly investigated by weight loss and electrochemical methods. The inhibition efficiencies of drugs obtained by all methods were in good agreement with each other. Torsemide exhibited higher inhibition efficiencies than furosemide in all the experimental studies. Polarization studies revealed that the inhibiting action of the compounds is under mixed control. The free energy of adsorption and the influence of temperature on the adsorption of inhibitors onto a mild steel surface have been reported. The adsorption of the compounds was found to obey the Langmuir adsorption isotherm. The mechanism of inhibition and formation of the Fe-inhibitor complex were confirmed by FT-IR and UV-visible absorption spectral analysis. The scanning electron microscopy (SEM) and atomic force microscopy (AFM) results established the formation of a protective layer on the mild steel surface. Quantum chemical calculations were applied to correlate the inhibition performance of inhibitors with their electronic structural parameters. © 2013 American Chemical Society.

Keywords: *HCL, corrosion inhibitor, free adsorption energy, quantum chemical calculation*

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HEAT AND MATERIAL FLOW IN METAL MATRIX COMPOSITES USING FRICTION STIR WELDING

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ABSTRACT

Welding technologies have been widely used in commercial and defense manufacturing industries for the joining of ferrous and non-ferrous metals. This is because of the high strength of the joints as compared to other joining methods, such as riveting, fastening, adhesive bonding, and so on. Conventional fusion welding processes such as GTAW, GMAW, and Laser have been widely used for joining aluminum and steel alloys. During fusion welding, heating, melting, solidification, and various solid-state transformations occur and these processes influence the microstructures and properties of the weldment. This paper focuses on the transformation of the metal matrix composites during FSW. The non-uniform heating and cooling during the welding process give rise to considerable in-homogeneity concerning strength and ductility across the weldment.

Keywords: *Weldability, Mechanical properties, Residual stresses, Mechanical model, Nugget geometry, microstructures.*

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FINITE VOLUME METHOD ANALYSIS OF PRESSURE LOSS AND FLOW FIELD IN FORK TRUCK MUFFLER

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ABSTRACT

Having the premise of the certain acoustic performance, a muffler should make the pressure loss as small as possible. A simulation model of a fork truck muffler with a complex structure is established. Based on the finite volume method, multidimensional numerical simulation regarding velocity field and pressure field of steady flows for a muffler is performed using CFD (computational fluid dynamic method). Flow characteristics and pressure distribution of the muffler are analyzed. It is found that the vortex inside the muffler creates a great pressure loss. With the increases of inlet gas flow rate , the pressure loss of the muffler increases gradually. The internal structure of the muffler is redesigned for obtaining the optimized structure on the basis of analysis. The influences of the inner tube length on the flow and pressure loss of muffler are researched. The study will provide a theoretical basis for designing a complex muffler.

Keywords: Complex muffler, Velocity field, Pressure field, Structure improvement.

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PREDICTION OF WELD DEFECTS IN FRICTION STIR WELDING OF ALUMINUM ALLOY AA5052-H32 FROM PROCESS PARAMETERS USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

In the present study, image processing techniques have been used to predict weld defects and residual stress during in-Friction Stir welding of Aluminum alloy AA5052-H32 using the information of input process parameters and natural frequency of vibrations. Traverse speed, Rotational speed, and Tool pin height have been considered as input process parameters. Both residual stress and natural frequencies of vibration of the weld obtained using each set of the input parameters are measured experimentally. Several image recognition techniques are used for various cross-sections both in horizontal and vertical directions have been used for the said purpose. The predicted welding residual stresses have been validated experimentally through X-ray diffraction (XRD) and good agreements are obtained. In addition, statistical tests are conducted, and the estimated reliability values of the employed models are also analyzed through Monte-Carlo simulations.

Keywords*: Friction Stir welding, Weld defects, Image processing techniques, Rotational Speed, Traverse Speed*

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WELDING BRAZING OF TITANIUM TO COPPER USING COLD METAL TRANSFER PROCESS

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ABSTRACT

3 mm Pure titanium TA2 was joined to 3 mm pure copper T2 by Cold Metal Transfer (CMT) welding–brazing process in the form of butt joint with a 1.2 mm diameter ERCuNiAl copper wire. The welding–brazing joint between Ti and Cu base metals is composed of Cu–Cu welding joint and Cu–Ti brazing joint. Cu–Cu welding joint can be formed between the Cu weld metal and the Cu groove surface, and the Cu–Ti brazing interface can be formed between Cu weld metal and Ti groove surface. The microstructure and the intermetallic compounds distribution were observed and analyzed in details. Interfacial reaction layers of brazing joint were composed of Ti_2Cu, TiCu and $AlCu_2Ti$. Furthermore, crystallization behavior of welding joint and bonding mechanism of brazing interfacial reaction were also discussed. The effects of wire feed speed and groove angle on the joint features and mechanical properties of the joints were investigated. Three different fracture modes were observed: at the Cu interface, the Ti interface, and the Cu heat affected zone (HAZ). The joints fractured at the Cu HAZ had higher tensile load than the others. The lower tensile load fractured at the Cu interface or Ti interface was attributed to the weaker bonding degree at the Cu interface or Ti interface.

Keywords: *Titanium, Copper, Cold metal transfer, Welding–brazing, HAZ*

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ALTERNATE FUEL BY PYROLYSIS PROCESS AND ITS USES IN IC ENGINES

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ABSTRACT

Pollution and environmental change are the present problems in our daily lives because of a growing population and growing industries. Plastic waste causes server damage to human health. Due to these changes happening in the environment because of plastic we need to take some measures. The recycling and disposal of plastic are causing environmental pollution. The pyrolysis process is the best way to dispose of plastic waste. Presently, we are short of fuels, and in the future, if fuels completely don't exist that would be a great tragedy to humans. So, we have chosen the alternative resource called pyrolysis. This pyrolytic oil can be directly poured into the engines. These fuels can reduce combustion and even reduce the internal loss to the engines which occur by combustion. The vehicles which emit more smoke can be reduced by using pyrolytic oil. Due to this slight reduction in combustion, the pollution in the environment can be decreased.

Keywords: *Environmental pollution, Alternate fuel, Pyrolysis, Plastic waste, Pyrolytic oil.*

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CHARACTERIZATION OF DISSIMILAR MATERIAL WELDED JOINT BETWEEN NUCLEAR GRADE MARTENSITIC P91 AND AUSTENITIC SS304 L

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ABSTRACT

The microstructural evolution and mechanical properties of gas tungsten arc welded creep might enhanced martensitic (CSEM) and austenitic stainless steel (SS) dissimilar welded joint is explored in the as welded (AW) and post weld heat treated (PWHT) conditions. The as received normalized and tempered P91 steel has been welded with SS304 L by preparing a conventional groove and employing a P91 GTAW filler wire. The welded plate is subjected to PWHT at 760 °C for 120 min followed by air cooling. The P91 steel in as received condition exhibited fully martensitic (tempered) structure with lathe morphology and prior austenite grain boundaries while SS304 L have austenitic structure with twins. The heterogeneity (as-welded condition) across the welded joint were produced in terms of microstructure and mechanical properties (hardness, Charpy toughness and tensile strength). The variation in mechanical properties has been minimized after the PWHT. PWHT has experimental a drastic influence on mechanical properties and microstructure of weld fusion zone and HAZ of P91 side however, remain unaffected for the SS304 L side HAZ. The strength of the welded joint have been measured 1016 ± 2.5 MPa and 906 ± 6.5 in as-welded and PWHT condition with joint efficiency of 140 % and 125 %, respectively.

Keywords: *SS304 L, Dissimilar welded joint, Microstructure, Mechanical properties*

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DESIGN AND MANUFACTURING OF CUSTOMIZED PROSTHETIC ARM USING 3D PRINTING

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ABSTRACT

A prosthetic hand is a common medical device for pediatric patients with a partial hand congenital defect or amputation. Among the various types of prosthesis, the myoelectric interface prosthetic hand recently has been highlighted and many researchers have tried to improve its functions. However, the high cost is one of the major limitations to its widespread use. There has been greater availability of the manufacturing knowledge source to the public with the goal of allowing more people to develop these prostheses without as great a financial burden. The advent of modern three-dimensional (3D) printing technology has facilitated these activities and the development of a low-cost, reliable, and durable prosthesis can have a major social impact on patients. These devices are manufactured using 3D printing technology which allows cheap, fast, and accessible manufacture, and because the Computer-Aided Design (CAD) modeled designs are easily scalable for growing kids and can be readily customized patient-to-patient for aesthetics or functionality. The 3D Printed prosthetic arm uses a string tensioning mechanism to allow for grip actuation upon activation and elastics to spring the fingers back during relaxation.

Keywords: *Computer-Aided Design, Customized Prosthetic, Prosthetic hand, 3D-Printing.*

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CHARACTERIZATION OF TRANSIENT LIQUID PHASE BONDING OF AZ31 MAGNESIUM ALLOY

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ABSTRACT

In the present paper, AZ31 magnesium alloy was transient liquid phase bonded using aluminum interlayers (with two different thicknesses of 9 and 14 μm), two bonding temperature of 440˚and 455℃ and different holding times. Optical and scanning electron microscopies were employed to determine the progression of isothermal solidification. In addition, X-ray diffraction method was used to determine the formation of the brittle $Al_{12}Mg_{17}$ compound. The hardness was found to be higher at the joint center compared to the joint sides, which can be related to the eutectic structure and high amount of intermetallic compounds at the center. The results showed that the 9 μm-interlayer led to greater shear strength, elongation and failure energy than the 14 μm interlayer, and the highest shear strength of ~35 MPa was obtained for 75 min bonding time and 9 μm interlayer. The fracture surface evaluation revealed the presence of more plastic deformation for the joints made by the thinner interlayer.

Keywords: *TLP, bonding, AZ31, magnesium alloy, Metallurgy, characterization*

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FLIGHT CONTROL AND STABILITY ANALYSIS OF A SYMMETRICALLY STRUCTURED QUADCOPTER

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ABSTRACT

The vast utilization of unmanned aerial vehicles has been increasing in recent years due to growing demands in various sectors operated for critical missions and time-saving purposes. The major advantage of UAVs is no risk of human life with secure and suitable surveillance. The UAV facilitates live video streaming and wide aerial coverage for monitoring. The dynamics of unmanned aerial vehicles (UAVs) dealing with vertical take-off and landing (VTOL) are equipped with various configurations such as single-main-rotor, tandem rotor, coaxial rotor, tri-rotor, quad-rotor, and Hexa-rotor. Among various configurations, quad-rotor and Hexa-rotor configurations have been chosen frequently for various applications through miniature aircraft. The components and subsystems of such configurations have been widely available for easy integration and flight tests. The modeling and attitude stabilization control problems of a four-rotor vertical takeoff and landing unmanned air vehicle (UAV) quadrotor are investigated. Taking the dynamical behavior of motors into consideration and ignoring the aerodynamic effect, a nonlinear controller is developed to stabilize the attitude. Additionally, an experimental demonstration is carried-out to investigate the stability behavior of a quadcopter undergoing a range of instantaneous step pay-load changes.

Keywords: *Thrust; Sensor; Quadcopter; Measurement; Control system; Stability*

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SENSITIVITY ANALYSIS AND MULTI-OBJECTIVE OPTIMIZATION OF AN ORGANIC RANKINE CYCLE

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ABSTRACT

The organic Rankine cycle (ORC) has been demonstrated to be a viable approach to recover low-grade waste heat and has been widely investigated in recent years. In the current research focused on the multi-objective optimization problem of ORC systems, few scholars consider the variation in turbine efficiency with the cycle parameters. This paper focused on the comparison of multi-objective optimization with variable turbine efficiency and that with constant turbine efficiency. The results obtained for the two types of turbine efficiency were compared, and the differences were analyzed. Flue gas at 523.15 K was used as the heat source, and pentane, hexane, heptane, cyclohexane, benzene and toluene were selected as working fluid candidates. The one-dimensional radial-inflow turbine efficiency prediction model was applied to replace constant turbine efficiency. The multi-objective model in conjunction with the turbine efficiency model was constructed by defining the net power output and system total cost per unit net power output as the objective functions. The non-dominated sorting genetic algorithm-II (NSGA-II) was used to optimize the evaporation temperature and condensation temperature as the decision variables. With the aid of the ideal point, the optimal solution of each working fluid was selected from the Pareto frontier. The results showed that the turbine efficiency varies with changes in evaporation temperature and condensation temperature. In the multi-optimization with constant turbine efficiency, toluene and cyclohexane are the optimal working fluids, whereas with variable turbine efficiency, benzene is the optimal working fluid. In the sensitivity analysis, the optimal exergy efficiency shows opposite trends for the multi-objective optimization with constant and variable turbine efficiency.

Keywords: *Organic, Rankine ,cycle, optimization, thermoeconomic*

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ANALYSIS OF HEAT TRANSFER CHARACTERISTICS THROUGH A PLATE HEAT EXCHANGER USING VARIOUS NANOFLUIDS

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ABSTRACT

In this paper, a corrugated plate heat exchanger in solar energy systems is used to investigate heat transfer and fluid flow characteristics of various nanofluids. By adding various nanoparticles (Al_2O_3-30 nm, SiC-40 nm, CuO-30 nm, and Fe_3O_4-25 nm) into the base fluid, effects of nanofluid types and particle concentrations (0.05 wt.%, 0.1 wt.%, 0.5 wt.%, and 1.0 wt.%) on the thermal performance of the plate heat exchanger are analyzed at flow rates in the range of 3–9 L/min. Results indicate that both heat transfer enhancement and pressure drop for nanofluids show significant increases compared to the base fluid. The Fe_3O_4-water and CuO-water nanofluids show the best and the worst thermal performances of the plate heat exchanger, respectively. When 1.0 wt.% Fe_3O_4-water nanofluid is used as the working fluid, compared to DI-water, the convective heat transfer coefficient is increased by 21.9%. However, an increase of 10.1% in pressure drop is obtained for the 1.0 wt.% Fe_3O_4-water nanofluid. Finally, empirical formulas of the experimental Nusselt number are obtained based on the experimental data. A new way to predict the thermal performance for various nanofluids in heat transfer systems is provided.

Keywords: *Nanofluid, Heat transfer enhancement, Pressure drop, Empirical formula, Plate heat exchanger*

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EXPULSION OF SYNTHETIC COLORS FROM TEXTILE WASTEWATER USING IMMOBILIZED DEAD C. TROPICALIS

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ABSTRACT

An efficient dye bio sorbent was developed for the treatment of textile wastewater by entrapping dead cells of C. Tropicalis, within sodium alginate matrix. The bio sorbent performance was evaluated in packed bed column with different pH (3 to 6), wastewater strength (25%, 50% 75%), bed height (5cm-15cm) and flow rate (0.5mLmin -1 to 1mLmin -1). pH 5, undiluted wastewater, bed height 15cm and flow rate 0.5mLmin -1 were found to be optimum for dye bio sorption. The linearized form of the modified Thomas model equation fitted well with the experimental data and described the dynamic adsorption of synthetic dyes from textile wastewater. The Bed depth service time model was used to express the effect of bed height on breakthrough curves. Dye laden immobilized dead C. Tropicalis was regenerated using 0.01molL -1 NaOH at an elutant flow rate of 1mLmin -1. The reusability of the immobilized biomass was tested in consecutive adsorption-desorption cycles. The FT-IR spectral analysis showed the involvement of amine, hydroxyl, carbonyl, amide and phosphoryl groups in biosorption of dyes from wastewater. The analysis of treated samples showed almost zero color and a significant decrease in Total Dissolved Solids (TDS).

Keywords: *TDS, NaOH, FT-IT, etc.*

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OPTIMIZATION OF FRICTION STIR WELDING PROCESS PARAMETERS OF AA5052-H32 USING TAGUCHI TECHNIQUE

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ABSTRACT

The quality of the welded joint is evaluated by examining the characteristics of the joint efficiency based on the ultimate tensile strength of the weld. In Friction Stir Welding (FSW) process, parameters like tool geometry (shape and size) play a significant role in the overall heat input, resulting in plasticized material flow around the rotating tool. In this study, the Taguchi approach of parameter design was used as a statistical tool for the design of experiment techniques to set the optimal welding parameters. The experimental results are laid by using Taguchi's L27 orthogonal array. The signal-to-noise ratio and the analysis of variance were utilized to obtain the influence of the FSW parameters on the weld strength. The results indicate that the rotational speed is the most significant parameter influencing the tensile strength, temperature, and hardness of the joint. The effect of FSW process parameters on the mechanical properties of AA 5052-H32 aluminum alloy has been analyzed in this work.

Keywords: *Friction Stir Welding, Tensile strength, Process parameters, Taguchi method, ANOVA.*

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UNION OF SILVER NANOPARTICLES FROM INDUSTRIAL POWDERS AND THEIR ANTIBACTERIAL PROPERTIES

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ABSTRACT

Use of various plant materials for the biosynthesis of nanoparticles is considered a green technology, as it does not involve any harmful chemicals. The present study reports that silver nanoparticles (Ag NPs) were synthesized from a silver nitrate solution by commercially available plant powders, such as Solanum tricobatum, Syzygium cumini, Centella asiatica and Citrus sinensis. Ag NPs were characterized by UV-vis spectrophotometer, X-Ray Diffractometer (XRD), Atomic Force Microscopy (AFM) and fourier transform infrared (FTIR) spectroscopy. The formation and stability of the reduced silver nanoparticles in the colloidal solution were monitored by UV-vis spectrophotometer analysis. The mean particle diameter of silver nanoparticles was calculated from the XRD pattern, according to the line width of the plane, and the refraction peak, using Scherrer's equation. AFM showed the irregular shapes of Ag NPs, and the formation of silver nanoparticles was found to be 53, 41, 52 and 42 nm, corresponding to Syzygium cumini, Citrus sinensis, Solanum tricobatum and Centella asiatica, respectively. FTIR spectroscopy confirmed the presence of protein as the stabilizing agent surrounding the Ag NPs. Antimicrobial activity of the silver bio-nanoparticles was performed by a well diffusion method. The highest antimicrobial activity of Ag NPs synthesized by C. sinensis and C. asiatica was found against Pseudomonas aeruginosa (16 mm). The Ag NPs synthesized in this process were found to have efficient antimicrobial activity against pathogenic bacteria.

Key words :*Nano particles, FTIR, AFM, XRD, etc.*

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MODELLING AND ANALYSIS OF SOFT STOREY BUILDING UNDER SEISMIC LOADING

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ABSTRACT

Open ground storey RC frame buildings are ordinary practice in India. However, the adverse performance of such buildings all over the world was known from long ago. Still, there are many buildings constructed with the ground floor as the soft storey. This means ground story columns are kept open without any infill walls. Even though we assume the load is transferred through the RCC members during design, these infills have a significant role in carrying the load under accidental loads such as earthquakes. The infill wall provides more stiffness to the structure and thereby increases the lateral strength of the structure. To overcome the effect of the soft storey, IS code 1893: 2002 recommends using a magnification factor of 2.5 for both bending moments and shear force calculations of the ground floor columns under seismic loading conditions. This paper focuses on the effect of the height of the soft storey floor on the seismic behavior and how drift will be varying with height.

Keywords*: seismic loading, modeling and analysis, soft storey building, RC frame*

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OPTIMIZATION OF PROCESS PARAMETERS IN WEDM OF INCONEL 825 USING GREY RELATIONAL ANALYSIS

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ABSTRACT

In this paper, an effective approach, Taguchi grey relational analysis, has been applied to experimental results of wire cut electrical discharge machining (WEDM) on Inconel 825 with consideration of multiple response measures. The approach combines the orthogonal array design of experiment with grey relational analysis. The main objective of this study is to obtain improved material removal rate, surface roughness, and spark gap. Grey relational theory is adopted to determine the best process parameters that optimize the response measures. The experiment has been done by using Taguchi's orthogonal array L36 (21 × 37). Each experiment was conducted under different conditions of input parameters. The response table and the grey relational grade for each level of the machining parameters have been established. From 36 experiments, the best combination of parameters was found. The experimental results confirm that the proposed method in this study effectively improves the machining performance of WEDM process.

Keywords: *Taguchi, SR, MRR, WEDM, Grey relational analysis, optimization*

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DEVELOPMENT OF DIGITAL FACTORY AND CYBER-PHYSICAL SYSTEMS USING IIOT

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ABSTRACT

The manufacturing organizations are facing numerous challenges to sustain and grow due to the current crisis arising out of the pandemic. The organizations are looking at various options to tide over the crisis they face today. Due to pandemics and lockdowns, production is at a halt and the companies cannot operate due to lack of manpower. The technologies like Internet of Things (IoT), Machine Learning (ML), Artificial Intelligence (AI), Robotics; Shop floor simulation, etc. have started to play an important role in manufacturing industries during this era. The application of intelligence to manufacturing has emerged as a compelling topic for researchers and industries around the world. The IoT application in the industrial sector is called as Industrial Internet of things(IIOT) and using these we can convert the manufacturing organizations into digital factories and cyber-physical systems. The paper presents a review of the application of IIOT for converting the existing factory into a digital factory.

Keywords- *Internet of Things (IoT), Industrial Internet of Things (IIoT), Machine Learning (ML), Artificial Intelligence (AI), Robotics; Shop floor simulation.*

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DIAGNOSTIC ANALYSIS AND CONDITION MONITORING OF INDUCED DRAUGHT FAN ROTOR SYSTEM

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ABSTRACT

Today's machines are more complex as they have to meet more stringent functional and operational requirements. Growing demand on reliability and performance of these machines and maintaining high productivity without sacrificing product quality have made it imperative for maintenance engineers to device newer strategies in maintenance of plant and machines. One of such strategies is condition monitoring, which has emerged as the most powerful tool in maintenance engineering to prevent uneconomical, unreliable, unhealthy, unsafe and even lethal conditions. In this paper an attempt has been made to monitor the condition of induced draught fan rotor system of a large utility thermal power plant. The data has been logged for a period of 6 months and has been rationalized for ease of investigation. The values are plotted on time-domain for velocity to facilitate trend monitoring. Fault diagnosis of the rotor.

Keyword: *Condition monitoring, induced draught, diagnostic analysis, draught fan rotor*

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UNMANNED AIRCRAFT SYSTEMS: REGULATIONS, APPLICATIONS AND FUTURE IN INDIA

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ABSTRACT

Adopting the new-age technologies such as Unmanned Aircraft System (UAS), Bio 3D printing, Robotics, IIOT, and Machine Learning, etc., is essential for the technological development of the countries. These technologies may also enhance the economic growth of the countries. Unmanned Aircraft Systems (hereinafter referred to as drones) offer immense opportunities for economic growth and employment generation. In essence, a drone is a flying robot that may be commanded remotely or fly autonomously using software-controlled flight plans in embedded systems in conjunction with onboard sensors and GPS. UAVs have been seen as enablers of a wide range of applications due to their small size and high stability. Drones are currently employed in a variety of civilian applications, including search and rescue, surveillance, traffic monitoring, weather monitoring, and firefighting, as well as personal drones and commercial drone-based photography, videography, agricultural, and even delivery services. This present review study focused on rules and regulations (UAS Rules, 2021) of the Unmanned Aircraft System, pros and cons, and the future of UAS in India.

Keywords: *Aircraft, Drone, Flying robot, Unmanned Aircraft System*

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DESIGN OPTIMIZATION OF A MICRO AIR VEHICLE (MAV) FIXED WING

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ABSTRACT

Micro air vehicles (MAV) are gaining attention due to their wide range of applications in civilian and defense fields. The wings of these vehicles generate a particular flow regime which is to be explored further. Since the theories on the aerodynamics of all affects are still to be investigated, simulation based computational fluid dynamics is a good approach rather than wind tunnel experiments which involves cost and long periods of experimentation. This study mainly emphasize on the lift, lift coefficient, drag and drag coefficient with respect to Reynold's number and angle of attack, by modelling and analyzing the fixed wing of a micro air vehicle. The analysis has been done selecting NACA25411 air foil. Modelling has been done in Gambit and analysis is taken up using Fluent. Angle of attack and Reynold's number have been optimized to increase the lift and decrease the drag.

Keywords: *Micro air vehicles, aerodynamics, angle of attack, air foil, drag*

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ADDITIVE MANUFACTURING OF A PROSTHETIC LIMB: A REVIEW

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ABSTRACT

This study will highlight the problems identified with a modern prosthetic leg. Continuing to improve existing advances in digital data acquisition, parametric modeling, and additive manufacturing techniques that should improve the quality of care for the disabled. Current research will provide information on the various strategies and benefits offered by the flexibility found in these digital methods.

Keywords: *prosthetics, additive fabrication, additive manufacturing, 3D scanning, 3D printing, biomimicry, parametrics, parametric modeling, finite element analysis.*

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WEAR CHARACTERISTICS OF CO-CR-W ALLOY DEPOSITED WITH LASER ENGINEERED NET SHAPING

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ABSTRACT

Commercially available Co-Cr-W alloy, known as Stellite 6, samples are deposited using Laser Engineered Net Shaping process using L9 orthogonal array of Taguchi method with three different process parameters, each at three levels. All the samples are tested for the microstructure analysis with ESEM and wear resistance. The EPMA mapping is also presented for analysis. The wear testing results reveal that the samples fabricated with 350W laser power, 7.5 g/min powder feed rate and 15mm/s laser scan speed have exhibited highest wear resistance at 30N load and 300rpm.

Keywords: *Net shaping process, Stellite, EPMA, ESEM, Taguchi method*

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FORMULATION OF METHODS FOR WATER DISTRIBUTION NETWORK

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ABSTRACT

Water is the basic need for many plants and human life. The development of any nation depends on the availability and supply of water. Due to contamination of water or scarcity of water in some of the rural areas, there are a lot of challenges will be raised. The supply of water is the primary concern for a society's growth and development. The living standards in a given geographic area depend on the supply of water to the public community. The quality of unprotected water seriously affects all living species. The social and economic status of a given rural area depends on the supply of water. The increase in the human population is one of the concerns for the supply of drinking water. The water is required for different purposes like irrigation, industrial use, mining use, generation of power supply, aquacultural use, etc., To ensure proper distribution of water supply, formulation of methods is necessary.

Keywords*: water, supply, population, development.*

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REVIEW OF SUGIYAMA'S EXPERIMENTS FOR DYNAMIC STABILITY OF ROCKET THRUST MOTOR

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ABSTRACT

This paper is inspired by the review articles of Langthjem and Sugiyama, and Elishakoff on the dynamic stability of non-conservative elastic systems. It examines Sugiyama′s experimental results on a cantilever column subjected to the weight and thrust of a small rocket motor mounted at the tip end. The test results cannot be utilized directly for comparison with estimated critical loads of the column but they demonstrate the stabilization of the system due to rocket thrust.

Keywords: *Follower, non-conservative elastic system, rocket thrust, dynamic stability*

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PERFORMANCE EVALUATION OF SHELL AND TUBE HEAT EXCHANGER USING NANOFLUIDS

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ABSTRACT

This study is about the performance evaluation of a shell and tube heat exchanger operated with nanofluid. Thermal conductivity, viscosity, and density of the nanofluids were increased, but the specific heat of the nanofluids was decreased with increasing the concentrations of the particles. The convective heat transfer coefficient was found to be 2–15 % higher than that of water at 50 kg/min of fluids on both sides. Nevertheless, energy effectiveness has improved by about 23–52 % for the above-mentioned nanofluids. As energy effectiveness (ε) strongly depends on the density and specific heat of the operating fluids, therefore, maximum ε has obtained for ZnO–W nanofluid and lowest found for SiO_2–W nanofluid.

Keywords: *ε -NTU Method, Heat Transfer Characteristics, Nanofluid, Tube-in-Tube Heat Exchanger, Water*

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ELECTRO-CHEMICAL CHARACTERISTICS OF LSTM DEPOSITED CO-CR-W ALLOY FOR BIO-MEDICAL APPLICATIONS

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ABSTRACT

In additive manufacturing processes, Laser Engineered Net Shaping (LENS) is the promising technology in developing medical implants with minimal material wastage and high accuracy in shape and size. It enables the custom design of implants that vary from patient to patient. In the present work, the LENS process has been used to fabricate and test Co-Cr-W alloy for its corrosion resistance. The process parameters selected for fabricating the samples are laser power; powder feed rate and laser scan speed, each at three levels. Samples are fabricated as per the Taguchi L-9 orthogonal array and analysis is carried out through the ANOVA and Grey Relational Grade Analysis. Through this methodology, the primary process parameters viz. Laser power (LP), Powder feed rate (PFR) and scan speeds (SS) can be optimized simultaneously for achieving a better combination of multiple performance characteristics. From the experimental results, the multiple performance characteristics of the corrosion potential (Ecorr) and corrosion current (Icorr) of Co-Cr-W alloy are evaluated. The combination of high Laser Power (350W), high Powder Feed Rate (20 g/s) and low scan speed (10 mm/s) are most influencing process parameters to achieve the best corrosion resistance samples.

Keywords: *Powder feed rate, Scan Speed, ANOVA, Grey Relational Analysis*

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HTML AND CSS: A BEGINNER'S GUIDE TO THE WORLD'S MOST VERSATILE LANGUAGES

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ABSTRACT

The purpose of this article is to introduce the Web languages, HTML and CSS which are widely perceived as the most versatile languages in the world. The paper will look in-depth into the history, development, and the current scenario for the respective languages. This paper will cover various aspects of the languages and in its conclusion will enable the reader to be acquainted with these languages. HTML 5 is the current generation of the markup language which is widely used for designing, structuring, and showcasing various contents on the Internet. Cascading Style Sheets or generally known as "CSS" is the standard language that is used for styling and structuring documents related to HTML or XML. The final leg of this paper will showcase the process of website creation using the languages and methods described in the article, which will enable all the readers to be familiarized with the languages and in general the basics of Web Development.

***Keywords**: CSS, HTML, XML, Web Design*

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MEDICAL IMPLANTS BY RAPID PROTOTYPING TECHNOLOGY- A REVIEW

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ABSTRACT

Rapid prototyping/manufacturing is computer operated manufacturing technique, builds parts directly from CAD data by additive sequence layerby-layer, unlike traditional manufacturing process where material is removed in sequence to obtain a desired part. Rapid prototype plays a crucial role in development of medical implants. As medical implants have complex design and vary from patient to patient. It is easy to make custom made medical implants by rapid prototyping at very less cost and time, compared to conventional manufacturing techniques. The present article showcases the significance of rapid prototyping applications in medical industry with suitable bio-compatible materials and manufacturing techniques used to fabricate the complex medical models.

Keywords: *prototyping, CAD ,rapid, techniques, medical implants bio-compatible materials*

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ANALYSIS AND DESIGN OF MULTI-STOREYED BUILDINGS

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ABSTRACT

The safety and stability of a structure is the primary objective of a civil engineer in design. Safe designing of a structure depends on the, what are all the possible loads the structure will be subjected in its life span. The various types of loads that are to be considered for design are to be followed as per IS codes. These codes also include load combinations that are to be used during design. There are various design philosophies are available as per the IS standards. Analysis pertains to determining the forces that will be generated during the application of loads on the structural members. To analyze a structure and determining forces, there are a good number of software are available. But usage of software requires the knowledge of structural behavior. Both reinforced concrete design and steel structural design are available. A thorough understanding of the basic concepts in analysis and design will help design a safe and stable structural design.

Keywords*: structural design, analysis, safety, stability, loads*

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EFFECT OF METAL TRANSFER MODE ON SPATTER AND ARC STABILITY IN UNDERWATER FLUX-CORED WIRE WET WELDING

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ABSTRACT

The effect of metal transfer mode on spatter and arc stability during underwater flux-cored wire wet welding at different process parameters are investigated adopting the synchronous acquisition system of X-ray image and electric signal. Two spatter modes i.e., the local droplet repelled spatter and the droplet explosion spatter were observed for the first time. The generation of the local droplet repelled spatter is attributed to the excessive and unstable repulsive forces, while the droplet explosion spatter is caused by the unstable repulsive forces and gas dynamic force. Welding spatters and arc stability depend on the metal transfer mode. During wide-angle globular repelled transfer mode, the droplet repelled spatter mode is observed and the forming frequencies of the local droplet repelled spatter and droplet explosion spatter are higher than other transfer modes. The short-circuit explosions are observed in short-circuit explosive transfer mode, causing numerous short-circuit explosive spatters. With the increase of arc voltage, both the spatter loss coefficient and voltage variation coefficient decrease firstly to the minimum at the arc voltage of 32 V and then increases gradually, attributed to the type and proportion of metal transfer mode.

Keywords: *wet welding, Welding spatter, Arc stability, Metal transfer mode*

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ASSESSMENT OF MULTIPLE-WIRE WELDING AS CANDIDATE FOR MULTI-MATERIAL ADDITIVE MANUFACTURING COMPONENTS

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ABSTRACT

Multi-Material Additive Manufacturing (MMAM) is an extension of Additive manufacturing (AM) technology. This extension has the capability to enhance the functional properties of the components. However, MMAM of metals is still a challenge in various AM processes due the material delivery system. In this study, MMAM of metals is investigated through multi-wire gas metal arc welding (GMAW) processwherein the material delivery is dealt with by wire feed rollers and controlled by welding current. This process is integrated with six-axis robot/ computer numeric control (CNC) that is capable of fabricating complex geometries without support structures using different torch positions. The proposed research aims to develop an MMAM metallic component through an insert that bonds between different materials similar to machicolation in building structures. Further, the relation of process parameters on thermal modelling, microstructure, and mechanical properties will be investigated.

Keywords: *Additive Manufacturing; Multi-material; Arc stability; Microstructure; Mechanical properties.*

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EFFECT OF LASER BEAM WELDING PARAMETERS ON MORPHOLOGY AND STRENGTH OF DISSIMILAR AA2024/AA7075 T-JOINTS

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ABSTRACT

This paper investigates the effect of laser welding parameters, such as beam power, welding speed, incident beam angle, incident beam position and beam diameter, on the weld geometry, microstructure, porosity and mechanical properties of successive double-sided laser beam welded AA2024-AA7075 T-joints using 4047 filler wire. A change in the welding parameters influences the weld geometry and porosity, but does not cause significant variations in the weld microstructures, though some liquation cracking was observed in the heat-affected zone of alloys AA7075 and AA2024. The macroporosity occurs more in the second weld seam than in the first one. The pull-out test results presented higher values than those obtained by other authors. The ultimate tensile load in pull-out test is influenced by the laser power, laser beam diameter and incident beam position. Macroporosity plays a relevant role in fracture initiation during pull-out tests. Porosity and liquation cracking influenced the fracture mode of the pull-out test specimens, but they do not significantly affect the results.

Keywords: *Laser, welding, parameters, T-joints, Defects*

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PRODUCTION OF 3D PRINTED FILAMENTS FROM WASTE PLASTICS

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ABSTRACT

Plastic pollution is the accumulation of plastic objects and particles (e.g., plastic bottles, bags, and microbeads) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans. Researchers estimate that more than 8.3 billion tons of plastic have been produced since the early 1950s. About 60% of that plastic has ended up in either a landfill or the natural environment. This project is about the production of 3D Printing filaments from waste plastics. The term 3D printing covers a process of technologies that offer a full spectrum of capabilities for the production of parts and products in different materials. Recycling waste plastic into usable filament requires two steps shredding the plastic into small pieces then extruding it with a filament extruder. 3D printing filament is created using a process of heating, extruding, and cooling plastic to transform small pieces into the finished product. A different speed is applied to the filament as it is pulled out of the extruder to define the width of the filament, most commonly 1.75 mm diameter. The filament can be used for the manufacturing of various physical models from virtual models.

***Keywords**: 3D Printing, Filaments, Extrusion, Plastic pollution, Waste plastics*

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METAL PROTOTYPING THE FUTURE OF AUTOMOBILE INDUSTRY: A REVIEW

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ABSTRACT

Metal prototyping an advanced rapid prototyping technique has shown a very high potential to reduce the time of manufacture and cost of product effectively. Implementation of metal prototyping to the extent of 4d printing improves the future of small, medium and large-scale enterprises of automobile industry. This paper gives a glance of metal prototyping to automobile industry. The implementation of future metal prototyping automobile industry involves 1. Re-engineering model generation for spare parts of two, three, four-wheeler automobiles, 2. Mathematical and software simulation by using fem techniques, 3.3d printing, 4. Metal prototyping though 3d/ 4d printing, 5. Prototype testing and research labs are described in detail. Finally, this review gives a glance on future automobile industry through metal prototyping

Keywords: *FEM, Metal prototyping, Automobile, 4d printing*

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A STUDY ON RAPID PROTOTYPING OF COMPLEX TISSUES WITH LASER-ASSISTED BIOPRINTING (LAB)

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ABSTRACT

Laser-assisted bioprinting (LAB) is an emerging tissue engineering (TE) tool that allows the printing of cells and fluids through cell-level modification, to reproduce bio-isotropy of living tissue. After introducing the reason for LAB in TE, we present the portable parameters related to the laser transmission method (LIFT), used in LAB. These parameters must be tuned to print active cell patterns with respect to the histological sequence of cell level, as well as high volume production. Finally, we introduce standard multi-component printing, 3D printing methods, in vitro and in vivo.

Keywords: *laser-assisted bioprinting, rapid prototyping, tissue engineering, regenerative medicine.*

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PROCESS MODELLING OF EXPLOSIVE WELDING USING A DENSITY ADAPTIVE SPH METHOD

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ABSTRACT

Explosive welding (EXW) involves processes like the detonation of explosive charge, impact of metal structures and strong fluid-structure interaction with complex features such as interfacial waves and jet generation. The whole EXW process has not been well modeled before due to the large deformation and moving interfaces while the associated mechanisms inherent in EXW are also not well understood. In this paper, the whole EXW process is simulated using a density adaptive smoothed particle hydrodynamics (SPH) model, in which a density adaptive algorithm is used to treat variable large density ratio in EXW and the kernel gradient correction (KGC) is used to improve computational accuracy of SPH. The mechanisms in EXW are investigated, and typical phenomena including the wavy interface, jet formation, interfacial temperature and pressure distribution as well as melting voids are examined. The mechanisms of wave formation are studied while two existing mechanisms, namely, the Jet Indentation Mechanism and the Vortex Shedding Mechanism are revealed with the present SPH simulations. It is demonstrated that with proper amount of explosive charge and initial welding angle, the present SPH method can well reproduce the morphology evolution of the welding interface from straight to wavy and further to wavy with vortex shedding. Furthermore, based on comprehensive numerical data from SPH simulations, two types of numerical weldability windows for EXW are presented together with discussions about different welding limits and effective explosive charge.

Keywords: *Explosive welding, Smoothed particle, hydrodynamics, kernel gradient correction*

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DESIGN AND FABRICATION OF PROTOTYPE HAND OPERATED CAN CRUSHER

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ABSTRACT

The importance of recycling in the area of engineering and technology increasing day by day. The amount of waste generated in tremendous quantity in the form of tiny cans is the important product that is to be recycled on an increasing scale. For performing recycling, can crushers be used where the tiny cans are designed for durability, flexibility, lightweight, strong and recyclable? The tiny cans are the most recycled of any beverated containers till today. The amount of research work carried out in this paper focuses on the design and fabrication of a prototype can crusher with the aim to reduce the scrap volume and make use of the cans to be recycled easily. The single slider crank mechanics are designed and applied for reducing the volume of the cans to 70%. The mechanism makes use of converting reciprocating motion to rotary motion. The applied methodology make use for automatic removal of can crusher from the crushing site without human intervention. Even though there are several types of can crushers are available in the market the completion of the new model provides a more practical usage than the previous one.

Keywords: *Can Crusher, Moment Arm, Single slider crank mechanism.*

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STRAIN HARDENING BEHAVIOUR OF A DISSIMILAR JOINT BETWEEN Ti–6Al–4V AND Ti7 ALLOYS

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ABSTRACT

The aim of this study was to evaluate the influence of strain rate and temperature on the tensile properties, strain hardening behavior, strain rate sensitivity, and fracture characteristics of electron beam welded (EBWed) dissimilar joints between Ti–6Al–4V and Ti17 (Ti–5Al–4Mo–4Cr–2Sn–2Zr) titanium alloys. The welding led to significant microstructural changes across the joint, with hexagonal close-packed martensite (α′) and orthorhombic martensite (α″) in the fusion zone (FZ), α′ in the heat-affected zone (HAZ) on the Ti–6Al–4V side, and coarse β in the HAZ on the Ti17 side. A distinctive asymmetrical hardness profile across the dissimilar joint was observed with the highest hardness in the FZ and a lower hardness on the Ti–6Al–4V side than on the Ti17 side, where a soft zone was present. Despite a slight reduction in ductility, the yield strength (YS) and ultimate tensile strength (UTS) of the joints lay in-between the two base metals (BMs) of Ti–6Al–4V and Ti17, with the Ti17 alloy having a higher strength. While the YS, UTS, and Voce stress of the joints increased, both hardening capacity and strain hardening exponent decreased with increasing strain rate or decreasing temperature. Stage III hardening occurred in the joints after yielding. The hardening rate was strongly dependent on the strain rate and temperature. As the strain rate increased or temperature decreased, the strain hardening rate increased at a given true stress. The strain rate sensitivity evaluated via both common approach and Lindholm approach was observed to decrease with increasing true strain. The welded joints basically failed in the Ti–6Al–4V BM near the HAZ, and the fracture surfaces exhibited dimple fracture characteristics at different temperatures.

Keywords: *Titanium alloy, Electron beam welding, Strain , hardening behavior, HAZ*

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OPTIMIZATION AND EXPERIMENTAL INVESTIGATION ON VARIOUS METAL CUTTING OPERATIONS

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ABSTRACT

From the last two decades, removing the unwanted material to produce the desired product in various manufacturing industries has been increased rapidly. Conventional machining (tool and workpiece in direct contact with each other) processes such as Turning, Milling, Drilling, Planning, Shaping, and Knurling, etc., have been used to remove the unwanted material to produce a good surface finish and accurate size of the product. Every engineer should know various machining operations considering the various operating conditions such as cutting speed, feed, and depth of cut, etc. In this proposed work, an experimental investigation will be done on the effect of operating conditions on the various metal cutting operations. Aluminum has been selected as a workpiece material to perform the various metal cutting operations because it is easily available, low cost, easy to machine, etc. The output of the proposed work is not only to gain basic knowledge but also to understand the operating conditions.

Keywords: *Acme thread, Buttress thread, BSW thread, Concave and convex turning, Diamond knurling.*

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EFFECTS OF PROCESS PARAMETERS ON WELDING OF DISSIMILAR METALS AA6061 AND AA7075 AL ALLOYS USING FRICTION STIR WELDING

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ABSTRACT

Dissimilar AA6061 and AA7075 alloy have been friction stir welded with a variety of different process parameters. In particular, the effects of materials position and welding speed on the material flow, microstructure, microhardness distribution and tensile property of the joints were investigated. It was revealed that the material mixing is much more effective when AA6061 alloy was located on the advancing side and multiple vortexes centers formed vertically in the nugget. Three distinct zones with different extents of materials intercalations were identified and the formation mechanism of the three zones was then discussed. Grain refinement was observed in all three layers across the nugget zone with smaller grains in AA7075 Al layers. All the obtained joints fractured in the heat-affected zone on the AA6061 Al side during tensile testing, which corresponds very well to the minimum values in microhardness profiles. It was found that the tensile strength of the dissimilar joints increases with decreasing heat input. The highest joint strength was obtained when welding was conducted with highest welding speed and AA6061 Al plates were fixed on the advancing side. To facilitate the interpretation, the temperature history profiles in the HAZ and at zones close to TMAZ were also measured using thermocouple and simulated using a three-dimensional computational model.

Keywords: *Dissimilar, materials, joining, TMAZ, HAZ*

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CHARACTERIZATION OF LASER WELDED JOINTS OF HIGH STRENGTH LOW ALLOY AND DUAL-PHASE STEELS

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ABSTRACT

High strength low alloy (HSLA) and dual-phase DP980 (UTS ⩾ 980 MPa) steels were joined using fiber laser welding in similar and dissimilar materials combinations. The welded joints were characterized with respect to microhardness and tensile properties at three different temperatures: −40 °C, 25 °C, and 180 °C. Tensile properties of the welded joints were compared to those of the base metal (BM) obtained under similar conditions. A good correlation was found between the welded joints and the BM in relation to the tensile properties obtained at the different temperatures. A general trend of increase in the yield strength (YS), the ultimate tensile strength (UTS) and energy absorption (EA) with decreasing temperature was observed; however, work hardening coefficient was not altered and insignificant scatter was observed in case of the elongation. However, in the DP980 steel, dynamic strain ageing was observed only in the BM.

Keywords: *HSLA, Fiber, laser, welding, energy absorption*

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PERFORMANCE PREDICTION OF SHELL AND TUBE HEAT EXCHANGER USING COMPUTATIONAL FLUID DYNAMICS

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ABSTRACT

Transfer of heat from one fluid to another is an important process for most chemical industries. The most common application of heat transfer lies in designing heat transfer equipment for exchanging heat from one fluid to another fluid. The devices for efficient transfer of heat are generally called Heat Exchanger. The most common and widely used type of exchanger in the oil refinery and the chemical industries is the Shell and tube heat exchanger employed for high-pressure applications. The objective of the present work is to design a shell and tube heat exchanger with a helical baffle and study the flow and temperature field inside the shell. The present work has been carried out with a view to predicting the performance of a shell and tube heat exchanger. The process in solving simulation consists of modeling and meshing the basic geometry of shell and tube heat exchanger using Computational Fluid Dynamics package ANSYS 19.0. The performance of the heat exchanger has been evaluated by using the CFD package FLUENT and has been compared with the existing literature values. An attempt has also been made to calculate the performance of the above heat exchanger by considering helix baffles instead of regular Segmental Baffles and the result so obtained have been compared. The performance parameters pertaining to a heat exchanger such as effectiveness, overall heat transfer coefficient, energy extraction rate, etc., have been reported in this work.

Keywords: *Ansys, Computational Fluid Dynamics, Heat Exchanger, Simulation*.

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MECHANICAL & MICROSTRUCTURE PROPERTIES OF HOT ROLLED Ti-Nb-Sn ALLOYS

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ABSTRACT

Titanium alloys with lower elastic modulus and free from toxic elements such as Al and V have been studied for biomedical matters. Ti–Nb–Sn alloys showed up as presenting great potential for the aforementioned purpose. The current study got Ti–35Nb-XSn alloys (x = 2.5; 5.0; 7.5) by applying the following techniques: arc melting, homogenizing and cooling in furnace, homogenizing and water quenched, hot rolling and water quenched. According to each step of the study, the microstructures were featured by means of optical microscopy, by applying a scanning electron microscopy (SEM) analysis as well as X-ray diffraction. The mechanical properties were gotten by means of: Vickers microhardness, tensile and ultrasonic tests. Their ratio between tensile strength and elastic modulus as well as the ductility were compared to other biomedical alloys already available in the literature. The mechanical behavior of the Ti–Nb alloys directly depends on the Sn rates that constitutes the phases as well as on the thermomechanical background to which the alloy was submitted to. The hot rolled Ti–35Nb–2.5Sn alloy showed high ratio between strength and elastic modulus as well as high ductility, just as high as those of some cold rolled Ti alloys.

Keywords: *β Titanium alloys, Biomaterials, Mechanical properties*

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MATERIALS SELECTION PROCEDURE FOR SANDWICHED BEAMS VIA PARAMETRIC OPTIMIZATION WITH APPLICATIONS IN AUTOMOTIVE INDUSTRY

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ABSTRACT

The future of automotive industry faces many challenges in meeting increasingly strict restrictions on emissions, energy usage and recyclability of components alongside the need to maintain cost competitiveness. Weight reduction through innovative design of components and proper material selection can have profound impact towards attaining such goals since most of the lifecycle energy usage occurs during the operation phase of a vehicle. In electric and hybrid vehicles, weight reduction has another important effect of extending the electric mode driving range between stops or gasoline mode. This paper adopts parametric models for design optimization and material selection of sandwich panels with the objective of weight and cost minimization subject to structural integrity constraints such as strength, stiffness and buckling resistance. The proposed design procedure employs a pre-compiled library of candidate sandwich panel material combinations, for which optimization of the layered thicknesses is conducted and the best one is reported. Example demonstration studies from the automotive industry are presented for the replacement of Aluminum and Steel panels with polypropylene-filled sandwich panel alternatives.

Keywords*: Sandwiched beam, weight reduction, design optimization, polypropylene-filled*

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BRIDGE CONSTRUCTION IN INDIA - VARIOUS CONSTRUCTION METHODS, TECHNOLOGIES AND EQUIPMENT

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ABSTRACT

From ancient times onwards, bridges play a significant role in communication between various points inland and thereby developing the locality. Over the period, as the technology advanced, there is a remarkable change in the construction technologies, materials used, and types of equipment used in constructing bridges. The paper gives an overall outlook on the different types of bridges available in India (with examples) and the different types of equipment and technologies used in its construction in India. The various types of FEM tools available for the analysis and design of the bridges, various methods of construction of bridges, factors affecting the selection of construction methods, various latest advanced technologies used in the construction of bridges, advanced equipment used for the construction of bridges are discussed in detail. The availability of advanced FEM tools, technologies, and equipment makes the design, construction, and maintenance of bridges effortless.

Keywords: *Bridges, FEM, Technology, equipment, types*

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CHARACTERIZATION OF FRICTION STIR WELDS ON UNMODIFIED AND P-MODIFIED AL-MG_2SI-SI ALLOYS

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ABSTRACT

Welded joints formed by friction stir welding (FSW) consist of three distinct zones: a base material zone (BMZ), a thermo-mechanically affected zone (TMAZ), and a weld nugget (WN). Primary Mg_2Si phases are identified as equiaxed crystals and polygonal particles in unmodified and P-modified Al-Mg_2Si-Si alloys in the BMZ, respectively. In the WN, the equiaxed primary Mg_2Si crystals in the unmodified alloys are transformed to significantly smaller polygonal/irregular particles; the corners of the polygonal primary Mg_2Si particles in the modified alloys become smoother and smaller. The segregation of the primary Mg_2Si phase is reduced for both the unmodified and modified alloys in the WN. Both unmodified and modified alloys have a lower solidus temperature in the WN. The ultimate tensile strengths (UTSs) of the welded joints are enhanced by 5% and 8% for the unmodified and modified alloys, respectively, in comparison with the parent material. The UTS of the welded joints in the modified alloy is ~20% higher than in the unmodified alloy.

Keywords: *Al-Mg_2Si-Si alloy, Friction stir welding, Microstructure, Mechanical properties*

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EFFECTS OF MICROSTRUCTURE AND RESIDUAL STRESS ON FATIGUE CRACK PROPAGATION BEHAVIOUR IN WIRE+ARC ADDITIVE MANUFACTURED Ti- 6Al- 4V

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ABSTRACT

Fatigue crack propagation tests of Ti-6Al-4V fabricated by the Wire+Arc Additive Manufacturing (WAAM) process are analyzed. Crack growth rate and trajectory are examined before and after the crack tip crossing an interface between the WAAM and wrought alloys. The study has focused on the microstructure and residual stress effect. First, the differences in crack growth rate and path between WAAM and wrought alloys are attributed to their different microstructure; the equiaxed wrought alloy has straight crack path, whereas the WAAM lamellar structure causes tortuous crack path resulting in lower crack growth rate. Second, based on measured residual stress profile in the as-built WAAM piece, retained residual stress in the much smaller compact tension specimens and its effect on crack growth rate are calculated by the finite element method. Numerical simulation shows considerable residual stress in the test specimen and the stress magnitude depends on the initial crack location and propagation direction in relation to the WAAM-wrought interface. Residual stress is released immediately if the initial crack is in the wrought substrate; hence it has little effect. In contrast, when crack grows from WAAM to wrought, residual stress is retained resulting in higher stress intensity factor; hence greater crack growth rate.

Keywords: *Additive manufacturing, Titanium alloy, Fatigue crack propagation, Residual stress*

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FORMATION MECHANISM ONION RING STRUCTURES IN FRICTION STIR WELDED DISSIMILAR ALUMINUM ALLOYS

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ABSTRACT

The formation mechanism for typical onion ring structure and void defect with heat input during FSLW was continuously visualized by an exit-hole continuous observation technique. Based on this result, the compatibility between microstructure, microtexture, element maps and strain maps using electron backscattered diffraction (EBSD) with the chemical indexing assisted by EDS analysis was simultaneously investigated. The results revealed that the threaded probe was significantly correlated to typical onion ring structure and the onion structure formed as soon as it touched the probe. This result is different from the results so far. On the other hand, the remnant of original interface between top and bottom plates after FSLW and asymmetrical flow around rotating tool were significantly correlated to the formation of void defect in low heat input condition.

Keywords: Friction stir lap welding, EBSD, dissimilar aluminum alloy, material flow

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REVIEW OF PCM ENCAPSULATION TECHNIQUES IN THERMAL ENERGY STORAGE SYSTEMS

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ABSTRACT

Phase change materials (PCM) are used for storing latent heat while changing from one phase to another (usually between solid and liquid states). Most commonly used PCMs materials may be grouped into organic, inorganic, and eutectic. These materials suffer from limitations such as subcooling, phase segregation, flammability, low thermal conductivity, and thermal instability. These problems may be overcome by encapsulation which reduces subcooling, increases heat transfer area, and control the volume change of the storage materials during the phase transition process.

A number of studies have been reported in the area of encapsulation methods for organic PCMs while the information about inorganic PCMs is limited. Also, the influence of encapsulation techniques on the thermophysical properties of PCMs is not well addressed. Therefore, the objective of this paper is to conduct a comprehensive review of encapsulation and characterization techniques for inorganic PCMs and to provide an analysis of the influence of synthesis parameters on the thermophysical properties of encapsulated PCMs. Two principal types of encapsulated inorganic PCMs were found: core-shell PCMs (core-shell EPCMs) and shape-stabilized PCMs (SS-PCMs). Classification of encapsulation methods of core-shell EPCMs and SS-PCMs are reported in this work.

Keywords: *PCM, Encapsulation, thermo-physical properties, subcooling, phase segregation, thermal instability, nano, meso, & microencapsulation*

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STUDY OF HEAT AFFECTED ZONE CRACKING IN LASER ADDITIVE MANUFACTURING OF INCONEL 718

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ABSTRACT

The heat affected zone liquation cracking behavior was studied in laser additive manufactured Inconel 718. Liquation cracking was found initiating from the weak site near the fusion line in the pre-deposited layer, propagating along the inter-dendritic region with the further deposition proceeding layer by layer. Total cracking length calculation results showed that when controlling the heat input and height increment constant, liquation cracking susceptibility increased with the increase of laser scanning speed; and when controlling the laser scanning speed and height increment constant, liquation cracking susceptibility increased with the increase of heat input. The effect of grain boundary misorientation on susceptibility to liquation cracking was also investigated through electron backscatter diffraction (EBSD) measurement, and the results showed that liquation cracking tendency increased with the increase of grain boundary angle, which was considered to be attributed to the higher stability of liquation film at larger grain boundary during the last stage of solidification.

Keywords: *HAZ cracking, Laser cladding, EBSD, Grain boundary misorientation*

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PERFORMANCE ANALYSIS OF INDUSTRIAL SILENCER USING FEM

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ABSTRACT

Classical analytical models used for prediction of the performance of reactive silencers are limited to conditions where the dimensions of the duct and resonators are small compared to the wavelength of the sound. Finite Element Analysis does not suffer from such limitations and has therefore been used to analyze the design of a reactive silencer for the exhaust stack of a 980MW power station. To assist in the design process, resonators of various dimensions were analyzed using FEA which has led to the derivation of expressions for the resonance frequencies of slot-type rhomboid shaped resonators as a function of the geometry. An important design issue is the influence that adjacent resonators have on the overall performance of the system. It was found that when resonators of similar resonance frequency are in close proximity, they can interact and lead to a decrease in the overall performance compared to that of a single resonator.

Keywords: FEM, silencer, resonator, performance analysis

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3D PRINTED POLYMER-BASED SMART MATERIALS FOR IMPROVING APPLICATION AND INTEGRATION

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ABSTRACT

Smart and functional materials processed by printing technologies reveal an increasing interest due to reduced cost of assembly, easy integration into devices and the possibility to obtain multifunctional materials over flexible and large areas. After introducing smart materials, printing technologies and inks, this review discusses the materials that are already being printed, mainly piezoelectric, piezoresistive, magneto-strictive, shape memory polymers (SMP), pH sensitive and chromic system materials. Since polymer-based smart materials are particularly attractive for device implementation, this review will focus on printed polymer-based smart materials. Finally, critical challenges and future research directions will be addressed.

Keywords: *Printing, technologies, Smart materials, piezoresistive, magneto-strictive, additive manufacturing, shape memory polymers*

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POLYMER-BONDED MAGNETS FROM PLATE-LIKE PARTICLE SUSPENSIONS USING 3D PRINTING

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ABSTRACT

This paper reports the 3d printing of polymer-bonded magnets using highly concentrated suspensions of non-spherical magnetic particles. In a previous study, magnets of arbitrary shapes have been successfully fabricated using the uv-assisted direct write (uadw) method. The magnetic remanence (b_r) of the uadw magnets was limited by the type of magnetic particles used and the highest printable particle loading. Magnetic particles produced from melt spinning have better intrinsic magnetic properties, but their plate-like shape has resulted in a higher working viscosity, posing a major challenge in 3d printing with uadw. Inspired by the "farris effect" in rheology, we mixed the plate-like particles of two different sizes to increase the polydispersity and reduce the overall viscosity of the mixture as the smaller particles can now fill the interstitial space between the larger ones. Using this rheological technique, a particle loading of as high as 65% by volume, or 93% by weight, was 3d printed. The resulting magnet has a density of 5.2 g/cm^3, an intrinsic coercivity (h_{ci}) of 9.39 koe, a remanence (b_r) of 5.88 kg, and an energy product ($(bh)_{max}$) of 7.26 mgoe, marking the highest values reported for 3d printed polymer-bonded magnets.

Keywords: *3D printing, Magnets, Rheology, Direct write, Suspensions*

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REDUCTION OF THERMAL GRADIENT OF MOLTEN POOL IN AM PROCESS

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ABSTRACT

Additive manufacturing (AM)—colloquially termed as 3D printing—is resulting in a paradigm change across multiple industries, such as the aerospace, biomedical, and automotive sectors. With rapid footsteps AM enters into the manufacturing sector and medical fronts; it almost omits the conventional processes and eradicates the use of traditional materials. From plastics, ceramics, and polymers to metals - the journey of AM process goes on and Titanium and its alloys play an important role in this path for its wide applicability, advantages, and biocompatibility. In the aerospace industry reduction of "Buy to fly ratio", repairing of engine brackets, weight reduction of seat buckles to medical fields for making patient-specific replacements, providing lightweight performance; medical strength, etc. towards the commercial use of geometrically critical industry products; titanium is accepted almost everywhere. This study reviews how to reduce the steep thermal gradient of the molten pool and checks epitaxial growth by maintaining equiaxed lattice structure in the different AM processes (specifically SLM) using Titanium.

Keywords- *AM,3D Applications, Its Alloy, Ti-6Al-4V, Medical Implant, BTF, Heating Cycles, Post Processing.*

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PERFORMANCE OF HYBRID MUFFLER USING ROCK WOOL AND GLASS FIBER AS ABSORBING MATERIALS

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ABSTRACT

Muffler is categorized in two broad manners as absorptive muffler and reactive muffler. A Muffler (silencer) is an important noise control element for reduction of machinery exhaust noise, fan noise, and other noise sources involving the flow of gases. Reactive mufflers which reduce noise by reflecting sound energy back to its source, and absorption mufflers, which absorb sound due to the energy dissipated in the sound-absorbing material. The attenuation levels of these types of muffler are dependent on the frequency of the noise source. Investigations on absorption mufflers have indicated that these have fairly good noise attenuation over a relatively wide frequency band. The combination of both reactive and absorptive muffler is termed as hybrid muffler. Hybrid muffler design may be expected to provide broadband high noise attenuation and low pressure drop. Experimental Two load setup and Wave 1-D is used to predict the transmission loss of hybrid muffler. Hybrid muffler generally includes the number of perforated tubes, number of perforated baffles with absorptive materials like asbestos, rock wool, bensoil, powertex & advantex etc. Transmission loss measurement using hybrid muffler is discussed in this paper. Various sound absorption materials that are currently used for noise reduction are used. This paper shows the acoustic performance of packed dissipative muffler with the variation in packing density of absorptive material. Here easily available absorptive materials glass fiber & rock wool is used with same space. This study is performed by taking four designs to observe the transmission loss performance by applying different absorptive materials with different packing density.

***Keywords**: Transmission Loss (TL), Hybrid Muffler, Sound Absorptive Materials, Two Load Method, Wave 1-D.*

DESIGN AND MANUFACTURING OF MODERN DENTAL ARTICULATOR DEVICE

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ABSTRACT

An articulator is a mechanical device used in dentistry to which casts of the maxillary (upper) and mandibular (lower) teeth are fixed, reproducing recorded positions of the mandible in relation to the maxilla. An articulator assists in the fabrication of removable prosthodontic appliances, fixed prosthodontics restorations, and orthodontic appliances. The use of second-generation semi-adjustable articulators for the reproduction of the mandibular kinematic often proves to be a technical and time constraint for the dentist. This paper presents designing an Articulator in order to simulate the mandibular movements of the human jaw. Its main goal is to improve the design of dental prostheses, an articulator is designed in a way in which it has movement in all directions. The Computer-Aided Design (CAD) articulator models are manufactured by using Additive Manufacturing (AM) Process.

***Keywords:** Additive Manufacturing, Computer-Aided Design, Dental Articulator, Mandibular*

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EVALUATION OF MUFFLER TRANSMISSION LOSS USING COMSOL

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ABSTRACT

Muffler analysis is always challenging task due to complex design, shape and size limitation for specific application. In this paper the inlet diameter of muffler is varied for comparison. Two finite element methods (FEM) Results are compared using COMSOL 5.0 software. Two different muffler configurations are considered, representing the effects of adding absorptive lining and without absorptive lining to increase the transmission loss (TL), from computational analysis it is observed that for 40 mm inlet transmission loss is more compared with 30 mm inlet diameter.

Keywords – Transmission loss (TL), Acoustic liners.

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ALGORITHMS FOR IMPROVING ACOUSTIC ATTENUATION PERFORMANCE AND FLOW CHARACTERISTIC OF MUFFLERS

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ABSTRACT

The parametric optimization of the reactive mufflers is researched by numerical analysis, regarding the performance of the acoustic and flow fields synthetically. The finite element method, based on the Helmholtz equation and the Navier–Stokes equation respectively, is utilized in the analysis of the acoustic and flow fields. And the initial and boundary conditions are set up in the physical fields respectively. The weighting multi-objective function about acoustic and flow fields is formulated. In addition, the optimization results of multidisciplinary, obtained by the Nelder Mead algorithm (NMA) based on the sensitivity analysis, the Monte Carlo algorithm (MCA) and Genetic Algorithm (GA) based on the random sampling, are analyzed comparatively. The optimization results indicate that the NMA can maximize the transmission loss (TL) and minimize the pressure drop with the given weight factor. Finally, numerical optimization examples confirm the validity and reliability of the proposed optimization method in the acoustic-flow field.

Keywords: Transmission loss, Pressure drop, Reactive muffler, Multidisciplinary optimization

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STRUCTURAL ANALYSIS OF 3D PRINTED SCAPULA PROSTHESIS

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ABSTRACT

In anatomy, the scapula shoulder bone, shoulder blade, wing bone, septal bone or blade bone, is the bone that connects the upper arm bone with the clavicle collar bone. The bone in a patient who suffers from a tumor may have to be replaced with an implant for preserving the full use. Additive manufacturing can provide the fastest solution as the implant required can be easily customized according to the patient. It allows the best solution available in the market. It is also mandatory for anyone who is looking for the implant to properly analyze, so it can be used accurately. In this research, we have chosen a customized scapula and done structural analysis for the feasibility of the implant for a patient. Three different materials were used for the structural analysis of the implant. The material chosen were composite resin, zirconia; titanium.

Keywords- *3D printing; Scapula; multi-material 3D printing; 3D models; 3D printing using composite resin, zirconia; titanium.*

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STUDY OF WIRE ARC ADDITIVE MANUFACTURING (WAAM) OF METALS: PROPERTIES, DEFECTS AND QUALITY IMPROVEMENT

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ABSTRACT

Due to the feasibility of economically producing large-scale metal components with relatively high deposition rates, significant progress has been made in the understanding of the wire arc additive manufacturing (WAAM) process, as well as the microstructure and mechanical properties of the fabricated components. as waam has evolved, a wide range of materials have become associated with the process and its applications. This article reviews the emerging research on WAAM techniques and the commonly used metallic feedstock materials, and also provides a comprehensive over view of the metallurgical and material properties of the deposited parts. common defects produced in waam components using different alloys are described, including deformation, porosity, and cracking. methods for improving the fabrication quality of the additively manufactured components are discussed, taking into account the requirements of the various alloys. this paper concludes that the wide application of WAAM still presents many challenges, and these may need to be addressed in specific ways for different materials in order to achieve an operational system in an acceptable time frame. the integration of materials and manufacturing process to produce defect-free and structurally-sound deposited parts remains a crucial effort into the future.

Keywords: *WAAM, Materials, Defects, Quality improvement.*

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ESTIMATION OF CONCRETE COMPRESSIVE STRENGTH USING MACHINE LEARNING ALGORITHMS

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ABSTRACT

For the design and analysis of structures, prior knowledge of the compression strength of concrete is essential. Concrete is prepared by mixing the coarse aggregate, fine aggregate, cement, and water in proper proportion. As the coarse aggregates and fine aggregates are collected from the natural source, the uncertainties associated with their physical properties are also high. These uncertainties are affecting the compressive strength of the concrete. To account for the variability of compressive strengths of the same grade of concrete, the safety factor, and partial safety factors are introduced in the structural design. Due to advances in the data science and electronics industry, machine learning algorithms can be deployed in predicting the compressive strength of concretes. In this study, we have used linear regression, K Neighborhood, Decision Tree, Random Forest, and XGBOOST algorithm to predict the compressive strength of concrete. The hyperparameters are optimized for the minimum errors. The regression coefficient (R2) value is 0.92 for the XGBOOST algorithm and for the regression model the R2 value is 0.67. So, Machine learning models can be deployed in the prediction of compressive strength of concrete and the performance of the algorithm is satisfactory.

***Keywords**: Compressive strength of Concrete, Machine Learning, XGBOOST, Random Forest*

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TOPOLOGY OPTIMIZATION OF A SUCTION MUFFLER TO MINIMIZE BROADBAND SOUND

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ABSTRACT

A suction muffler used in a fluid machine has three functions: noise reduction; minimizing pressure drop and improving energy efficiency using acoustic effects. However, no method of suction muffler design considers all three of these functions concurrently. Therefore, in this study, we attempt to provide an integrated design method of a suction muffler in a fluid machine that considers all three functions. The topology optimization method for acoustic and fluid systems was applied to an integrated design. However, the interaction between fluid and acoustic was not considered. In addition, the acoustic input impedance of a suction muffler was used for a specific acoustical resonance frequency to improve the energy efficiency of a fluid machine. Finally, the sequential optimization method based on physical investigations was proposed to satisfy several design criteria. The proposed method was applied to the suction muffler in refrigerator's compressor.

Key wards: *Muffler, efficiency, acoustic resonance, acoustic input impedance*

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RETROFITTING TECHNIQUES OF OLD BUILDINGS AND LATEST BUILDING TECHNIQUES - CASE STUDY

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ABSTRACT

Indian culture is reinforced with many historically significant buildings and structures. It is very much essential for the rehabilitation of such old structures through various retrofitting techniques for preserving the history, architecture, and culture of our country. In this paper, the various retrofitting techniques used in the rehabilitation of existing structures and the latest innovative techniques in building construction are discussed in detail. Besides, the application of retrofitting techniques used in structures was illustrated with the help of some case studies from India. The retrofitting of Chhatrapati Shivaji Maharaj Terminus, Mumbai, and the latest building techniques used for the construction of Bogibeel Bridge were considered for case study purposes. In the case study, the reason for choosing the particular restoring techniques, the challenges faced during the construction and rehabilitation process are convoluted in brief.

Keywords*: Latest technology in construction, case study, retrofitting, old building*

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PREDICTION AND OPTIMIZATION OF ORGANIC RANKINE CYCLE (ORC) BASED DIESEL ENGINE WASTE HEAT RECOVERY USING ARTIFICIAL NEURAL NETWORK (ANN)

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ABSTRACT

This paper presents performance prediction and optimization of an organic Rankine cycle (ORC) for diesel engine waste heat recovery based on artificial neural network (ANN). An ANN based prediction model of the ORC system is established with consideration of mean squared error and correlation coefficient. A test bench of combined diesel engine and ORC waste heat recovery system is developed, and the experimental data used to train and test the proposed ANN model are collected. A genetic algorithm (GA) is also considered in this study to increase prediction accuracy, and the ANN model is evaluated with different learning rates, train functions and parameter settings. A prediction accuracy comparison of the ANN model with and without using GA is presented. The effects of seven key operating parameters on the power output of the ORC system are investigated. Finally, a performance prediction and parametric optimization for the ORC system are conducted based on the proposed ANN model. The results show that prediction error of the ANN model with using the GA is lower than that without using GA. Therefore, it is recommended to optimize the weights of the ANN model with GA for a high prediction accuracy. The proposed ANN model shows a strong learning ability and good generalization performance. Compared to the experimental data, the maximum relative error is less than 5%. The experimental results after optimizing the operating parameters are very close to ANN's predictions, indicating one or more operating parameters can be adjusted to obtain a higher power output during the experiment process.

Keywords: *Diesel engine, Organic Rankine cycle, Artificial neural network*

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SURFACE CRACK DETECTIONS IN BUILDINGS USING DEEP LEARNING

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ABSTRACT

Due to advances in the electronic industry, sensors are nowadays installed in buildings to automate the many utilities. For the structural health monitoring of structures sensors such as accelerometers, high-definition cameras, etc. are attached and continuously analyzed for detecting the faults on the structures. In this study, we will use deep learning algorithms for detecting the cracks on the building surfaces. The 40000 high-definition images are available in the literature in which have been labeled as “Positive” and “Negative”. Each class of images has 20000 samples and each image has 227 x 227 pixels with RGB channels. Four convolution network models such as VGG16, ResNet50, Xception, and MobileNet are used in our study. All four models have performed very well with more than 99% accuracy. So, Deep learning algorithms are very much effective in detecting the cracks from the images and can be used for real-time structural health monitoring.

Keywords*: Deep Learning, CNN, Crack detection*

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CFD ANALYSIS OF REACTIVE MUFFLER

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ABSTRACT

Muffler design is traditionally a trial and error process. This paper describes the flow analysis of a reactive muffler using CFD simulation in order to improve its performance by reducing the back pressure created on the engine. The back pressure of the muffler is computed from CFD simulation. The CFD analysis is done to avoid the tedious experimentation. The flow simulation is carried out using k-ε turbulent model as it is most suitable for turbulent flows having less converging time. Total four cases were analyzed including the base model muffler. Thus, three modifications were done in muffler geometry. The modification with reduced baffle spacing produced least back pressure with reduction in back pressure by 8.59%.

Keywords: *CFD, reactive muffler, flow simulation, k-ε turbulent model*

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STRUCTURAL AND GAS FLOW ANALYSIS OF MUFFLER UNDER STATIC AND DYNAMIC LOADING CONDITION

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ABSTRACT

High pressure and temperature exhaust gases coming out from automobile engine are made to pass through muffler for reduction of sound resulting from propagation of these pressure waves. The mufflers may be of reactive, dissipative and resonating type. The present paper deals with an automotive muffler that is modeled based on practical dimensions of a 4-stroke 2-cylinder MAHINDRA MAXIMO PLUS C.I. engine in CATIA V5software. The geometry adopted is elliptical in nature. Comparative static structural analysis for stress, strain and deformation along with modal analysis for deformation under dynamic loading has been performed for perforated and non-perforated design of the muffler using ANSYS Workbench 14.5. The effect of incorporation of perforation is studied on the corresponding static and dynamic behavior of the muffler.

Keywords: *automotive muffler, dynamic loading, modal analysis, static loading, structural analysis*

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PREDICTION OF ROCKFALL TRAJECTORY

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ABSTRACT

The landslides in recent times of Uttarkhand caused very serious damage to the life of the people and the loss of property. This is due to the major rockfall which is occurred in that area. There may be several reasons for this rockfall. Individual rock bounces along the steep hills and causes damage to the property and life. Due to heavy rainfall, the contact between the rock boulders and hills will be lost and rock rolls along the steep slopes of hills. With very high-velocity rock travels and bounces and will hit the nearby properties or highways. The momentum with which rock travels at a high speed causes damage to life and property. Research to address these problems and possible numerical and analytical solutions have to be found.

The role of a civil engineer is to identify the areas of weak rock zones causing landslides and rockfall trajectories have to be calculated. The analysis and research in this direction will help to design suitable protection measures and required construction structures has to build.

Keywords: *rockfall, landslides, analytical solutions, velocity.*

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THERMODYNAMIC ANALSYIS AND OPTIMIZATION OF A MULTI-GENERATION SYSTEM

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ABSTRACT

In this work, a hybrid system composed of a compressed air energy storage, a micro gas turbine, an organic Rankine cycle, a solar dish collector, and a multi effect distillation is presented as a combined power, heat, and fresh water production system. Energy and exergy analyses are applied to investigate thermodynamic performance of the system. The results show that the system consumes 278 kWh electricity and produces about 3.7 ton hot water during charging mode. Also, the system is capable of generating up to 523 kWh electrical energy and 2.5 ton potable water during the discharge period. The charge and the discharge period are 6.52 and 4 h respectively. Exergy analyses reveals that solar dish collector and combustion chamber are the major contributors for exergy destruction. Parametric analysis is employed to investigate the key parameters which have the major influence on the system performance. These parameters include cavern minimum and maximum pressures, gas turbine inlet temperature, dish collector aperture diameter, steam turbine inlet pressure, and desalinator feed water temperature. Optimization results show that round trip efficiency can rise from 65.2% to 70.35%, using upper limits of cavern minimum and maximum pressures. Besides, rising inlet temperature of gas turbine and restricting air cavern maximum and minimum pressures to their lower limits results in a 19.18% exergy efficiency improvement. Finally, economic analysis is performed to evaluate main cost and income sources of the system. As multi objective optimization shows, devising conditions that lead to produce more electrical energy improves system economic performance considerably.

Keywords: *Hybrid system, Micro gas turbine, Dish collector, ORC*

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STRUCTURAL ANALYSIS OF 3D PRINTED DENTAL IMPLANT USING DIFFERENT MATERIALS

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ABSTRACT

Advanced manufacturing technologies use computer-aided design digital models to create personalized 3D objects automatically. 3D printing is one of the most commonly used processes where the model designed in any of the CAD software is fed through the 3D printers and desired products are produced. The process uses various materials and each material has its own capabilities. The choice of material will completely rely on the application we intend for. In this study, we have designed the dental implant using Creo and the model is analyzed using Ansys. Three different materials were used for the structural analysis of the implant. The material chosen were composite resin, zirconia; titanium. This paper also reviews the types of 3D printing technologies available for the production of chosen materials and their applications in dentistry and in maxillofacial surgery.

Keywords- *3D printing; digital one-piece casting; multi-material 3D printing; 3D models; 3D printing using composite resin, zirconia; titanium.*

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MULTI-OBJECTIVE OPTIMISATION AND WORKING FLUID SELECTION IN LOW TEMPERATURE ORGANIC RANKINE CYCLE

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ABSTRACT

In China, the utilization of low-temperature waste heat (especially temperature less than 100°C) plays a significant role in increasing the energy-consumption efficiency in the industry. The organic Rankine cycle (ORC) is considered as a promising method to recover the aforementioned part of the waste heat. In the study, six potential candidates, namely R141b, R142b, R245ca, R245fa, R600a, and R601a were screened from 12 dry or adiabatic organic working fluids based on their thermodynamic performances in the ORC. A multi-objective optimization (MOO) was performed for the thermodynamic performance (exergy efficiency, EXE) and economic performance (levelized energy cost, LEC) by using non-dominated sorting genetic algorithm-II (NSGA-II). The Pareto frontiers were obtained for the six candidates with the algorithm, and each optimal compromise solution was accurately obtained with the fuzzy set theory. Based on the EXE and LEC of the optimal compromise solution, the total cost and power generation efficiency for the six candidates were determined. This was used to obtain an explicit evaluation index in economic performance, namely static investment payback period (SIPP), to identify that the R245ca corresponded to the most cost-effective working fluid with the shortest SIPP. This suggests R245ca was the fastest to cover the investment and cost of the ORC system. Furthermore, a fast decision- making method was introduced to select the optimal working fluid based on the grey relational analysis (GRA) by considering key physical property parameters of the working fluids. The results suggest that any potential working fluid to recover low-temperature waste heat in the ORC can be evaluated by the simplified grey relational degree (SGRD) proposed in the study.

KEY WORDS: Working fluid, levelized energy cost, grey relational analysis (GRA), SGRD,

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DESIGN AND DEVELOPMENT OF SMART DUAL AXIS SOLAR TRACKING (DAST) SYSTEM

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ABSTRACT

Increasing global warming and depleting fossil fuels necessitate the utilization of alternate energy sources to meet future energy needs. Renewable energy sources are capable of providing pollution-free and cost-effective electricity. Solar energy is one such free and abundant energy source that can be captured & stored in the day and used whenever required. For maximum energy capture efficiency, the sun rays have to fall perpendicular to the solar panels, and thus a mechanism is required to move/align the panel to maximize the panel efficiency.

The aim of this work is to design and develop a Smart Dual Axis Solar Tracking (DAST) system for the accurate positioning of solar panels in order to maximize power output. The designed solar tracking system utilizes two motors that rotate the solar panel through a hemispheroidal 3-D rotation. The differential voltage between the solar panel and LDRs will drive the motors to position the panel. The motors are decoupled from each other to avoid control problems. The developed DAST system was found to have panel collection efficiency by out 36% compared to that of the fixed board.

Keywords: *Solar tracking, Dual Axis, Renewable Energy, Panel Efficiency, Solar Panel Control*

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PERFORMANCE SIMULATION AND OPTIMIZATION OF INNOVATIVE OCEAN THERMAL ENERGY CONVERSION (OTEC) SYSTEM

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ABSTRACT

Based on multi-objective particle swarm optimization (MOPSO) algorithm, with considering levelized cost of energy (LCOE) and exergy efficiency as two different objective functions, an innovative Organic Rankine Cycle (ORC) model based Ocean Thermal Energy Conversion (OTEC) system is investigated for trade-off Pareto optimization. In the present study, six key parameters including evaporating temperature, condensing temperature, warm seawater temperature at the outlet of evaporator, cool seawater temperature at the outlet of condenser, degree of superheat, and depth of cool seawater have been selected as decision variables. R717, R152a, R134a, R227ea, R600a and R601 are chosen as working fluids. Meanwhile, Linear Programming Technique for Multidimensional Analysis of Preference (LINMAP) is introduced in order to make decision for Pareto frontier. The results indicate that LCOE and exergy efficiency are two conflicting objectives, which are impossible to both achieve their optimal values simultaneously. According to the non-dominated sorting of Pareto optimal solution (POS) for the six working fluids, R717 and R601 have the best performance with 0.34 $/kWh of LCOE, 28.17% of exergy efficiency and 0.52 $/kWh of LCOE, 28.47% of exergy efficiency, respectively, followed by R152a, R600a and R134a which have relatively poor performance, but better than R227ea.

Keywords: *OTEC, ORC, MOPSO, exergy, Multi-objective*

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WELD DEFECT MONITORING IN GAS METAL ARC WELDING PROCESS USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

The gas metal arc welding process (GMAW) is one of the arc welding processes commonly used in industries due to its wide range of applications and economic advantages. In the GMAW process, the arc interacts with the environment leading to weld defects that are realized in post-weld non-destructive techniques (NDT). This leads to the necessity of in-process monitoring and control of the process to ensure quality by defect-free welds. The present work is a preliminary study intended to develop an in-process monitoring system that can identify and classify the defects in the GMAW process. In this study, experiments are conducted on the tube-to-tube butt joints in a flat position by varying the process variables such as current, voltage, travel speed, and contact-tube-to-work piece-distance (CTWD). It involves good weld as reference for three types of defects such as porosity, burn through and lack of penetration were considered. The instantaneous current and voltage signals were recorded using an acquisition system that is later used in statistical features extraction. Based on statistical features such machine techniques were deployed to classify the defects with reference to good weld and their efficiencies are reported.

Keywords: *Arc welding process; Real-time monitoring; Machine learning; Weld defect classification.*

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THERMO-ECONOMIC EVALUATION OF SOLAR ORGANIC RANKINE CYCLE BASED ON TYPICAL SOLAR RADIATION YEAR

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ABSTRACT

The thermo-economic optimization of a solar organic Rankine cycle (SORC) should consider the features of fluctuations in solar radiation based on local historical solar radiation. However, the use of historical solar radiation is inconvenient for thermo-economic optimization because it involves considerable computational effort for simulation. To overcome this inconvenience, we propose the thermo-economic optimization of SORC by using typical solar radiation year (TSRY). TSRY is a synthesis of typical solar radiation on the basis of historical solar radiation, indicating that TSRY can reflect the typical features of fluctuations in solar radiation in a specific area. Afterward, the multi-objective genetic algorithm (GA) is selected to optimize the dynamic performance of a small-scale SORC by using the TSRY. In GA, the evaporation temperature and capacity of thermal energy storage are taken as optimization parameters, and the power output and fluctuation in power output are optimization goals. Accordingly, Pareto frontiers that optimize the SORC performance can be obtained. The effect of different parameter combinations in the Pareto frontiers and the scale of the SORC on thermo-economic are further analyzed using annual net profit as an indicator. Our analysis shows that a minimum SORC scale for profitability is set for a given location, and the profit growth rate increases as the system scale increases.

Keywords: *Organic Rankine cycle, Solar energy, TSRY, Annual net profit*

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IDENTIFICATION OF TRAFFIC SIGNS USING DEEP NEURAL NETWORKS

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ABSTRACT

In recent days, we have been moving towards automated self-driving transport systems. For the smooth movement of vehicles on the roads, it is essential to follow the traffic rules by the vehicles. The road signs are not always clear in India due to less maintenance. In this study deep learning model is employed to classify the given traffic signs. The testing dataset consists of 12000 images, and convolutional neural networks are trained to predict the new road signs. The hyperparameter of the networks is optimized to obtain maximum accuracy. The trained model is accurate up to 86% in the testing datasets. So, the usage of convolutional neural networks for the prediction of a traffic sign is successful and can be deployed in real-world problems.

Keywords*: traffic sign classifications, convolutional neural network, deep learning*

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STRESS ANALYSIS OF THIN RIMMED SPUR GEAR WITH ASYMMETRIC TROCHOID

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ABSTRACT

Involute spur gears are widely used machine element in many industrial areas. Thin-rimmed spur gears are popular in applications where low weight design and high power transmission are required. The stress occurred on thin-rimmed spur gears are different from standard spur gears due to deformations on rim. For this reason, rim thickness is key parameter for stress analysis of thin-rimmed gears. As rim thickness decreases, the value of maximum bending stress increases and the location of maximum stress is moved bottom of tooth which results in fatigue life reduction. In this study, to decrease maximum bending stress and to move upper the critical point; asymmetric trochoid profile is proposed. Asymmetry is constituted with using rack cutter has different tip radius on sides. This allows using larger tip radius on one side. Firstly, 3D design of spur gear with thin rimmed is realized in CATIA precisely. Then gears are imported to ANSYS package for finite element analysis. Normal force is applied on HPSTC. The rim surface is not fixed to allow rim deformations. The effects of using asymmetric trochoid on value and location maximum bending stress of thin rimmed spur gears is obtained with conducted case studies.

Keywords: *Thin rimmed, involute spur gear, asymmetric trochoid*

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WIRE ARC ADDITIVE MANUFACTURING OF SHAPE MEMORY ALLOY

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ABSTRACT

Wire arc additive manufacturing (WAAM) processes play a vital role due to its layer-by-layer deposition technique capable to produce complex geometries that are not possible with traditional manufacturing processes. The WAAM of shape memory alloys (SMA's) components could enhance the functional properties, economic efficiency of the component, reduction in assembly, and lead time. The present proposal proposes wire arc additive manufacturing (WAAM) of SMA's that are used to fabricate components for damping applications in various fields such as automotive, aerospace and medical, etc. In this study single-wire GMAW process and Twin-wire or Tandem GMAW process is considered for material delivery and deposited layer by layer with help of six-axis motion either by CNC or robot that is capable to deposit at any position allows fabricating complex components without support material.

Keywords: *Wire arc additive manufacturing; Shape memory alloys; Microstructure; Mechanical properties*

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WIND AND SOLAR ENERGY BASED MOBILE CHARGER

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Abstract:

Charging of mobile phone is a big problem when travelling a long distance journey or where power supply is not available. This paper proposes a universal mobile charger which can work on wind as well as solar energy. This charger is highly efficient and very economical as it uses non-conventional energy sources of power. It comprises photovoltaic array, wind turbine, asynchronous (induction) generator, controller, lead-acid storage batteries, and an inverter unit to convert DC power to AC power. But the energy generated from solar and wind is much less than the production by fossil fuels, however, electricity generation by utilizing PV cells and wind turbine increased rapidly in recent years. This paper presents the Solar-Wind hybrid Power system that harnesses the renewable energies in Sun and Wind to generate electricity. System control relies mainly on micro controller. It ensures the optimum utilization of resources and hence improve the efficiency as compared with their individual mode of generation. Also, it increases the reliability and reduces the dependence on one single source. This hybrid solar-wind power generating system is suitable for industries and also domestic areas.

Keywords: Universal mobile charger, economical mobile charger, mobile charger, mobile phones

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IMPROVEMENT OF BIO-COMPATIBLE IMPLANTS USING LASER ENGINEERED NET SHAPING PROCESS

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ABSTRACT

Additive manufacturing or Rapid Prototyping (RP) is an advanced manufacturing technology emerging as key player in both industrial and medical fields. Dissimilar to traditional manufacturing processes, in additive manufacturing process material is added as sequential thin layer to achieve the build parts with minimal post processing and it requires less time to fabricate prototypes with high accuracy. Additive manufacturing shows desired results for fabricating the customized medical implants. As there is a large variation to part structure from patient to patient, it is difficult to make implants from conventional manufacturing processes. So, rapid prototyping is most advanced and convenient to fabricate a medical implant that suits the patient's requirements. The present paper reviews the works produced by Laser Engineered Net Shaping (LENS) technique to fabricate the medical implants from bio-materials.

Keywords: *Net shaping, bio-compatible implants, 3D printing, LENS*

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FEM ANALYSIS OF CAM SHAFT IN AUTOMOBILES

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ABSTRACT

Camshaft is used in the engine for transfers motion to inlet & exhaust valve. If transfer of motion is not proper then the strokes of the engine will not do in proper way. It also effects on performance of engine. To make work of camshaft in precise way, it is required in order designing a good mechanism linkage of camshaft. In four strokes engine one of the most important component is camshaft, such an important part and that over the years subject of extensive research. In this study, Design of Camshaft is done as per power stroke and suction stroke and its model is done in CATIA and Static and Model Analysis is carried in Ansys Work bench. By varying Materials like Cast Iron & Nickel chromium molybdenum steel and find out which is best material Suits for design.

Keywords: *Cam Shaft, Design, static and model analysis*

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PREDICTION OF FRACTURE BEHAVIOR OF TITANIUM GRADE 2 SHEETS

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ABSTRACT

The objective of the present research work is to study the fracture behavior (void coalescence) of titanium grade 2 sheets using the Single Point Incremental Forming (SPIF) process and its dependence on various process parameters. The importance of tool diameter on the fracture behavior of the titanium grade 2 was investigated and it was found that the maximum deformation fracture strain was observed for the highest (12 mm) tool diameter. The Forming Limit Diagram (FLD) is plotted for each speed of titanium grade 2 sheets. The variation of fracture behavior with respect to speed was examined and it showed that this was the maximum for higher speed of 600 rpm spindle speed. The void coalescence analysis was carried out using AutoCAD software, and the strain triaxiality was determined. The Energy Dispersive X-ray Spectroscopy (EDS) analysis was investigated to confirm the elemental composition of titanium grade 2 sheets.

Keywords: *Titanium, SPIF, FLD, strain triaxiality*