3.4.3.1: Number of research papers in the Journals notified on UGC website during the last five years

Index Page

S.No	Description	Page no.
1	2021-Part 1 Research papers in the Journals notified on UGC website	2-91

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Correlation of strength development of RCA in quaternary blended cementitious system

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Abstract. Recycled concrete aggregate (RCA) obtained from demolished structures can be used for concrete making, and is established as a promising material in the field of construction. In the present study, the effect of RCA on the mechanical properties of different strength concretes admixed with Micro silica, fly ash and nano-silica as a part replacement to cement was considered. The quantity of cement varied from 350-690 kg/m^3 with the additions of Fly ash at 0, 20 and 30%, micro silica at 0, 5, 10 and 15%, and Nano silica at 0, 1, 2, 3 and 4%. The samples were cured for 7, 28, 56 and 90 days and tested for Compressive strength. Split tensile and flexural strength evaluation was carried out on samples which have been cured for 28 days. The workability of fresh concrete was determined. With the help of the tested database, equations for prediction of compressive strength using modified Bolomey's equation were generated. Equations for the flexural strength and split tensile strengths based on compressive strength were developed and compared with equations available in the literature.

Keywords: Bolomey's equation; Construction & Demolition (C&D) waste; fly ash (FA); mechanical properties; Micro silica (SF); Nano silica (NSF)

1. Introduction

Cement is the most widely used construction material. To meet the demand for housing and infrastructure, a considerable amount of cement is produced which in turn affects the environment. Reducing cement consumption and also maintaining sustainable development is the chief concern in the development of the nation. The concrete industry is the largest consumer of natural resources such as sand and gravel. It is a part of the internationally supported strategy to meet sustainable development and environmental goals. Due to this the construction industry has to progressively choose supplementary cementing materials as partial replacements to cement and C&D waste for aggregates, respectively. Fraay *et al.* (1989) stated that the strength of concrete

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Nat.Volatiles&Essent.Oils,2021;8(4):5698-5711

Neural Network Based Prolong Structural Building Monitoring Management System Using Hybrid Wireless Sensor Network

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Abstract

The wireless sensor network is well suited for smart building monitoring system as it is cost effective compared with wired network. A hybrid protocol that uses concept of LEACH to increase the life time of sensor network and HRP protocol for effective communication to base station is use in building monitoring system. The sensors such as humidity sensor, strain sensor, temperature sensor, and electrical current monitoring sensor are deployed in huge amount around the building infrastructure and these sensor are organized as different clusters. At initial stage cluster head sensor activates few member sensors for gathering information and rest of sensors are inactive state. This increases the life time of sensor network. If anything happens abnormal then few more sensors are activated to gather more information by cluster head. A neural network is implemented to isolate information from the cluster member nodes and communicate effectively to sink node. In order to reduce the work load of cluster head node, Information Collection Node (ICN) and Energy Monitoring Node (EMN) are added in each cluster to isolate information and monitor energy level of cluster member nodes. Thus hybrid protocol for structural building monitoring system is implemented that increases life time and effectively convey sensory information to sink node in wireless sensor network.

Keywords: - Structural building monitoring system, Hierarchical clustering, LEACH, HRP.

1. Introduction

Now a day's wireless sensor networks play a major role in collecting information from sensors and sending to the sink node. Sensor networks are deployed in various areas such as healthcare monitoring, civil building application, and military defenses. Wireless sensor networks can sense information humidity, pressure, temperature etc .These sensors collects information about the surroundings then process the information and send to base station (BS) [1].

Internet of Things (IoT) is the emerging technology that are used in various application such as health care smart cites, vehicular networks, machine to machine communication and other areas . In IOT uses RFID to uniquely identify things and controlling them with various mechanisms. IOT is used in pervasive computing i.e. present everywhere that gather information for all IOT device component and processes these information. Networking Scientists, Research & Development industries, and many

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Effect of Accelerated Curing on Strength of Quaternary Blended Cement Concrete with Recycled Aggregate

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Keywords: Quaternary Blended Cement Concrete (QBC), Fly ash (FA), Micro silica (SF), Nano silica (NSF), Recycled Concrete Aggregate (RCA), Accelerated Curing.

Abstract. The studies carried out on accelerated curing of Quaternary Blended Cement (QBC) Concrete with and without recycled aggregate are presented and the test results are encouraging by which 90% design strength can be achieved at 100°C for a period of 3 hours for both methods of curing. In this experimental investigation cement is replaced by fly ash, micro silica and Nano silica partially to produce QBC Concrete. The variables include the grade of concrete, powder content and recycled aggregate percentage. The natural aggregates were replaced by recycled aggregate at three levels of 0%, 50% and 75%. Nano silica is varied at 2 and 3% by weight of cement while maintaining fixed percentages of fly ash and micro silica in cement. Two methods of curing were employed; boiling water method and hot air curing and two grades of concrete M-40 and M-60 were used in this investigation.

Introduction

Traditionally, the quality of concrete is expressed in terms of its compressive strength after curing for 28 days before testing. The time specification is too long, for construction control and also for applying corrective measures. If the strength of concrete can be predicted within a short duration of time, the quality can be improved. Accelerated curing is one method by which high early-age strength is achieved in concrete and also can be used for the prediction of strength in the mix design. This technique is used for achieving the high early-age strength for the removal of formwork in the prefabrication industry, to reduce the cycle time, thereby resulting in cost-saving. The need of the hour is for evaluating concrete in the field using a consistent and speedy method in which accelerated curing technique can be used [1].

An appropriate rapid curing methodology is needed for making good concrete since this method is detrimental to the long term performance of concrete. The surface permeability test was used to quantify the influence of curing conditions and heat damage effect of steam curing. The surface permeability and the long term strength of concrete were observed to be affected with increased porosity, however, the quantity of Portlandite was decreased with a subsequent water curing [2]. In the production of High-Performance Concrete (HPC), a binary blend of FA and three types of RCA at 100% was used and the development of strength was studied by using initial steam curing and standard curing method. The use of high-quality RCA from HSC had produced a similar NA concrete, however, the steam cured RCA concrete had lesser mechanical properties but with porosity [3]. The high early strength cement always gives a higher strength compared to OPC at all ages of curing, and in steam curing, though it had a detrimental effect on the strength gain, with a proper mix design the concrete can be utilized for pavement structures, flooring and slabs [4]. The utilization of micro silica (SF) in ternary blends has helped to improve the chloride penetration

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Comparative study on shear performance of blended pozzolonic RC beams with fly ash and recycled aggregates

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Shear failure in a reinforced concrete beam is a sudden failure which is associated with crushing of concrete and is a brittle failure. A structural designer should be aware of various components of shear resisting mechanisms particularly the shear resistance of concrete. In this regard, an experimental investigation was carried out on forty simply supported reinforced concrete beams, to examine their shear performance of with and without shear reinforcement. This paper reports the results of a laboratory based experimental study aimed at studying shear performance of blended concrete beams with fly ash and recycled aggregates. Blended concrete beams of M35 and M45 grades were produced by partially replacing the cement by 25 percent fly ash and the Natural Coarse Aggregates (NCA) were replaced by Recycled Coarse Aggregates (RCA) in different fractions of 0,25,50,75 and 100 percentages. The experimental shear strength of blended concrete beams was then compared with predicted shear strength evaluated from various international codes and some existing empirical models in order to adjudicate the relevance of the experimental shear strength with the predicted shear strengths for beams without shear reinforcement.

KEYWORDS: Fly ash; shear; blended concrete; reinforced concrete beams; recycled aggregate; shear strength.

Mechanical properties of blended concretes give us general idea of its suitability for nonstructural and structural applications. But its real performance is assessed when used in structural members and tested under simulated loading which is similar to real time loading condition. The induced stresses primarily include flexural, shear and tensile stress. This real time simulated load tests help us to categorize the performance criteria for blended concrete. Han et al.[1] and Maruyama et al.[2] reported that, structural members made from Recycled Coarse Aggregates (RCA) sustain large deflections and relatively lower shear strength and flexural strength when compared to similar structural members made from natural aggregate. Therefore, the applicability of RCA for structural applications has been a matter of concern for many researchers.

Many researchers studied shear behavior of recycled aggregate concrete beams at different replacement levels of RCA. Sogo et al.[3] and Sato et al.[4] investigated the shear behavior of Recycled Aggregate Concrete (RAC) beams without shear reinforcement and at different percentages of tension reinforcement. They observed that the failure modes and crack patterns of RAC beams were very similar to the conventional beams. González and Martínez[5] reported the results of shear performance of reinforced RAC beams with 50% RCA and a tension reinforcement of 2.98%. The ultimate load and deflection of RAC beams exhibited no significant difference as compared to the Natural Aggregate Concrete (NAC) beams. They also concluded that, the existing shear design provisions for reinforced concrete beams can readily be used for RAC beams without any modification. Etxeberria et al.[6,7] carried out experiments on RC beams containing 25%, 50% and 100% of RCA reveals that, the reduction in cracking load is unavoidable with the incorporation

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Abstract

In general, pedestrians want to cross a road at a mid-block section instead of intersections because it is the shortest route. According to an Indian scenario, most of the crosswalks in urban areas are not signalised and controlled. In this study, the crossing behaviour of pedestrians in terms of speed at a midblock section was studied by considering several parameters. Statistical tests such as ANOVA and Pearson correlation tests were performed in order to know the effect of parameters on the crossing speed of a pedestrian. The pedestrian's age and gender, crossing type, pattern, time, number of stops, number of two wheelers, three wheelers, light and heavy commercial vehicles, and groups significantly affect their crossing speed. A multiple linear regression model was developed by considering the most significant parameters. The mean absolute percentage error, root mean square error, and R2 values were calculated to validate the models.

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Key words

- Ai g;
- Ggpf gt;
- Gtr ys ; Myi i ci g; Tsggf , AOP _A.

1RV L K R V

Pedestrian safety must be the first priority in a transportation planning group. In developing countries, pedestrian safety is a major problem in urban areas due to speedy urbanization and increases in the vehicular population. A lot of factors influence pedestrians while they are crossing a road. A pedestrian crossing a road makes decisions as to whether to accept certain gaps between the flow of approaching vehicles. Pedestrian actions continuously change with respect to environmental characteristics, and their vulnerability is enhanced with increases in motorized traffic. The jaywalking behavior of a pedestrian is greater when crossing at a mid-block section compared to walking on sidewalks. A higher number of conflicts occur at mid-block locations due to jaywalking, which leads to more pedestrian fatalities. In developing countries such as India, pedestrians need to cross median openings due to the absence of footbridges and subways. Generally, pedestrians judge safe gaps in a traffic stream when crossing a road at mid-block sections. The pedestrian crossing process at an uncontrolled intersection involves two aspects: first the pedestrian approaches the crossing facility, and second, performs the crossing maneuver. The crossing maneuver process involves the pedestrian departing from one curb to another curb across the roadway. Generally, pedestrians wait at curbs before starting to cross the road to view the available gaps. Then pedestrians will decide whether to accept or reject any gaps for crossing safely based on previous experience.

In general, a pedestrian's speed is 1.2 m/s without any restrictions. According to the Traffic Engineering Handbook (Dewar 1992), a speed of 0.91–0:98 m/s is recommended for the design of pedestrian facilities. The Institute of Transportation Engineers (ITE Committee 4A-6 1983) suggests a speed of 0.75 m/s when there is a greater number of older pedestrians at a location. The Highway Capacity Manual [Transportation Research Board (TRB) 2000] suggests 1.2 m/s if the older pedestrian population is less than 20%; otherwise, 1.0 m/s is advisable. The Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD) [Federal Highway Administration (FHWA) 2003] suggests 1.21 m/s from the curb to the other side of a roadway. The

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Research Article

Energy Efficient Scheduling Algorithm to Increase the Life Time of Battery Power in Wireless Sensor Networks For Structural Health Building Monitoring Applications

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Abstract: Because of its ability to reduce the costs associated with the installation and maintenance of SHM systems, structural health monitoring using wireless sensor networks has piqued researchers' interest. These systems are used to monitor critical infrastructure like high-rise buildings, bridges, and stadiums, and they have the potential to extend the life of structures and improve public safety. WSNs for SHMs face unique network design challenges due to their high data collection rate. This paper provides a comprehensive overview of SHM using WSNs, including a description of the algorithms used in physical harm detection and localization, network design issues, and future systematic investigation directions. Time synchronization, sensor placement, data processing, and quantifiability are all discussed and compared as network design issues. For improving the lifespan of a wireless sensor network, the proposed framework includes four stages: node investigation and deployment, clustering nodes, shortest path construction, and data transmission. This paper proposes a novel framework that consists of four stages: optimal node deployment, clustering of nodes, shortest route construction, and data transmission. It's built into the NS2 software, and the results are double-checked. Finally, the proposed framework's performance is assessed by comparing its results to those of other approaches and demonstrating its efficiency.

Keywords: Structural health monitoring, sensor types, network data flow methods, network scalability, and energy harvesting are some of the key words

1. Introduction

Wireless sensor networks have emerged as a powerful and cost-effective platform for connecting large networks of sensors in the last decade. Sensors distributed throughout a structure are used to analyse the health of the structure in these networks, which have many applications in the health, military, business, and industrial fields. [1] to [2]. Traditionally, SHM systems have been built with wired sensor networks, but the lower installation and maintenance costs, as well as the high reliability of WSNs, have made them a compelling alternative platform. [4]-[7]. Significant reductions in the cost of exploitation WSNs for SHM would change their effective use in critical public and private infrastructure and expand applications such as short-term health monitoring. Sensors for SHM are deployed at multiple locations in WSNs via a structure. At 100 hertz sampling frequencies, these sensors collect data on acceleration, surrounding vibration, load, and stress. As a result, the sensing and sampling rates, as well as the quantity of data collected, are higher in WSNs than in other applications, and as a result, WSNs for New challenges are introduced by SHM. Designing a network presents a number of challenges. Sensing element nodes send detected data to the sink either directly or by forwarding each other's packet information collectively. This process is critical for the detection and localization of structural damage and can occur in a variety of places, including nodes, cluster heads, and central servers, depending on the situation. Structure's topology Damage detection usually necessitates a comparison of the structure's current modal options with those associated with the structure's undamaged state. The mode shapes and natural vibration pattern for a given structure are the primary representations of a structure's modal options.

SHM has been used in vital structures such as aircraft, ships, high-rise buildings, dams, and bridges. Essentially, these installations are weird, but they have a growing range of WSNs. A research team from the University of California, Berkeley, placed one of the first SHM on the Sound Bridge in 2007.

Studies on Impact Resistance of Self-Compacting Concrete with mechanically treated Recycled Coarse Aggregate

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Abstract. Self-compacting concrete (SCC) is an extraordinary type of concrete that is extremely flowable and spreads into the formwork without the need of external vibration. In order to attain self-compatibility SCC obliges extensively surplus quantity of fine particles as compared to conventional concrete. Recycled Coarse Aggregate (RCA) obtained by crushing of old concrete is used in the investigational analysis. Nan-Su method is used to design the SCC mixes A and B (M35 and M45). The current experimental study aims to evaluate the impact energy of Recycled Coarse Aggregate (RCA) based self- compacting concrete by replacing with Natural Coarse Aggregate (NCA) (25%, 50%, 75%, and 100%) in unprocessed and processed states for various number of revolutions (500R, 1000R, 1500R, 2000R). Tests were carried out with a constant mass of hammer (16.38 kg). The impact energy determined for the Mixes A and B is compared with respect to replacement level and processing of RCA. The impact energy calculated is maximum for mix-A (1500 and 2000 revolutions) and mix-B (2000 revolutions) at 75% and 100% replacement of RCA respectively. From the experimental results of obtained Coefficient of Variation (CoV) with respect to processing of aggregate, in both the mixes it is observed that RCA in unprocessed state and processed state (1500R) has good Coefficient of Variation. Comparing the results of Coefficient of Variation with respect to replacement level of aggregate it has a very good CoV at 25% replacement level of RCA for both the mixes.

Keywords: Self-Compacting Concrete, Natural Coarse Aggregate, Processed recycled coarse aggregate, unprocessed recycled coarse aggregate, Impact resistance.

1. Introduction

One of the current trending challenge for a Civil engineer is to plan, design and built the construction projects with the minimal use of natural resources and also to make use of alternate construction materials to maintain ecological balance. [1] Enormous amount of demolition waste generated is creating a huge pressure on the environment thereby increasing land pollution. [2] To minimize the impact of demolition waste it can be recycled and used in construction projects. [3] There is an urgent need for improving the standards of using alternate construction materials to make a sustainable development.

A virtuous volume of research has been carried out on the static behaviour of concretes but there is a lag in the behaviour of impact resistance of special concretes using recycled materials. [4] RCC structures are subjected to dynamic loads for a very short duration. [5] The various dynamic loads coming on the structures are like machine vibration, seismic forces, wind

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Finite element analysis on MWNT reinforced S-glass composite

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Abstract

Fiber reinforced composite is a composite material consisting of a matrix reinforced by a fabric. Shear strength can be defined as the maximum shear stress that a material is capable of sustaining. Shear strength is calculated from the shear fracture load and the shear loaded area. Interlaminar shear stress (ILSS) is the shear stress observed between the laminae of a laminate. The objective of the present work is to perform finite element analysis on neat and CNT reinforced S glass epoxy composite (CRSE) using ANSYS software to estimate the instantaneous shear modulus (ISM) and observe the effect of notch separation on the measured ILSS. In S glass epoxy composite (SGEC), least and peak values of ILSS and ISM are 14.79 MPa, 35.35 MPa and 15.19 MPa, 33.12 MPa respectively when the notch separation is 5 mm and 1 mm.

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Keywords

Finite element analysis; ANSYS; S-glass; Epoxy; Multi- walled carbon nanotube

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Experimental investigation of high cycle fatigue life of jute fibre reinforced hybrid composite material for axial flow fan blades

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Abstract

Axial flow fan blades made of glass fibre reinforced plastics have a detrimental impact on the environment after their service life due to their non-biodegradability. To reduce the impact of blade materials on the environment and to improve biodegradability, it is necessary to reinforce the material with natural fibres without effecting the mechanical properties. This paper investigates the tension–tension fatigue life of three different hybrid composites. They are an 18-ft axial flow fan blade material (GFRP), the 8th layer of GFRP replaced with woven jute (G8J), and the 12th layer of GFRP replaced with woven jute (G12J). The number of cycles to failure was found at a stress ratio of 0.1, a test frequency of 10.5 Hz and at normalized peak stress ratios of 0.85, 0.7, 0.55, and 0.4 by using constant amplitude loading. As S-N curves were fitted into the experimental data, power function formulas were developed to estimate fatigue life at specified normalised peak stress ratios. It was interesting to note that all the three materials had reached their endurance limit (10^6 cycles) at a normalized peak stress ratio of 0.4 and the fatigue life of woven jute reinforced composites is about 78% of GFRP. Thus, it was proposed that partial reinforcement of woven jute in fan blades is recommended at low normalised peak stresses when biodegradability after service life is the major concern. The manufacturing cost of the woven jute reinforced blade is also less than the conventional blade. The two-parameter Weibull distribution function was used to correlate the scattered fatigue life data at various normalized peak stress ratios. These curves have a lot of design value in real composite material applications because they anticipate the sample response at the time of service based on the degree of reliability.

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Keywords

Glass fibre reinforced plastic composite (GFRP); Tension-tension fatigue; S- N curve; Woven jute reinforcement; Weibull distribution; Reliability analysis; Mean life

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Research Article

Post-Surface Processing and Virtual Simulation Analysis of Ball-Punch Test on CP-Ti Material

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The titanium alloy is one of the prime materials for many engineering applications. It has been recommended for the components in automotive engines, power sector, biomedical industries, and more applications. It is due to the unique properties of the material with good strength and corrosion resistance. However, it is very challenging to handle Ti-based materials in manufacturing sectors without damaging the metallurgical quality. Thus, an attempt made to study the deformability of the CP-Ti material through ball–punch test to represent the stress, strain, and formability limit during mechanical loading and plastic deformation. The experiments are conducted following the ASTM E643 standards to study the material behavior. The maximum cupping reached to a height of 8.69 mm and got teared at the peak of doom. The separation has induced grain detachment due to tensile loading. The same condition is used to simulate with PAM STAMP™ software and 8.48 mm is the maximum cupping height achieved. The different is 0.21 mm. The results are interesting with similar observations and found acceptable to study the deformation.

1. Introduction

In the last two decades, demand for titanium alloy and its research are found increased in automobile components, biomedical engineering, and food processing industries [1–3]. These alloys are recommended for structural engineering and load bearing systems and widely used as alternate materials for biomedical components. The titanium alloy offers best performance in automobile components subjected to extreme load/suspension systems. Especially, the structure component should have high corrosion resistance, good formality, and high strength with low modulus to sustain reliable service period of the structure developed [4]. Literature is available to discuss about the processing of titanium alloys [5]. In general, the titanium alloys are widely used in aero jet engine components to make compressor disc, fan doom, and fan blades. It should possess high strength with less weight, less fatigue, and creep failures [6]. Jiang and Huang investigated and reported the grain replacement and effects on mechanical forming of Ti alloy. While processing the material through mechanical loading, the crystalline structure of alloy varies with respect to process condition. The commercial pure titanium (CP Ti) is HCP (hexagonal closely packed) structure below 800°C and

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EMISSION OF ALDEHYDES FROM LHR DIESEL ENGINE WITH CARBURETED BUTANOL AND JATROPHA OIL

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ABSTRACT

Experiments were carried out to study emission of aldehydes from low heat rejection diesel engine, which consist of air gap insulated piston among 3-mm air gap with an alloy of nickel superni crown, air gap insulated liner with superni place in and ceramic coated cylinder head with normal temperature condition of crude jatropha oil - butanol mixture operation with varied injection timing and injection pressures and compared with diesel - butanol mixture operation and also clean diesel operation on conventional engine (CE). At maximum load operation by different percentages of butanol on a mass basis was introduced into the engine via a variable jet carburettor installed at the engine's inlet manifold. Comparative studies were made between LHR engine and conventional engine with diesel, crude jatropha oil and carbureted butanol at recommended injection timings and varied injection pressures. Aldehydes were measured by using the dinitrophenyl hydrazine (DNPH) method at maximum load engine operation of the engine.

Keywords: LHR engine, Aldehydes, Butanol, Emissions.

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Original Article

TESTING OF SPARK IGNITION ENGINE WITH ALCOHOL

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ABSTRACT

Individual transport favors SI engines due to many reasons such as less vibration, more comfort, and easy stop-and-go service. These engines are symbols of advanced technology and are known for modern civilization. The engines, which execute a single power stroke in two revolutions of the crankshaft which give higher workability, which means they can convert more amount of heat into work. Conventional fuels generated from nature are dwindling due to high demand because of the increase of automotive engines are being replaced with renewable fuels, which have got many advantages like they are regenerated in nature, less cost, and emit lower pollution levels. Alcohols, renewable fuels are volatile and they possess many advantages over conventional fuels. Tests are executed to determine workability and products of the exhaust of the engine with the change of a ratio of compression executing one power stroke of two revolutions of the crank SI engine with CH3OH blended petrol (20% CH3OHl, 80% petrol by vol) having a coating of cuprum, [CCE, cuprum (thickness, 0.3 mm) coated on piston's top portion, liner's inner portion and head of the cylinder] and validated with the data of standard engine SI engine (CE) with neat petrol operation. Workability factors and products of exhaust were taken into account with CCE with CH3OH mixed with petrol and correlated with CE with the neat operation of petrol. CCE exhibited better workability and a reduction of products of exhaust with respect to CE with experimental fuels.

KEYWORDS: Substituted Fuels, CE, CCE, Workability & Products of Exhaust

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INTRODUCTION

The invention of new fuels is an important issue as these conventional fuels are reducing day by day with high demand in supply with the use in automobiles and agricultural sector and also emissions of the exhaust are higher and higher with these conventional fuels. Alcohols are replacing conventional fuels as they have higher RON and more volatile causing efficient burning in the chamber of combustion. [Heywood, 1988]. Their properties are much superior to those of petrol. With the use of low quantities of alcohol mixed with petrol in SI engine. The engine can be used directly without much change in structure. A good number of scientists made trails with alcohol mixed with petrol in small quantities in the base SI engine. [1-6]. They narrated that workability is raised with alcohol mixed petrol with respect to neat petrol operation. CH3OH mixed with petrol by the ratio of 1:3 in volume enhanced workability and lowered products of exhaust with respect to neat petrol with CE [7-9]. Workability of the engine enhanced with a coating of cuprum on inside components of engine such as piston, liner, and head of the cylinder owing to lower resistance of cuprum for transfer of heat. [10-11]. CO and UBHC are the products of the exhaust from the SI engine. Deterioration of health will be caused by inhaling of products of exhaust into the breathing system. They impose severe headache, vomiting sensation, dizziness, loss of hemoglobin, etc if they are breathed in [12-15]. Aldehydes which are carcinogenic in nature are to be checked if they are used as fuels. [16]. Different techniques are available to measure aldehydes, out of which DNPH (Dintro Phenyl Hydrosome) method or wet method is a simple technique. Hence these emissions are to be controlled at the immediate step. Different

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Abstract

Fiber reinforced composite is a composite material consisting of a matrix reinforced by a fabric. Shear strength can be defined as the maximum shear stress that a material is capable of sustaining. Shear strength is calculated from the shear fracture load and the shear loaded area. Interlaminar shear stress (ILSS) is the shear stress observed between the laminae of a laminate. The objective of the present work is to perform finite element analysis on neat and CNT reinforced S glass epoxy composite (CRSE) using ANSYS software to estimate the instantaneous shear modulus (ISM) and observe the effect of notch separation on the measured ILSS. In S glass epoxy composite (SGEC), least and peak values of ILSS and ISM are 14.79 MPa, 35.35 MPa and 15.19 MPa, 33.12 MPa respectively when the notch separation is 5 mm and 1 mm.

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Keywords

Finite element analysis; ANSYS; S-glass; Epoxy; Multi- walled carbon nanotube

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Original Article

PIONEERING FACTORS DRIVING DIVERGING TYRE TECHNOLOGY FROM CONVENTIONAL TYRES TO NON-PNEUMATIC TYRES

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ABSTRACT

Non-Pneumatic Tires (NPT) are tyres that are not pneumatically inflated and are supported by flexible spokes and a closed construction. Several important reasons to upgrade from traditional tyres include maintaining the correct composition of internal air, avoiding excessive wear and tear, and avoiding unexpected damage. Several significant considerations to consider when selecting non-pneumatic tyres are their high rolling resistance, inability to flatten, and minimal maintenance. The combination of elastic polymer and composite materials results in excellent performance, and the asymmetric design enables non-pneumatic tyres to fulfil a variety of jobs, providing them an advantage over traditional tyres. The strength of the NPT is determined by its form and structure, and there are many shapes and structures available for different purposes. Cost savings are achieved via the design of spoke structures and the efficient manufacturing of components. Airless tyres should improve by designing spokes in such a manner that the weight distribution is uniform, the cushioning effect is enough for appropriate vibration damping and vehicle dynamics stability, and there is no debris trapped between the spokes. The drawbacks of non-pneumatic tyres include heat build-up in the tyres and reduced suspension, which results in decreased driver and passenger comfort. This article will mainly discuss the many reasons that have contributed to the shift away from traditional tyres toward airless tyres. The issues discussed include the advantages of the NPT over traditional tyres and the disadvantages that must be addressed in the future via the adaptation of different architectures, forms, and manufacturing methods.

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Optimal sensor placement for identifying multi-component failures in a wind turbine gearbox using integrated condition monitoring scheme

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ABSTRACT

Wind turbine gearbox has a high failure frequency and downtime, and therefore, several sensors are installed to perform condition monitoring to reduce the operation and maintenance costs. A gearbox can have infinite sensor nodal positions, but, in reality, the positioning of sensors is limited to a finite number of locations. Also, sensor location influences the quality of the data captured by the sensors, which is of key importance in a condition monitoring system. Hence selection of optimal sensor placement (OSP) is a challenging task which needs to be addressed. When the sensor type changes, the measurement response changes, and hence the OSP methodologies based on the measured responses may not work well. For addressing this, an optimization method based on statistical features is proposed to find the optimum sensor placement (OSP). In order to evaluate the effectiveness of the proposed method, experiments are conducted on a laboratory scale model of wind turbine gearbox considering multi-component faults and an integrated condition monitoring scheme. Variational mode decomposition and the Spearmen correlation coefficient are used to processes raw acoustic and vibration signals. Feature extraction is performed to obtain nine statistical features, and a mathematical objective function is constructed as a function of these features. Grey wolf optimizer is employed to find the optimal values of the statistical features. Fault classification is performed using Random forest (RF) and deep multi-layer perceptron (MLP) algorithms. Optimal sensor network identified by the above method reported classification accuracy of 86.88% and 88.34% for RF and MLP, respectively. As a result, the number of sensors reduced from eight to five. The proposed method can be used as an effective technique for OSP problems.
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1. Background & literature survey

The current climatic conditions and change in climate policies have attracted various countries worldwide to adopt renewable technologies to fight climate change. Wind energy technology has gained much attention and investments in the renewable energy markets in the past few decades. World wind energy association (WWEA) reported a 29% global growth in wind energy installed capacity from 2015 to 2020 [1]. Wind turbines (WT) operate under changing weather conditions and are often subjected to severe operating conditions. Eventually, the failures occurring in any sub-system of the wind turbine, may lead to damage in other components and might further result in catastrophic failures. Among the different sub-systems of the wind turbine, the gearbox has the highest failure rate and downtime [2]. The WT gearbox transmits the power from low-speed rotor shaft to the high-speed shaft that drives the generator, thus enduring fluctuation loads from both the turbine and generator sides. Inaccurate installation, manufacturing error, and abrasion may cause distributed defects, whereas fatigue loads may cause localized defects such as gear tooth crack, bearing race cracks, and bearing spall [3]. Frequent breakdown of the gearbox sub-systems (either gears or bearings) is common due to the harsh environment created during operations, leading to immense operation and maintenance costs.

Condition monitoring (CM) has gained significant attention in recent years in the field of preventive maintenance in reducing operation cost, downtime of wind turbines, and maintenance costs. CM monitors the real-time machinery health condition, helps in making optimal maintenance decisions, and improves machine reliability. Defect identification and quantification in machinery components are achieved with the help of sophisticated signal processing and decision support algorithms in a CM system. Various

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Experimental and FE Analysis of Tensile and Bending Properties of Glass/Jute Epoxy Hybrid Composite

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Abstract- This paper explores on comparison of tensile and bending stresses of hybrid composite specimens by experiments and with finite element analysis ANSYS. The hybrid composites are prepared with woven E-glass fibre, woven Jute fibre reinforced in the Diglycidyl ether of Bisphenol-A (EP-306) epoxy along with hardener Diethylene tetra amine (EH-758). Composite is prepared by the hand layup technique at room temperature (28^{0}C). Tensile specimens with ASTM 3039 standard and bending specimens with ASTM 7264 standard dimensions were cut from the laminate. The specimens FEA models were created using ANSYS 19.2 and failure loads of specimens from experiments are applied on the specimen models. The tensile stresses and bending stresses developed in the specimens were observed at failure loads. The results ensured that the experimental results have well agreed with the ANSYS results.
KEY WORDS- Woven jute fibre, Woven glass fiber, hybrid composite, tensile strength, bending strength, ANSYS 19.2

I. INTRODUCTION

A composite is a material made of two or more materials. They have reinforcement and matrix material. If it consists of more than one reinforcement then it is called a hybrid composite. In hybrid composites the advantage of one fibre would complement what is lacking in another. A continuous fibre composite made of layers of fibres in unidirectional, bi directional etc. Each layer is called lamina and the composite is called laminate. Nowadays the use of natural fibres [1] (sisal, hemp, kenaf, jute and coir) draws more attention for low load applications, and now the research has moved towards sustainability of dynamically loaded components by partial replacement with natural fibres. Ashik et al. [2] found that hybrid glass/jute(60%-40%)-epoxy composite has 66% more tensile strength than non-hybrid jute-epoxy composite and hybrid glass/jute(40%-60%)-epoxy composite has 49% more tensile strength than non-hybrid jute-epoxy composite. Hybrid glass/jute-epoxy composite (60%-40%) has 61% more flexural strength than non-hybrid jute-epoxy composite and hybrid glass/jute-epoxy (40%-60%) composite has 44% more tensile strength than non-hybrid jute-epoxy composite.It is also observed that increasing glass fibre volume increases both tensile strength and bending strength in hybrid composite. However, for tensile specimen tabs modeling is not done and stress variation is not properly shown. Saravana Bavan et al. [3] had fabricated the natural composite beam using Maize fibre reinforced in unsaturated polyester resin polymer matrix and carried out a test to determine the deflection and stress characteristics finite element technique using ANSYS software.The research reveals by increasing the fibre content to an optimum content, there is a possibility of reducing the stress concentration in the matrix and at the fibre interface. But more stress deviation on the fibre matrix, and at the interface regions of the composite tends to fibre debonding. Khatri et al. [4] assessed the mechanical characteristics such as tensile strength, flexural strength, impact strength and Young's modulus of multiple composites. Free vibration features are also analyzed for natural fibre composite beams. In addition to analytical study from experiments on composites from

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INVESTIGATIONS ON EXHAUST EMISSIONS OF HIGH GRADE LOW HEAT REJECTION DIESELENGINE WITH COTTON SEED BIODIESEL

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ABSTRACT

Biodiesels derived from vegetable oils present a very promising alternative for diesel fuel, since they have numerous advantages compared to fossil fuels. They are renewable, biodegradable, provide energy security and foreign exchange savings besides addressing environmental concerns and socio–economic issues. However drawbacks associated with biodiesel of high viscosity and low volatility which cause combustion problems in compression ignition engines, call for low heat rejection (LHR) engine. LHR engines have significant characteristics of higher operating temperature, maximum heat release, and ability to handle low calorific value fuel. Investigations were carried out to determine exhaust emissions with LHR engine and conventional engine (CE) with crude cotton seed biodiesel. LHR engine consisted of an air gap insulated piston, an air gap insulated liner and ceramic coated cylinder head with different operating conditions of normal temperature and preheated temperature cottonseed biodiesel with varied injector opening pressure. Nozzle testing apparatus was used to increase injector opening pressure. Particulate emissions and oxides of nitrogen were determined with sophisticated analyzers at full load operation of the engine. LHR engine reduced pollutants at higher injector opening pressure at preheated temperature of biodiesel in comparison with neat diesel operation on CE.

Keywords: Biodiesel; LHR engine, Fuel performance; Exhaust emissions.

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Original Article

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KEYWORDS: Substituted Fuels, CE, CCE, Workability & Products of Exhaust

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INTRODUCTION

The invention of new fuels is an important issue as these conventional fuels are reducing day by day with high demand in supply with the use in automobiles and agricultural sector and also emissions of the exhaust are higher and higher with these conventional fuels. Alcohols are replacing conventional fuels as they have higher RON and more volatile causing efficient burning in the chamber of combustion. [Heywood, 1988]. Their properties are much superior to those of petrol. With the use of low quantities of alcohol mixed with petrol in SI engine. The engine can be used directly without much change in structure. A good number of scientists made trails with alcohol mixed with petrol in small quantities in the base SI engine. [1-6]. They narrated that workability is raised with alcohol mixed petrol with respect to neat petrol operation. CH3OH mixed with petrol by the ratio of 1:3 in volume enhanced workability and lowered products of exhaust with respect to neat petrol with CE [7-9]. Workability of the engine enhanced with a coating of cuprum on inside components of engine such as piston, liner, and head of the cylinder owing to lower resistance of cuprum for transfer of heat. [10-11]. CO and UBHC are the products of the exhaust from the SI engine. Deterioration of health will be caused by inhaling of products of exhaust into the breathing system. They impose severe headache, vomiting sensation, dizziness, loss of hemoglobin, etc if they are breathed in [12-15]. Aldehydes which are carcinogenic in nature are to be checked if they are used as fuels. [16]. Different techniques are available to measure aldehydes, out of which DNPH (Dintro Phenyl Hydrosome) method or wet method is a simple technique. Hence these emissions are to be controlled at the immediate step. Different

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REDUCTION OF EXHAUST EMISSIONS OF SEMI ADIABATIC DIESEL ENGINE WITH ALTERNATIVE FUELS

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ABSTRACT

Drawbacks associated with crude vegetable oils (high viscosity and low volatility) and alcohol (low energy content and cetane number) for use in compression ignition engine call for biodiesels. These biodiesels have numerous advantages compared to fossil fuels as they are renewable, biodegradable, provide energy security and foreign exchange savings besides addressing environmental concerns and socio-economic issues. However, these alternative fuels (vegetable oils and its biodiesels) are highly to moderate viscous and require hot combustion chamber, provided by semi adiabatic diesel engine. Investigations were carried out to determine exhaust emissions of a high grade semi adiabatic diesel engine consisted of air gap insulated piston, air gap insulated liner and ceramic coated cylinder head with different operating conditions [normal temperature and pre-heated temperature] of crude rice bran oil and its biodiesel with varied injector opening pressure. Exhaust emissions were determined at various values of brake mean effective pressure of the engine fuelled with crude rice bran oil and its biodiesel. Comparative studies on exhaust emissions were made with diesel working on similar conditions. Particulate emissions decreased, while NO_x levels increased with LHR engine with biodiesel operation. Exhaust emissions improved with increase of injector opening pressure and preheating of biodiesel.

Key words: Alternative fuels, biodiesel, injection pressure, preheating, exhaust emissions, vegetable oils.

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COMPARATIVE STUDIES ON CONTROL OF EMISSIONS OF TWO STROKE AND FOUR STROKE SPARK IGNITION ENGINES

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ABSTRACT

Alcohols are proved to be efficient fuels for petrol engine, as their octane rating are very high and that too, there are renewable in nature. The exhaust emissions of petrol engine cause human hazards, once they are inhaled in and also cause environmental effects like Greenhouse effect and acid rains. Hence control of these pollutants is an immediate step and an urgent task. Investigations were carried out to determine and control the exhaust emissions of carbon monoxide (CO) and un-burnt hydro carbons (UBHC) emissions of two stroke and four stroke of single cylinder, spark ignition (SI)engine having copper coated engine [CCE, copper-(thickness, 300 μ) coated on piston crown and inner side of cylinder head] provided with catalytic converter with sponge iron as catalyst with methanol blended gasoline (80% gasoline and 20% methanol by volume) and compared with conventional engine (CE) with neat gasoline operation. The engine was provided with catalytic converter with sponge iron as catalyst. There was provision for injection of air into the catalytic converter. CCE showed reduction of pollutants, when compared with CE with both test fuels. 4-Stroke engine decreased exhaust emissions effectively in comparison with 2-stroke engine with

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Original Article

CONTROL OF EXHAUST EMISSIONS OF CI ENGINE

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ABSTRACT

Compression ignition (CI) engines run efficiently with alcohols and vegetable oils. However, alcohols due to low ignitions characteristics and vegetable oil with high viscosity cause problems of combustion in CI engines. The drawbacks associated with these fuels call for semi adiabatic diesel engine (SADE). The advantages of high volatility of alcohol and high Cetane number and calorific value of vegetable oil can be taken into consideration if their fuels are used in SADE. CI engines emit particulate matter (PM) and oxides of nitrogen (NO_x). Inhaling of these pollutants affect the human health apart from causing environment disorders. Hence, products of exhaust are to be addressed. Tests were aimed in controlling products of exhaust on SADE with air gap insulated piston and air gap insulated liner with varied air gap thickness with carbureted C2H5OH and cottonseed oil at different injection pressures. The PM and NO_x were determined by using sophisticated analyzers. The SADE with carbureted C2H5OH and cottonseed oil decreased the product of exhaust with respect to diesel fuel on base engine.

KEYWORDS: SADE, Alternative fuels, Air gap piston, Air gap thickness, Air gap liner, Pollution levels & Health hazards

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INTRODUCTION

The concept of SADE is to reduce heat loss to the cooling media by facilitating insulation for the coolant. Ample of methods available for initiating low heat rejection to the coolant were employing coatings of ceramics [Venkateswara Rao *et a*l, 2013; Srikanth *et al,* 2013.a.; Janardhan *et al,* 2013; Murali Krishna *et al*, 2013] on components of combustion chamber of the engine. They reported that performance and pollution levels marginally improved with respect to base engine. Investigations were also attempted on SADE with air gap insulation with oils from the seeds of vegetables. Piston was divided into two parts and assembly was made by revising, screwing, welding etc, out of which screwing was proved to be efficient method of assembly. Hence, trials were taken on grade-2 SADE with insulation of air gap with oils taken from the seeds of vegetables. [Janardhan *et al*, 2012; Murali Krishna *et al*, 2013.b; Srikanth *et al,* 2013.b.]; they claimed that workability and pollution levels marginally improved with respect to base engine, instead NO_x levels increased with SADE-2. A few researchers (Jabez Dhinagar, 1993) used a variety of materials of the piston's crown with change of thickness of air gap. (Dhinagar *et al,* 1993; Kesava Reddy *et al,* 2012; Ratna Reddy et al, 2012]; they claimed that increase of insulation increased NOx levels and improved workability parameters. The products of exhaust of CI engine are PM and NO_x. They cause health disorders once they are inhaled in, [Fulekar, 1999; Sastry et al, 2004; Ghoose et al, 2004]. Hence, these emissions are to be controlled at any cost. PM is higher with the oils taken from the seeds of vegetables as they are highly dense and has higher molecular weight fuels. Hence instead of using pure vegetable oils, these were used along with alcohol fuels. [Murali Krishna et al, 2014; Murali Krishna et al, 2015; Vamsi Krishna eta al, 2019]; they claimed that that higher degree of insulation of SADE with the use of alcohol improved performance along with

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INVESTIGATIONS ON EXHAUST EMISSIONS FROM COPPER COATED SPARK IGNITION ENGINE WITH GASOLINE BLENDED ALCOHOLS

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ABSTRACT

Investigations were carried out to control the exhaust emissions from four─ stroke, variable speed, variable compression ratio, single -cylinder, spark ignition (SI) engine, with test fuels of butanol blended gasoline (80% gasoline and 20% butanol by volume) and ethanol blended gasoline (gasohol) (80% gasoline blended with 20% ethanol) having copper coated combustion chamber [CCCC, copper-(thickness, 300 μ) coated on piston crown, inner side of cylinder head and on liner] provided with catalytic converter with copper as catalyst and compared with conventional SI engine (CE) with neat gasoline operation. Aldehydes were measured by wet chemical method. Exhaust emissions of carbon monoxide (CO) emissions and un-burnt hydrocarbon (UBHC) were evaluated at different values of brake mean effective pressure (BMEP) of the engine. Aldehydes were evaluated at full load operation of the engine. A microprocessor-based analyzer was used for the measurement of CO/UBHC in the exhaust of the engine. Copper coated combustion chamber with gasohol considerably reduced pollutants in comparison with CE with pure gasoline operation. Catalytic converter with air injection significantly reduced pollutants with test fuels on both configurations of the engine. The catalyst, copper reduced the pollutants effectively with both test fuels in both versions of the engine.

Keywords: S.I. Engine, CE, copper coated combustion chamber, Exhaust Emissions, CO, UBHC, aldehydes, Catalytic converter, Sponge iron, Air injection.

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https://iaeme.com/Home/issue/IJMET?Volume=12&Issue=5

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INVESTIGATIONS ON LOW HEAT REJECTION DIESEL ENGINE WITH CARBURETED ALCOHOLS AND CRUDE COTTONSEED OIL

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ABSTRACT

Alcohols and vegetable oils are promising fuels for replacing conventional diesel fuel. The advantages of alcohol (more volatility, low carbon to hydrogen ratio) and vegetable oils (comparable calorific value and cetane number) are attracting features to use them as substituted fuels in diesel engines. However demerits of alcohol (low calorific value and low cetane number (measure of combustion quality in diesel engines)) and vegetable oils (high viscosity and low volatility) call for low heat rejection (LHR) engine which has high heat release rate and faster rate of combustion. Heat flow to the coolant is minimized by providing thermal insulation in the path of heat flow to the coolant. Investigations were carried out to study the exhaust emissions from high grade low heat rejection (LHR) diesel engine consisting of air gap insulated piston with 3-mm air gap with superni (an alloy of nickel) crown, air gap insulated liner with superni insert and ceramic coated cylinder head with normal temperature condition of crude cottonseed oil and carbureted alcohol (methanol/butanol) with varied injection pressure and compared with methanol operation over butanol operation and also with net diesel operation on conventional engine (CE). Exhaust emissions of particulate matter and oxides of nitrogen (NO_x) were recorded by AVL Smoke meter and Netel Chromatograph NO_x analyzer respectively at full load operation of the engine. Aldehydes were measured by dinitrophenyl hydrazine (DNPH) method at full load operation of the engine. Particulate levels and NO_x levels decreased by 92% and 12% respectively with LHR engine at recommended injection timing of 27°bTDC (before top dead centre) and at an injection pressure of 190 bar with methanol operation in comparison with neat diesel operation on CE.

Keywords: Crude Vegetable Oil, Methanol, butanol, CE, LHR engine, Emissions.
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(https://ugccare.unipune.ac.in/apps1/home/index)

VOLUME 8, ISSUE 6, 2021

1. Development And Validation Of Rp- Hplc Method For Dissolution Study Of Olmesartan Medoxomil And Hydrochlorothiazide In Combined Dosage Form (https://drive.google.com/file/d/1CnB8cv_hsB76lRPnTTl5ltPHhnMPgk4E/view?usp=sharing)
Mona Patel, Harsha Patel, Ojash Patel
SSSRGI, Vadasma, Gujarat.
Page No: 1-13
DOI:20.18001.GSJ.2021.V8I6.21.37291

2. Design And Development Of Prom Dress By Couture Sewing Methods (https://drive.google.com/file/d/12Tpo3SW5nEsJDPXlQq3lToOUbv7z93q2/view?usp=sharing)
Sindu M, Mekala N
Bannari Amman Institute of Technology, Sathyamangalam, Erode.
Page No: 14-20
DOI:20.18001.GSJ.2021.V8I6.21.37292

3. Design And Development Of A Transformable And Detachable Capsule Collection (https://drive.google.com/file/d/1m_JlJxCH_QlfljFp9aKgUF3bsObF48oS/view?usp=sharing)
Niveathitha S, Shan Amrutha
Bannari Amman Institute of Technology, Sathyamangalam – 638 401, Tamil Nadu, India.
Page No: 21-38
DOI:20.18001.GSJ.2021.V8I6.21.37293

4. Development Of An Effective Strategy To Possibly Eliminate Unnecessary Time Consumption In Retail Store Operations (https://drive.google.com/file/d/18nIv2cBIdMCKBCdNWHNFQKahJz3NnL3N/view?usp=sharing)
Vaishnavi M, Priya R
Bannari Amman Institute of Technology, Sathyamangalam.
Page No: 39-45
DOI:20.18001.GSJ.2021.V8I6.21.37294

5. Deconstruction In Contemporary Fashion (https://drive.google.com/file/d/10h9-lJ0g76WypMI0M2PpcPSBS9iZCP40/view?usp=sharing)
Devi Sri A, Mekala N
Bannari Amman Institute of Technology Sathyamangalam – 638 401, Tamil Nadu, India.
Page No: 46-53
DOI:20.18001.GSJ.2021.V8I6.21.37295

6. Facing Challenges And Uncertainties In Work During Covid-ii (https://drive.google.com/file/d/1c3QCDZuYc5D-ZMcx-SLnBEFvbxZjJ0SN/view?usp=sharing)
D.ANANTHAPADMANABAN
SSN College of Engineering, Kalavakkam-603110.
Page No: 54-57
DOI:20.18001.GSJ.2021.V8I6.21.37296

7. Automatic Defect Detection In Knitted Fabric Using Mlp And Cnn (https://drive.google.com/file/d/1OBvT7GLpGKiYo8nzPs6pMmuzy-LKeLW2/view?usp=sharing)
Madhan Kumar S, Subrata Das, Sundaramurthy S
Bannari Amman Institute of Technology, Sathyamangalam, Erode.

181. New Trends In Speed Control Of A.c. And D.c. Electric Motors- A Review (https://drive.google.com/file/d/1yzMaFFI_2VTCTg8sASkNYEczqjeHQ2aF/view?usp=sharing)
Ravindra Mukund Malkar, Vaibhav Baburao Magdum
DKTE Society's Textile & Engineering Institute, Ichalkaranji, (MS), India.
Page No: 1816-1821
DOI:20.18001.GSJ.2021.V8I6.21.37471

182. Analysis Of Power Generation From Vertical Axis Wind Turbine (https://drive.google.com/file/d/1fLotf859kw00MbfCs9AacZkvLCcDYu_R/view?usp=sharing)
J. Pavan Kumar, K. Sudhakar Reddy, B.Ramakrishna
Mahatma Gandhi Institute of Technology, Hyderabad-500075.
Page No: 1822-1828
DOI:20.18001.GSJ.2021.V8I6.21.37472

183. Dental Disease Classification Using Deep Learning: A Survey (https://drive.google.com/file/d/1HWnJaRstWxQXgjlAtiWEB84k5taDPKwu/view?usp=sharing)
Krishna Sheth, D.T. Salunke, Astha Kubavat, Atul Raj
JSPM's Rajarshi Shahu College of Engineering, Tathawade, Pune, India.
Page No: 1829-1841
DOI:20.18001.GSJ.2021.V8I6.21.37473

184. Regression Analysis For Estimation Of Outer Surface Finish With The Variation Of Feed Rate And Stagger Of A Flow Formed Component (https://drive.google.com/file/d/1HWnJaRstWxQXgjlAtiWEB84k5taDPKwu/view?usp=sharing)
V.V.R.Seshagiri Rao, P.V.R.Ravindra Reddy
Chaitanya Bharathi Institute of Technology, Hyderabad-75.
Page No: 1842-1847
DOI:20.18001.GSJ.2021.V8I6.21.37474

185. Kinetics Of Reactive Extraction Of Levulinic Acid Using Tri-n-octylaminein 1-hexanol (https://drive.google.com/file/d/1VwJ24eftKHterZFj8gN5HqoDF8tprx18/view?usp=sharing)
N.Meenakshi, Dr.B.Sarath Babu, K.Govindaiah
Sri Venkateswara University College of Engineering, Tirupati -517502, Andhra Pradesh, India.
Page No: 1848-1857
DOI:20.18001.GSJ.2021.V8I6.21.37475

186. Secure Triple Connected Two Domination Of A Graph (https://drive.google.com/file/d/1VdbLONoieIXRqwRArJotf27G-qxoHQGp/view?usp=sharing)
N. Saradha
SCSVMV University, Enathur, Kanchipuram.
Page No: 1858-1869
DOI:20.18001.GSJ.2021.V8I6.21.37476

187. Formulation And Characterization In Vitro Release Of Topical Nanogel From Natural Source In The Management Of Psoriasis (https://drive.google.com/file/d/1Exp8HokLmHZQgx068cjB5T-NQNsBnfD_/view?usp=sharing)
Shivanshu Gangwar, Md.Semimul Akhtar
S.R.M.S College of Engineering and Technology, Bareilly, U.P.
Page No: 1870-1886
DOI:20.18001.GSJ.2021.V8I6.21.37477

188. Breast Cancer Risk Analysis And Prediction : A Review (https://drive.google.com/file/d/1k7w910Jb0p0_5fCMKoLn_aO2salFmQca/view?usp=sharing)
D.S Adane, Akansha Banode, Laxmikant Kabra, Mansi Agrawal
Shri Ramdeobaba College of Engineering and Management, Katol Road, Nagpur–440013.
Page No: 1887-1896
DOI:20.18001.GSJ.2021.V8I6.21.37478

189. Branding China? The Congruity Between Country-of-origin And Brand Origin (https://drive.google.com/file/d/1r1gEoa59h-UFIC_iruDWHXvFKzYkTXpb/view?usp=sharing)
Dr.Sadiya Siddiqui
Integral University, Lucknow.
Page No: 1897-1913
DOI:20.18001.GSJ.2021.V8I6.21.37479

Control of Carbon Monoxide Emissions from Conventional and Copper Coated Two-Stroke SI Engines with Methanol Blended Gasoline with Catalytic Converter Employing Catalysts

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Abstract- Experiments were conducted to evaluate and control the carbon monoxide (CO) emissions from two stroke single cylinder, spark ignition (SI) engine, with alcohol blended gasoline (80% gasoline, 20% methanol, by volume) having copper coated engine [CCE,copper-(thickness, 300 μ) coated on piston crown] provided with catalytic converter with sponge iron and manganese ore as as catalysts and compared with conventional SI engine (CE) with pure gasoline operation. The carbon monoxide (CO) emissions were determined at different values of void ratio, mass of catalyst, air flow rate and temperature of injected air with Netel Chromatograph CO analyzer. Copper coated combustion chamber with methanol blended gasoline with catalytic converter using sponge iron catalyst with air injection significantly reduced the pollutants in comparison with CE with pure gasoline operation. .

Keywords – copper coated engine, methanol blended gasoline, catalytic converter, catalyst, sponge iron, manganese ore

I. INTRODUCTION

Fast depletion of gasoline fuels their ever increasing costs and the increase of pollutants with these fuels forces a search for alternate fuels. Alcohols (methyl alcohol and ethyl alcohol) are the probable alternate fuels, because of their compatibility with petroleum fuels. No major engine design modification is needed, if small quantities of alcohols are blended with gasoline. The change in fuel composition like blending of petrol with methanol is one of the methods adopted to improve the combustion characteristics of the engine. The major predominant emissions from SI engines when run with alcohols are CO emissions. As the exhaust emissions of CO (%) cause harmful health hazards on human beings and on environment, necessarysteps are to be taken in the form of changing the fuel composition or engine design modification or both, to decreasethem. A simple technique to decrease the pollutants from the engine is coupling catalytic converter to the exhaust pipe of engine. CO is formed due to incomplete combustion. CO is formed when excess fuel is present and little oxygen is available. Yasar *et al.* [1] experimentally investigated the effects of methyl alcohol or butyl alcohol blend on the exhaust emissions and noise level. The results showed that the concentrations of CO and NOx emissions were decreased depending on the higher alcohol contents. Murali Krishna *et al.* [2] carried out investigations on control of CO in the exhaust of engine [3]. Manganese ore is used as catalyst in the converter. CCE reduces the CO emissions considerably at different operating conditions when compared with CE.

The present paper evaluated the variation of CO emissions of copper coated combustion chamber at different values of void ratio, mass of catalyst, air flow rate and temperature of injected air. Methanol blended gasoline in CCE with sponge iron catalyst found to decrease the % CO emissions over CE with pure gasoline operation.

The rest of the paper is organized as follows. Experimental Programme was explained in section II. Experimental results and discussion are presented in section III. Conclusions are given in section IV.

II. EXPERIMENTAL PROGRAMME

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Mathematical Modeling and Analysis of Hoop Stress in Hydroforming Deepdrawing of n-sided Polygonal Cup

G Kishan, B.V.S. Rao

Abstract: ***The main objective of this paper presents the analytical evaluation and mathematical modelling of hoop stresses of aluminium 7075 alloys in hydro forming deep drawing of n-sided polygonal cup. It is very important to find the magnitude of these stresses generated within the flange region during the deep drawing process for various n-sided polygonal cups. In the flange region two types of stresses will be generated. When is radial tensile stress, it is taking place radially outward direction from the side of the cup to outer side of the blank material. and other is hoop stress it is compressive. It is perpendicular to the radial lines drawn from the job axis to the side of the blank. It is also parallel or tangential to the blank circumference. These two stresses will be generated within the blank material by the application of punch force.. As compared to the conventional deepdrawing process, hydroforming is very convenient. uniform deformation of the blank taking place throughout out the process.***
Keywords: ***Hoopstresses,Hydroformdeepdrawing,n-sided polygonal cup***

I. INTRODUCTION:

Hydroforming deepdrawing process is one of the most important cold working process to manufacture different shapes with uniform thickness of the deepdrawn cups. In this process pressure of fluid is important parameter. The quality of cup without any failures such as fractures and wrinkles is only depends on this fluid pressure. In this process fluid pressure is applied on either sides of the blank of n-sided polygonal material. Before the deepdrawing operation the hydraulic fluid is placed in between the punching Chambar and die cavity. These two connected by means of bypass Path in the die shown in the fig.(1) some of the empty place is provided in between surface of die and blank holder. The gap is utilised to easy flow of fluid and moment of the blank. While deepdrawing operation taking place punch moves towards die cavity, The hydraulic fluid pressure In the die cavity slowly increases to maximum value. Then fluid passes through the bypass path and enter on the peripheral surface of the blank. On the either side of blank moving fluid film will be generated. When the pressurized fluid film moves either side of the blank surface shear force will be generated. The generated shear force is always proportional to the velocity gradient of the viscous fluid. It is also depends on the viscosity of the fluid.

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In this process subjected to equal shear forces by the effect of fluid pressure on both sides of the blank, the blank moves to the center of the gap. The blank is less than the height of the fluid film.

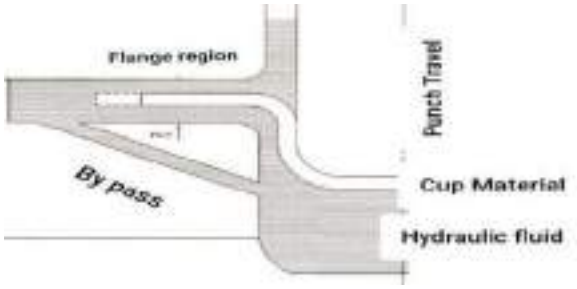

Fig.1: Hydroforming deep drawing process.

II. LITERATURE SURVEY:

Fakui.S.et al [1], Investigated the most important characteristics of forming process and the use of fluid pressure as a die. They have done mathematical analysis of hydro forming deepdrawing by considering total Strain energy theory. Yossifon et al [2] In this paper by considering classical theory of plasticity, on assuming plane strain tensile failure, rapture by tensile instability in hydroforming deep drawing formulated and tested. A distinct opening zones of fluid pressures upper and lower limits investigated recommended for the practical use.Yossifon et al [3] conducted experiments and developed a mathematical model for hydroforming deepdrawing process. In their experimental work they founded permissible operating fluid pressure path to predict the deep drawn parts from the failures. Zhang et al [4], In this paper basic theory of hydroforming deep drawing process explained. Principles and features are introduced. Theoretical and numerical simulations are explained to get better deep drawn products of highly smooth surface finish and improved mechanical properties.Thiruvarudehelvan.S et al [5] presented theoretical analysis of hydroforming deep drawing process with constant pressure of hydraulic fluid.In this paper theoretical results are compared with the experimental work and also presented lower and upper bounds for the hydraulic fluid pressure. Thiruvarudehlvan.S et al [5] investigated merits and demerits of the hydroforming deepdrawing princess by considering different variations of hydraulic pressure. An enhanced processing aspect investigated and discussed many techniques. Lang et al [7] Investigated a new technique in Hydraulic deepdrawing process.

Investigate the effect of process variables on the mechanical behavior of aluminum composites using the Friction Stir Process

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Abstract

The aim of this research is to provide a thorough elaboration of metal matrix composite manufacturing using various combinations of reinforcements and the principles of friction stir technique, as well as the effect of the input process parameter on material characteristics, as conducted by various research groups. The investigators began to look for a link between the experimental parameters and the output responses. Friction stir welding and processing use a fraction of the energy of other processes. The metal matrix composites replace regular used materials for many engineering applications with their unique mechanical and metallurgical properties, strength, durability, corrosion resistance. The friction stir process's process parameters, which include rotational speed, tilt angle, feed rate, and deposition rate, have a significant impact on the mechanical properties of fabricated composite surfaces. The solid state nature of the processing method has resulted in an improvement in various properties in surface composites. The pin profile also affects mechanical characteristics significantly. On surface composites, the current study will provide a concept for a defect-free weld with higher and improved mechanical properties.

Keywords: Governing parameters, FSP, Al-Composites.

I. Introduction

In the automotive and aerospace industries, popular materials like iron and steel are increasingly replaced by light materials like magnesium or aluminum alloys to obtain a special strength-to-weight ratio [1]. However, due to their low stiffness, aluminum and magnesium alloys are not suitable for structural applications. Consequently, the benefits in structural design are limited by the use of lightweight aluminum or magnesium alloys. To overcome this concern, an attempt has been made to construct MMC using lightweight metal as the matrix [2]. Carbonate, SiC, TiC, oxides, boride, and carbon materials are frequently used as reinforcements in the fabrication of MMC and are used in the form of particles, fangs, and filaments [3]. The mechanical, metallurgical, and tribological properties and characteristics of

A state-of-the-art review on Al-MMC and its budding applications

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Abstract

Gears are the primary mechanical components found in power transmission systems, industrial rotating machines, and defence and aerospace applications. Spur gears are extremely useful, easy to use, and widely used in mechanical transmission systems. Metal matrix composites overcome the shortcomings of traditional monolithic materials. Aluminium composite materials (ACMs) are used in place of traditional materials. Physical, mechanical, and tribological properties were excellent. Machines in the modern era operate at varying speeds and under varying load conditions. When the load reaches a certain maximum, the function of the gear teeth is usually impaired in order to extend the life of the gears. The spur gear was modeled using AMCs. The spur gear was modelled using various modelling software's, and the method for testing the various spur gear materials was performed in simulation software's. As a result, we must reconsider ACM weight management and stress distribution. Finally, the ACMs gears were shown better mechanical properties than current alloys.

Key words: AMCs, Gears, Modeling software's, Simulation software's

I. Introduction

Because of their strong physical, tribological, and mechanical properties, ACMs are emerging materials for a variety of engineering applications (transportation, aerospace, marine, defense, automotive, textile, mineral, food processing, and electronics). Cog wheels are the primary mechanical components of power transmission systems and industrial rotating machinery, and their size varies according to the power transmission rate, type of loading, load bearing capacity, and type of operation. The strength of the day to weight, stiffness to weight, and cheap have all risen rapidly in recent years. Cog wheel with characteristics such as constant velocity ratio and simple arrangement for shaft speed acceleration (or delectation). A gear is a component of a transmission system that transmits rotational torque by exerting force on the teeth of another gear or device [1].

NUMERICAL AND EXPERIMENTAL INVESTIGATION OF EFFECT OF STACKING SEQUENCE ON THE FRACTURE PARAMETERS OF COMPOSITE MATERIALS

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Abstract:*Delamination growth is the most commonly occurring failure mode in laminated composite structures used in many fields of engineering. Delamination growth and the associated damage in laminated composite materials can be characterized by stress intensity factor and energy release rate for a given structural geometry, applied load and delamination location which inturn are correlated to critical stress intensity factor and critical strainenergy release rate. In this paper, the fracture toughness and energy release rate of non-hybrid woven glass/epoxy (G20), non-hybrid woven carbon/epoxy (C20), hybrid carbon core composite (G5C10G5), and hybrid glass core composite (C5G10C5) plates have been investigated in mode-I fracture experimentally and numerically through three-point bending test on single edge notch bending [SENB] specimen through ASTM D5045 and Ansys respectively.The stacking sequence is varied in such a way to see the effect ofeffective flexural modulus and axial modulus on the fracture parameters.Conclusively it is understood that the stacking sequence plays a significant role with regard to damage caused by delamination. The results presented here compare the different laminates and the deviation in experimental and numerical values. The deviationsobserved in results are in acceptable limits.*

Key words: Stress intensity factor, Carbon core hybrid composite,glass core hybrid composite, Hybrid composite, single edge notch bending specimen.

Aluminium metal matrix composites and effect of reinforcements – A Review

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Abstract. A composite is a fusion of two or more different material chemically and unsolvable phases; its properties and structural concert are greater the ingredients performing homogeneous phases. ceramics and Metals, as well, can be implanted with particles, to advances their property; these mixtures are known as MMCs. Aluminum alloy compose a significant engineering material generally engaged in the aerospace industries for the production of dissimilar parts and equipments. It is due to its more strength to density fraction that it a sought after MMCs. A variety of processing technique and mechanical properties testing's available for manufacturing the Aluminium matrix composites. The mutual reinforcement's effect on Aluminium Metal Matrix composites with individual and multiple particulate reinforcements like Hybrid Metal matrix composites are finding better applications in aerospace industries, automobile industries, underwater, and transportation. In the current situation, a bunch of research activities were on pipe line. This review particularly directs the engineers and researchers towards right reinforcement materials selection especially hybrid composites by their properties in the appropriate field and diverse technique involved in production of metal matrix composites.

1. Introduction

Metal matrix composites are mixtures of more than two materials where customized properties are attained by efficient blending of different ingredients. Metal matrix composites consisting of discontinuous fibers or else continuous fibers in a molten metal get mixture of specific modulus and very high strength. From the last few decades in much industrial application concentrate on MMCs due to their specific properties like ratio of strength to weight and also cost effectiveness. Here we discussed about reviews of the research papers relevant to Al MMCs. Before going to the discussion, we are required to know the variation between the composites and alloy. The alloys are made by mingling of more than two metallic elements, especially to give greater strength or resistance to corrosion properties etc. The composites (MMCs) are metallic elements combined with non-metals give their significant properties for specific application this called MMCs.

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Analysis of Effect of Stagger and Feed Rate on Ovality of Flow Formed tube using ANOVA

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Abstract: Flow forming is a widely used mechanical working process used to reduce thickness of the tubes. Compared ot machining it improves the strength. It is extensively used for manufacturing of components used for aerospace and automobile applications. However, the surface finish and the deformations after removal from the mandrel due to residual stresses are the important concerns of this process. So in the present work experimental investigations are carried out the relative effect of the most important parameters; stagger and the feed rate and their combined effect on the ovality of the tube formed by flow forming process. Experiments are carried out on SAE 4130 Steel using L4 orthogonal array. Column effect method is used to find the most influential parameter, plotting method is used for finding the interaction between the parameters and finally ANOVA is used to ascertain results obtained by the former methods

Key words: Orthogonal array, flow forming, ovality, column effect method, ANOVA

1.0 Introduction

Until 1950 the thin walled components form the sheet metal such as domestic products were used to be manufactured by spinning process [1]. Due to higher skill requirement and lower repeatable more mechanized processes such as flow forming is developed [2]. More over lubrication becomes a major problem in drawing of long cylinders necessitating a better process for manufacturing of thin walled cylindrical components [3] as the There is a significant work by various authors on mechanics of shear forming, shear spinning of cones, spinning of tubes. It is very difficult, if not impossible, to work to close dimensional tolerances, especially when producing large diameter articles from thin gauge material. It is equally difficult to control thickness variations in the final product to less than about 25% of the blank thickness. In contrast to hand spinning sheet metal, flow forming is based upon the principle of equal volumes. The basic shape used for practically all calculations in flow forming is cylinder. The thickness of the preforms is a function of the final length of the finished product [4]. Flow forming is a technique of elongating a thick walled preforms by reducing its wall thickness [5]. Because of a number of merits such as lesser loads, flexibility, cheaper tooling the designs can be optimized for weight and cost specifically in automotive and aerospace [6]

Various parts that can be manufactured by flow forming are rocket motor shells, airframe and power train components, Gas bottles etc. flow forming machines are much more robust and can generate sufficiently higher forces, so are capable of processing of stronger materials such as super alloys [7]

The various parameters that need to be considered in flow forming are the speed of the mandrel, the contact geometry between the roller and the work piece, the feed, tangential force, roller angle, roller nose radius, the angle of the tilt of the roller axis with respect to the mandrel axis etc.

Literature states that pressure acting on the cylinder is not uniform. The friction force and between the cylinder tube and mandrel affects the average pressure on the roller [8]. Moreover, the deformation area is very small compared to the work piece area there by the deformation is resisted by the material surround to the localized deformed area. Because of this the stress-strain distribution is highly complex and nonhomogeneous [9]. This may induce residual stresses depend on the pressure at various places and also due to inhomogeneity in the

Experimental Analysis of Staggerand Feed Rate on Surface Finish of Flow Formed component using ANOVA

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Abstract:*Flow forming is an incremental forming process widely used used to reduce thickness of the tubes. Compared ot machining it improves the strength. It is extensively used for manufacturing of components used for aerospace and automobile applications. How ever, the surface finish and the deformations after removal from the mandrel due to residual stresses are the important concerns of this process. So in the present work experimental investigations are carried out the relative effect of the most important parameters; stagger and the feed rate and their combined effect on the surface finish of the tube formed by flow forming process. Experiments are carried out on SAE 4130 Steel using L4 orthogonal array. Column effect method is used to find the most influential parameter, plotting method is used for finding the interaction between the parameters and finally ANOVA is used to ascertain results obtained by the former methods.*

Keywords:**Flow Forming, surface finish, ANOVA, S/N Analysis**

1. Introduction

Flow forming is process in which tube fitted on the madrel is is locally deformed by the rollers to reduce its thickness. In the processes the mechanical properties of the material improve a lot . before the mid of 20th century , the thin walled components form the sheet metal such as domestic products were used to be manufactured by spinning process [1]. Due to higher skill requirement and lower repeatable more mechanised processes such as flow forming is developed [2]. More over lubrication becomes a major problem in drawing of long cylinders necciating a better process for manufacturing of thin walled cylindrical components [3] as the There is a significant work by various authors on mechanics of shear forming, shear spinning of cones, spinning of tubes. It is very difficult, if not impossible, to work to close dimensional tolerances, especially when producing large diameter articles from thin gauge material. It is equally difficult to control thickness variations in the final product to less than about 25% of the blank thickness. In contrast to hand spinning sheet metal, flow forming is based upon the principle of equal volumes. The basic shape used for practically all calculations in flow forming is cylinder. The thickness of the preforms is a function of the final length of the finished product [4]. Flow forming is a technique of elongating a thick walled preforms by reducing its wall thickness.[5]. Because of a number of merits such as lesser loads, flexibility, cheaper tooling the designs can be optimized for weight and cost specifically in automotive and aerospace [6]

Various parts that can be manufactured by flow forming are rocket motor shells, airframe and power train components, Gas bottles etc. flow forming machines are much more robust and can generate sufficiently higher forces, so are capable of processing of stronger materials such as super alloys [7].

The various parameters that need to be considered in flow forming are the speed of the mandrel, the contact geometry between the roller and the work piece, the feed, tangential force, roller angle, roller nose radius, the angle of the tilt of the roller axis with respect to the mandrel axis etc.

Study on the Effectiveness of Implementation of ISO 9001:2015 QMS Standard to an Educational Institution- A case study

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Abstract: Quality management systems is the systematic procedure for ensuring the product or service quality. In order to bring the consistency ,traceability and accountability in the process for gaining belief of the customer and also to improve the internal processes, International Organization of standardization brought out its first quality system standard in 1987.it was further revised in 1994, 2000, 2008 and 2015. From 2000 revision onwards the system approach is changed to the process approach which brought an element of continuous improvement in the standard in contrast to the approach of consistency that exists in 1987 and 1994 standards.Even though the standard is generic, it is widely applied to industries rather than a service sector like educational institutions. More over the definitions in the standard can easily interpreted to a manufacturing industry rather than service sector. In the present work the authors tried to map the ISO 9001:2015 standard to the educational institution with a case of implementation of the standard to the an Engineering college working under self financed category. The effectiveness of implementation of ISO standard was studied taking admission process as sample and found that the implementation is effective even in unfavourable external factors.

Key words:ISO 9001:2015, Educational Institution, Quality system standard

1.0 Introduction

During the post globalization era , the competitive advantage can only be gained by focusing on the quality of products and services [1,2]. It was realized that products alone can not assure the quality. Hence system standards were in place. First ISO standard on quality system was published in 1987 [3]. subsequently, it was revised in 1994, then in 2000, then in 2008 and the latest revision is in 2015. The major change in the standard occurred in 2000 revision in which the system approach is changed to process approach [4]. Customer satisfaction is given due importance in further revisions. Quality i.e the fitness for use is a static measure where as customer satisfaction which is defined as reaction of customer to the condition of fulfillment [5] is a dynamic one. A number of studies were conducted on the impact of implementation of ISO 9000 quality system standards on the performance of various organization [6,7,8,9]. Some of them reported positive results and some negative. There were studies that performance, product quality and customer satisfaction greatly improved by implementation of ISO 9000 quality standards especially in developing countries [10,11,12]. this is relevant to India as United Nations categorized India as lower-middle income country.

But most of the above studies is confined to industry. So effort is made in this work to investigate the effectiveness ISO 9001 QMS standard in the educational institution considering a case study. The scope the study includes the identification of processes, setting measurable parameters, monitoring them with a defined frequency and plan for the continues improvement. The institution which is considered for study was certified under QMS standard ISO 9001:2015.

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Research Article

Optimization of Cross Section in spring design for Two Wheeler Shock Absorber

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Abstract:

The vehicle suspension system connects to the vehicle at its wheels and contributes to the vehicle's road handling and braking for better safety, driving pleasure andoffers comfortable ride well isolated from road noise, bumps and vibrations [1].The basic element of a suspension system is the spring and the material used for the helical coil spring is of great importance.In this work the shock absorber with spring is modelled in SOLIDWORKS and analysis is carried out on ANSYS by varying different cross sections for the spring. The comparative study is carried out between existing spring and new spring materials. Static analysis determines the stress and deflection of the compression spring

Keywords: Inconel x750, Monel K500, ANSYS, Static analysis

1. Introduction

A suspension system contains springs, dampers, shock absorbers, tyres linkages that connect the vehicle system. Each of the following has its own working, by combining which we get the total working of the suspension system. It allows the vehicle to bounce up and down on rough roads while the rest remains fairly steady. It allows the vehicle to corner with minimum roll or tendency to lose traction between the tyres and the road surface. Shock absorber is the crucial part in vibration handling and provides comfort. Shock absorber is the combination of spring and the damper. Spring is the unit which absorbs potential energy, whenever a vehicle hits a bump, and dissipates it as heat. When the vehicle is travelling on a level road, the spring is compressed quickly when the wheel strikes the bump. The compressed spring rebound to its normal dimensions or normal loaded length which causes the body to be lifted. The spring goes down below its normal height when the weight of the vehicle pushes the spring down. This, in turn, causes the spring to rebound again. The spring bouncing process occurs over and over resulting in lessening of vibrations each time, until the upand down space finally stop. The vehicle handling becomes very difficult and lead to uncomfortable ride when bouncing is allowed. To control this bouncing dampers or dashpots are used. Dampers are used to absorb this vibration energy and dissipate as heat. Suspension systems are used in automobile industries, in all type of road transportation. Suspension systems are also used in aerospace applications. It is also used in supporting many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of the structures to earth quake damage and resonance [6].

The structural simulation is used to determine the strength and stiffness of a product by reporting component stress and deformations. The type of structural analysis performs depends on the product being tested, the nature of the loads, and the expected failure mode[2]. If the yield stress is exceeded the structure will fail due to material failure. The Analysis involves discretization called meshing, boundary conditions and loading.

In the present work, the materials for spring are Stainless Steel, Inconel x750, and Monel K500 are used for analysing vonmises stress and deformation in each case with a constant design load .after selecting the best among these materials the analysis is done with different cross sections like circular, square, triangular, and hexagonal cross section for maximum stress and deformation in the spring with the constant design load. The main objective is to design the shock absorber spring for two wheeler vehicle and to optimize the cross section.

2. Material Properties

INCONEL x750 is a precipitation hardenable nickel-chromium alloy used for its corrosion and oxidation resistance and high strength at temperatures to 1300°F.It is used in various applications like rocket-engine thrust chambers, heat-treating fixtures, forming tools, extrusion dies, springs and fasteners. Its composition is shown in table1.

Guide Vane Height Effect on Performance of Sheer Wind Turbine

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Abstract- A sheer wind turbine is a new concept of wind energy harnessing technology that eliminates the disadvantages like huge size, swept area and bird species loss, noise pollution etc. of traditional turbine and provide power output with reduced cost. Its peculiarity is that it eliminates the tower loading turbines. The main advantages of sheer wind turbines are sucks the air omni-directionally and funnel is placed at the ground level where impact of the low velocity wind on the turbine causes energy generation thus it eliminates the disadvantages of traditional windmills like low turbine reliability, downtime issues, adverse environmental issues. The overall objective of this work is to model the system with different guide vane heights as 1.75m, 2m, 2.25m and 2.5m with throat diameters as 0.5m to 0.8m to understand actual fluid flow inside the INVELOX where the wind turbines are situated. Various computations are carried out to check the relation between wind direction and inside geometry of system through CFD simulation. The study shows it is possible to capture, accelerate and concentrate to obtain higher power output. And hence INVELOX is better way of harnessing wind energy any time any were.

Keywords – Guide vane height, Sheer wind, Invelox, Wind turbine

I. INTRODUCTION

Energy Production is most important issue of today's era. We have been using different kinds of energy in our day to day life. We have been using fossil fuels in the form of energy since 1700's. The industrial revolution of 18 century gave rise to use of substance based energy forms i.e. fossil fuels like petrol, diesel, gasoline, etc. These energy forms are easily accessible in nature. But even though being easily accessible these energy forms are available in limited amount and world is leading towards population explosion on other hand. Also they have some drawbacks like they are getting unaffordable day by day, and their emission leads to pollution, thus causing damage to ecosystem. And now from 1970 onwards we started facing energy crisis due to all these factors. Hence it was need of time to adopt new energy generation techniques.

1.1 Description of the INVELOX delivery system-

INVELOX stands for INcreased VELOcity. A new concept in utilizing the low speed wind is defined. INVELOX is the innovation of Daryoush Allaei supported by SHEERWIND in developing and installing for experimental purpose. The five key parts of INVELOX are shown in Fig. 1. These key parts are (1) intake, (2) pipe carrying and accelerating wind, (3) boosting wind speed by a Venturi, (4)wind energy conversions system, and (5) a diffuser.

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Research Article

Numerical Analysis of an Aircraft Wing

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Abstract
A wing is a structural component of aircraft which is used to produce lift during the flight. Wing structure contains skin, ribs and spars sections. Wings are the most prominent lift producing component of the aircraft. The selection and design of the profile do depend on the type of the aircraft and its purpose. Testing the wing structures experimentally is very expensive and time consuming. In the present study a standard NACA profile considered is modeled in SOLID WORKS and structural analysis is carried out using ANSYS workbench. The stress analysis is carried out to examine the stresses along the length of the wing. Wing with and without spar and ribs are taken for analysis. Aluminum 2024-T3, steel and balsa wood are considered for the study. The purpose of the present study is to correlate and validate the finite element model against the modal test for further complex analysis. The deformation pattern and the associated stress fields are predicted accurately using the proposed finite element analysis.

Key words: aircraft wing, spar, deformation.

1. INTRODUCTION

A wing of an aeroplane structure is capable of flying with help of airfoil profile that generates the lift by the vehicle's forward air speed which in turn generates pressure difference at the top and bottom surfaces. The wing forms a primary structural component of which is used to produce lift force during flight and researchers have paid attention with regard to parametric design and optimization [**1, 2**]. When the engine is started air is sucked into the compressor through the inlet increasing pressure ratio at the exit of the compressor. Then air and fuel is mixed inside combustion chamber and burnt. When high pressure, high temperature gases is accelerated through the nozzle, thrust force is produced which propels the aircraft in forward motion. Due to this forward motion, air flows over the wing which is aerodynamic in shape. Due to the aerodynamic shape of the wing along with Bernoulli's principle the velocity of flow is less at bottom of the wing and high at top of wing. Due to this pressure difference is created between top and bottom surface of wing and thus lift is generated [**3**]. Wing must have high strength to weight ratio, high fatigue life since it is subjected to alternate repeated loadings during flight. The main aim of the paper is to find the deformation and stress distribution in a wing made up of three different materials. The structural steel, AL2024T3 and balsa wood are considered. Finite element analysis is performed on the generated wing structure using SOLID WORKS and ANSYS software. The results presented here have shown that the properly design aircraft wing can perform better when focused on the dimensions of the wing. The cross section of wing is called airfoil which is made aerodynamic in shape to reduce drag [**4**]. The aerodynamic efficiency of wing is expressed in terms of lift/drag ratio. Fuselage and empennage are other structural components of aircraft. Fuselage houses passengers, crew, and cargo etc. while as empennage provides stability to the aircraft during flight. Aluminium is widely used material for aircraft structure. About 80% of the structure is made up aluminium and aluminium alloys [**5**].

2. METHODOLOGY

The geometric data for the chosen NACA profile is chosen from NACA website [**6**]. The wing profile is created in xz plane and extended along z axis as shown in **fig 1** Using Solid works software [**7**]. Different part files are created each for the wing, spar and rib and are finally assembled in the workspace giving appropriate constraints. The **fig 2** gives the details of the wing structure in sectional view.

Emission Characteristics of Diesel Engine with Dual Fuel Operation

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***Abstract*: Day by day, the fossil fuels are draining and there is a necessity of alternate for the fossil fuels. In the present work, the jatropha oil (JO) and methanol are used as alternative fuels in the diesel engine. The Kirloskar (India) make diesel engine is used for the experiment. Manufacturer's suggested injection timing and injector opening pressure are 27^0 bTDC (before top dead centre) and 190 bar, respectively. In the present work, the emission tests were conducted on the diesel engine with dual fuel operation of JO-methanol at different injection timings and injection opening pressures and the results were compared with that of diesel operation at manufacturer's suggested injection timing and injector opening pressures. The JO was injected through the fuel injector. The methanol was inducted with the help of variable jet carburetor at various percentages of jatropha oil by mass at full load. The injection timings were varied from 27^0–34^0 bTDC and the optimum injection timing was found. The optimum injection timing is the timing at which the engine gives higher brake thermal efficiency (BTE). The optimum injection timing was found out to be 32^0 bTDC with JO operation. The injector opening pressure was varied from 190 to 270 bar, in steps of 40 bar. The optimum induction of alcohol was found out to be 35%, 35% and 40% at injection opening pressures of 190 bar, 230 bar and 270 bar respectively.**

***Keywords* – Diesel fuel, jatropha oil, methanol, suggested injection timing, optimized injection timing, suggested injection opening pressure, emissions.**

I.INTRODUCTION

Fossile fuels are consumed in many sectors and especially the consumption of diesel fuel is very high. These fossile fuels are depleting day by day. Moreover, the fuel prices are fluctuating in International Market. This will call for the necessity of alternative fuels which are renewable in nature. The methanol and jatropha oil (JO) can be used as alternate fuels for diesel fuel. The methanol is highly volatile. The C/H ratio is less and contain oxygen in its composition. Jatropha oil has cetane number comparable to that of diesel.

With the vegetable oil operation, the researchers [1] - [3] reported an increase of smoke levels whereas the researchers [4] - [7] reported decrease of smoke levels, compared to the diesel fuel operation on the engine. The researchers [8] - [9] used alcohol in the diesel engine and reported an increase of smoke levels whereas the researchers [10] - [21] reported drastic decrease of emissions with the use of alcohol, compared to the diesel operation. With the advancement of injection timing, the researchers [11], [13], [16], [22] reported decrease of emissions. With the increase of injector opening pressures, the researchers [1], [13], [22] reported reduction of emission levels from the engine.

In the present work, the emissions of the diesel engine, running on dual fuel operation of JO-methanol were studied at different injection timings and injector opening pressures. The results thus obtained were compared with that of the diesel operation on diesel engine.

II. MATERIALS AND METHODS

Fig.1 gives the schematic diagram of the experimental set up for the JO-methanol operation. The engine is a single cylinder, four stroke diesel engine. The specifications of the engine are given in Table-1. The copper shims of suitable size are inserted between the engine frame and the pump body to change the injection timing. With the help of nozzle testing device, the injector opening pressure was changed to 230 bar and 270 bar. The effect of injection timing and injector opening pressure on the emissions with test fuels were studied. The smoke and nitrogen oxide (NO_X) are the main emissions from a diesel engine and they were measured by smoke meter and NO_X Analyzer respectively, at various engine loads. The specifications of Smoke meter and NOx analyzer is given in Table-2.

The injection of JO was through the fuel injector and the methanol was inducted using a variable jet carburetor at various percentages of JO by mass at full load. Two separate fuel tanks were used for JO and methanol and a by-pass arrangement was provided to run the engine either with pure JO or with JO-methanol operation. Table-3 gives the properties of test fuels.

Investigating Various Modal Analysis Extraction Techniques to Estimate Damping Ratio

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Abstract- **This Paper deals with estimation of damping of aluminium cantilever beam varies methods. A cantilever excited beam was used in free decaying, circle fit, force-displacement (Hysteresis Loop Method) and frequency sin sweeping damping measurement. The decaying oscillations and resonance peaks obtained by tip amplitude of the beam. Logarithmic decrement was obtained from free decaying oscillations at the first resonance. Circle fit method was done by impulse hammer, force –displacement method was conducted at tip amplitude of 0.4 mm their resonance frequencies and Frequency sweeping was conducted with sweeping rate of 2400Hz/sec and 142 Hz/sec. The damping of Al cantilever estimation different techniques.**

Keywords – Damping, Modal extraction methods, cantilever beam.

I. INTRODUCTION

Material damping is an important property of a material member. In vibration field material damping is generally considered. Material damping has been studied by Y. Kue and F. Hashimoto etal [1]. Material damping calculated in terms of stress distribution function for each mode of vibration and damping stress function. It is found that the relation between the loss factor and max stress amplitude is very similar for each mode of vibration when modes vibrate with equal stress applied when stress amplitude is less than 7 $X10^6$ to 10^7 pa.

Fuxing Yin *etal* [2] compared the damping by measuring strain at the root of the cantilever beam for varying the strain amplitudes for different techniques, i.e logarithmic decrement and frequency sweep for finding damping , conducted experiments on different strain amplitudes in the vicinity of resonance frequency of the beam. The loss factor results are described in a contour as a function of strain amplitude and frequency.

A.P Jeary *etal* and Yukio Tamura *etal* [3,4] experimentally evaluated material damping in tall building in japan, the first mode damping ratio in a small amplitude region increases linearly with natural frequency or vibration amplitude. Damping ratio predictors including frequency and amplitude dependencies.

Material damping has been studied by Y. Kue and F. Hashimoto etal [5] ,Material damping calculated in terms of stress distribution function for each mode of vibration and damping stress function. It is found that the relation between the loss factor and max stress amplitude is very similar for each mode of vibration when modes vibrate with equal stress applied when stress amplitude is less than 7 Mpa to 100M pa. FuxingYin et al [6] compared the damping by measuring strain at the root of the cantilever beam for varying the strain amplitudes for different techniques, i.e logarithmic decrement and frequency sweep for finding damping, conducted experiments on different strain amplitudes in the vicinity of resonance frequency of the beam. The loss factor results are described in a contour as a function of strain amplitude and frequency. A.P Jeary et al and Yukio Tamura et al [7,8] experimentally evaluated material damping in tall building in japan, the first mode damping ratio in a small amplitude region increases linearly with natural frequency or vibration amplitude. Damping ratio predictors including frequency and amplitude dependencies. Neal Granick et al[9] showed that damping as measured in air largely aerodynamic drag and was displacement amplitude and frequency dependent, damping as measured in vacuum was wholly material damping, independent on frequency, when stress below 137.89 Mpa, and air damping as much as 10 times greater than material damping. R.F.Gibson and et al[10] did experiments on aluminum dwell tests and damping predicted by Zener thermo elastic theory showed good agreement at low amplitudes, where damping is independent of amplitude, and large amplitudes of cantilever beam air damping be taken into account.

In this paper will investigate damping by different methods in literature and will analysize the estimation of damping in the system by taking a cantilever beam. Assuming that It is linear system where its dynamic behavior can be described by a second order differential equation, It is time invariant, It is under damped system.

Development of 3D printed model using medical CT scan data with optimum build time

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Abstract- The work aims at providing a 3 D model of a mandible, by taking medical CT scan data. The scan data is converted to 3D model in the form of STL file using 3D slicer software. The 3D model is then edited to the specific part such as mandible. The model is then imported into Cura software to optimize parameters such as layer thickness, print speed and build orientation.

Keywords – 3D printing, layer thickness, print speed, build orientation.

I. INTRODUCTION

3D Printing or Additive manufacturing is a process in which a material is printed layer by layer. Although there are many ways this can achieved but the basic principle remains same. It involves conversion of 3d model into STL file, which divides object into multiple layers and then the part is printed layer by layer according to the geometry. The most commonly used 3D printing is Fused Deposition Modeling (FDM) as many 3d printers are evolved based on this technology with cheaper price. The use of this technology in medical field is very beneficial as any complex object can be 3d printed as it becomes easy for surgeons to visualize the defects and design implants specific to needs of the patient. Dina Radenkovic has used 3D printing technology for development of organs using CT or MRI Scan data and laid the importance of properties required for the material to be implanted.[1]. Dayeong Hong has studied the effectiveness of 3 different 3D printers based on CT images and also 3d printing of lung model using fused deposition [2]. Rengier.F .et.al has explained the importance of parts which can be graspable with aid of 3d printing and how effective it is in case of visualizations compared to flat screens[3]. Mitsouras, D, et,al. has explained the need for rendering Digital Imaging and Communications in Medicine (DICOM) images as 3D models[4]. Ventola, C. Lee has emphasized on use of 3D printing technology for various organs including hard and soft tissues.[5]. In this work, a 3D model of mandible is designed and optimum parameters for minimum build time is established.

Friction Stir Welded Joint Efficiency of Aluminium Alloy 6061-T6

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Abstract:

Friction stir welding is a Solid state welding process which can produce low cost and high quality joints. This is because it does not require the consumable filler materials and can eliminate some welding defects like crack and porosity. The main objective of the present study is to check the Weldability of Aluminium Alloy 6061-T6 using Friction stir welding and to determine the weld strength. Experiments are conducted at rotational speed of 900 RPM, Welding speed of 40 mm/min, axial force of 5KN and Title angle of 0^0 on 6 mm thick AA6061-T6 alloy plates using friction stir welding. A Cylindrical Taper tool of High Speed Steel with shoulder diameter of 22 mm, Pin diameter of 7mm and pin length of 5.8 mm is used for friction stir welding. Tensile strength of friction stir welded joints of AA6061-T6 specimens are tested on UTM and Tensile strength and stress strain curve are recorded.

Keywords: Friction Stir Welding, Aluminium Alloy 6061-T6, HSS Tool, Process Parameters, Tensile Strength, Stress-Strain curve.

I. Introduction

Friction stir welding (FSW) is One of the best technologies that have been identified to join low-temperature alloys especially aluminium and have been successfully employed to join aluminium alloy in many applications such as in marine, military, automotive and aerospace industries [1]. The concept of FSW is simple; a rotating non-consumable tool with a specially designed shoulder and pin is inserted into a butting edge of plates or sheets to be joined till the shoulder contact the top surface of work piece and traversed along the line of joint to produce the weld.

Experimental Investigation on Influence of Process Parameters for Machining AISI 310 on EDM

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Abstract- Electrical discharge machining (EDM) is a well-established machining option for manufacturing geometrically complex or hard material parts that are extremely difficult-to-machine by conventional machining processes. The non-contact machining technique has been continuously evolving from a mere tool and dies making process to a micro-scale application. machining alternative attracting a significant amount of research interests. In the present work, Experimental investigations were carried out to find out Material Removal Rate (MRR), Surface Roughness (SR) and Tool Wear Rate (TWR) for different machining parameters. Different electrode materials viz. copper, bronze, aluminum are selected for the Investigation. The objective of the experiments is to identify the best material in terms of higher MRR, excellent surface finish and low tool wear rate. Various machining parameters were used to conduct the experiments and surface finish, MRR and Tool wear rate were measured. From the experimental results it was found that when current is increased surface finish value will be increased and MRR was decreased. Copper electrode has better Material removal rate as compared with Aluminum and Bronze under the same conditions.

Keywords – Material Removal Rate (MRR), Surface Roughness (SR), Tool Wear Rate (TWR)

I. INTRODUCTION

In non-conventional machining, considerable amount of material is removed from the raw material to get the desired profile. This fact leads metal removal, a more expensive process when compared to other manufacturing processes. So cost consciousness is very much expected in producing a component. There are no scientific and economics approaches to reduce the non-productive times but there are considerable possibilities in reducing the machining time without detracting the quality of the machined component. Presently greater attention is given to Material Removal Rate (MRR), surface roughness and Tool wear rate in the industry. There is a need to select the machining parameters for economic machining. Due to high investment and machining cost of nonconventional machines, there is a need to efficiently operate the machines. The cost of machining is sensitive to the selection of machining variables. The machining variables are selected properly by using optimization techniques. With the advancement and developments in new technologies, low weight- high strength, high hardness and temperature resistant materials have been developed for special applications such as aerospace, automobile, medical etc. In the machining of hard and metal matrix composite materials, traditional manufacturing processes are being increasingly replaced by more non-traditional machining processes such as Electrical Discharge Machining (EDM). Since the introduction of the Wire Electric Discharge Machining (WEDM) process, it has evolved from a simple means of making tools and dies to the best alternative of producing micro-scale parts with the highest degree of dimensional accuracy and surface finish. Selection of correct machining conditions is the most important aspect to be taken into consideration while machining a component. WEDM is a complex machining process controlled by a large number of process

VIBRATION ANALYSIS OF VARIABLE LIQUID FILLED STAINLESS STEEL THIN CYLINDRICAL SHELLS

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ABSTRACT: In the present work Vibration behavior of empty and variable fluid levels, contained in stainless steel cylindrical shells of 2mm and 3mm subjected to horizontal accelerations are considered. Mathematical expressions, which shows the motion of cylinder were developed and modified by the method of small amplitude wave approximations, enabling equations for the various modes of vibrations and natural frequencies to be obtained. Also, expression for frequency is formulated by the consideration of fluid in the cylindrical shell. The results were compared by considering modal analysis of stainless steel shells, modelled and analysed using ANSYS. Natural frequencies for different mode shapes are developed for the both 2mm and 3mm stainless steel shells of empty and with variable water column by 20% from the base of the shell. Damping ratios were calculated using half power method. Natural frequencies predicted from analytical method correlated with ANSYS, were found to be in close agreement.

KEYWORDS: Thin Shells, Natural Frequency & Damping Ratio

1. INTRODUCTION

Shell structure with the presence of liquid tends to modify the dynamic properties of that structure, namely: natural frequencies, mode shapes of vibration and damping ratios. For thin-walled cylindrical structures such as liquid storage tanks and certain nuclear and offshore structures these effects are of a more complex nature than for structures with lesser flexibility. The change in the dynamic properties of the structure is generally attributed to an increase in the effective mass of that structure due to the liquid, known as the 'added-mass'. Some of the earlier works are as follows.

Vijayarachavan and Evan-Iwanowski [5] analyzed, both analytically and experimentally, the parametric instabilities of a circular shell under seismic excitation. The cylinder position was vertical and the base was axially excited by using a shaker. In this problem, the in-plane inertia is variable along the shell axis and, when the base is harmonically excited, it gives rise to a parametric excitation. Instability regions were found analytically and compared with experimental results.
Trotsenko and Trotsenko [58], studied vibrations of circular cylindrical shells, with attached rigid bodies, by means of a mixed expansion based on trigonometric functions and Legendre polynomials; they considered only linear vibrations.

Farshidianfar A. and FarshidianfarM.H.[6] were carried out both theoretical and experimental analyses on a long circular cylindrical shell. A total of 18 modes, consisting of all the three main mode groups (axisymmetric, beam-like and asymmetric) were found under a frequency range of 0–1000 Hz, by only applying acoustical excitation. Acoustical excitation results were compared with those obtained from contact excitation. It was discovered that if one uses contact methods, several exciting points are required to obtain all modes; whereas with acoustical excitation only one acoustical source location for the excitation is needed. Furthermore, acoustical excitation produced much better results, compared with contact excitation, in the frequency band 0–3200 Hz.

RaydinSalahifar[7] analysed cylindrical shells based on the variational form of Hamilton's principle, the field equations and boundary conditions are formulated for circular cylindrical thin shells under general in-phase and out-of-phase harmonic loads. The resulting field equations are solved in a closed form for general loading and

Experiments on the thermo-mechanical behavior of Al 319 strengthened with recycled glass.

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Abstract—The current study investigates the mechanical behavior of glass/Al composite using powder metallurgy. The main feature of glass content is low weight to high strength reveals enhanced strength.The results of the glass content sintering the temperature and sintering time on the composite properties have been investigated. The common glass content is 5vol%, 10vol% &15vol% and thus the sintering temperature and time are 600-660°C and 6 hours severally.The Al 319 base alloy was compared to their glass-aluminum composite variations in tensile, density, hardness, wear resistance, and the fabrication of recycled glass/aluminum composites using powder metallurgy.Tensile strength and density of fabricated composites decrease as the weight percentage of recycled glass increases while hardness, thermal conductivity, and wear rate remain constant.

Key Words—Al composites, vol.% of recycled glass, powder metallurgy.

1. Introduction

Scrap Al319 reinforced with metallurgically created nano iron compound was investigated with low value producing of sunlight and efficient multi-functional materials for engineering applications [1]. Al composites reinforced with particles tend to improve properties processed by completely different methods [2]. Over the last few decades, high-performance Al composites with high strength, stiffness, density, and wear resistance capability have been widely developed [3].Among these, Al319 aluminum is widely used as an engineering applications [4]. Al319 is an intriguing choice for military and automotive applications because the alloy has important properties such as high quality, lightweight, and a high limit in terms of foundry [5]. This combination can likewise be effectively utilized as a network from the reused crisp piece (chips) to create fantastic metal grid composites in a monetary way [6]. Reused glass can now replace up to 95 % of raw materials; glass is 100 % recyclable and can be reused indefinitely without deterioration in quality or immaculateness. Assembling profits by reusing in a variety of ways: reused glass decreases discharges

Numerical Analysis of Engine Hood

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Abstract- Weight reduction is one of the major factor in automobiles for improving the fuel efficiency. In this paper the conventional metal used for engine hood is replaced with the Fiber reinforced plastics (FRP). A three dimensional solid model of the engine hood is prepared. Mid surface of the solid model is generated and imported for analysis. The surface model is first checked for continuity as very small details are lost during importing. The material properties are defined and the mesh is generated. Boundary conditions and loads are applied. By varying the thickness numerical static analysis is performed and optimum value of the thickness for the surface is obtained.

Keywords Engine hood, FRP, Surface Model, Static analysis

INTRODUCTION

FRP composites are being promoted as materials for the century because of their superior properties like high strength-to-weight ratio, corrosion resistance, and excellent thermo mechanical properties.

The UD-GFRP composite laminates were tested for failure with drilled hole under uni-axial tensile testing by developing a finite element model [1].

The elastic properties under the effect of hygrothermal conditions on polymeric composite materials is investigated by developing a micromechanical degradation model [2].

The strength failure of the guyed tower was evaluated using the maximum strain, maximum stress theories, and Tsai Wu failure criterion and also the dynamic response at any location along tower height was calculated by using the conservative formula for simple scaling [3].

Fracture analysis conducted on Titanium alloys has revealed quasi-cleavage fracture with small symptoms of plastic shearing in the early part of cracking [4].

Between steel and fiber-reinforced composites the effects of fiber type and fiber orientation's on the interface bonding is investigated for three different composites: glass fibers,carbon fibers/epoxy and Kevlar fibers/epoxy. These were tested under different orientations.To

Efficient Activated Metal Inert Gas Welding Procedures by Various Fluxes for Welding Process

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Abstract

In the past years so many developments and innovation are made to increase the performance of the welding machine by reducing the power consumptions, cost, labour skills and many more. In a row, A-MIG welding process is one of the welding processes which increase the welding properties of material at the same consumption of the power and resources. A-MIG welding is wildly used to optimize the parameter of MIG welding. A steady flow welding power gracefully delivers electrical vitality, which is directed over the bend through a segment of exceptionally ionized gas and metal fumes known as plasma. Metal inert gas (MIG) welding is most regularly used to weld thick segments of tempered steel and non-ferrous metals, for example, aluminum, magnesium, and copper compounds. Three sorts of oxides, Fe2O3, SiO2, and MgCO3, were utilized to research the impact of initiating transition helped gas metal bend welding (GMAW) on weld dab math, precise twisting and mechanical properties. The most noteworthy impact on the inward structure factor was knowledgeable about instance of MnO dynamic transition, which diminished the inside structure factor by 20 %. If there should arise an occurrence of the outside structure factor the applied SiO2 dynamic transition caused the greatest increment which is 37 %. In the hardness dispersion and the microstructure of the joints, including the weld metal and the heath influenced zone, no critical contrasts were experienced contrasted with the example welded with no transition material.

Keywords: MIG welding, GMAW (gas metal arc welding), micro structure, flux winding.

1 Introduction

Metal inactive gas welding known as gas metal arc welding which uses aexpendableconductor to generate arc between workpiece and electrode. The inert gas argon, in rare cases helium (more expensive) gases are used to protect the weld bead for atmosphere contaminates, these gases are also called shielding gas and filler materials are normally used. The procedure grants those drivers more amazing control through those welds over contending procedures for example, protected metal circular segment welding Furthermore gas metal circular segment welding, permitting for stronger, higher personal satisfaction welds. MIG welding is utilize to joint ferrous Furthermore non-ferrous materials for example, steel, copper, aluminum, magnesium, nickel, What's more their alloys..

MIG welding procedure has fails to weld thick section of material in single pass and it has low productivity. To recover the performance of MIG welding triggered flux are used to increase the depth of penetration in single pass. Activated flux is mixed with the acetone and blinder and applied thin past on the workpiece by brush or spray. A-MIG welding system makes it could reasonably be expected to heighten the accepted MIG welding hones for joining those more than 10 mm thick plate by absolute pasquinade with no edge preparation. The mechanical properties moved forward contrasted with those welds made without any flux material. Over our Examine we investigated the impacts of eight distinctive animated fluxes and mixtures On point of interest Throughout GMAW utilizing animated protecting gas. In the event that of circular segment welding the main impetus of the struck them streams in the weld pool could a chance to be originated starting with four separate phenomena, those buoyancy, those surface-tension (which brought about the with the goal known as Marangoni impact [9]), the high speed development of the circular segment plasma, and the Lorentz energy. [10,11]

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Research Article

Impact Of Strain Rate On Mechanical Properties Of Metallic Sheets At Various Temperatures

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ABSTRACT: It is known that in warm and hot forming processes, the forming speed and with-it combined strain rate has immense role on material flow in bulk and sheet metal operations. In contrast, the influence of the strain rate on the flow curve has been rarely analysed at room temperature. This work analyses the influence of strain rate on flow curve of bimetallic sheets, Copper and Aluminium metals. Evaluation of the flow curve is carried out as a function of strain rate. In this work three different strain rates are considered for three different materials viz bimetallic sheets(Cu-Al), Copper and Aluminium. In addition to this ,the evaluation of flow curve at elevated temperatures is carried out. The Variation of mechanical properties with strain rate are plotted and analysed.

Keywords: strain rate , bimetallic strip ,Flow curve.

1 Introduction .

Often materials are subjected to external force when they are used. Mechanical Engineers calculate these forces and material scientists investigate how materials deform or break as a function of force, time, temperature, and other conditions. Materials scientists learn about these mechanical properties by testing various materials and evaluating the mechanical properties like Brittleness, Creep, Ductility, Elasticity, Fatigue, Hardness, Malleability, Stiffness, Yield strength. Heating the metal will displace atoms from their position and the displaced atoms form a new structure.

The earliest surviving bimetallic strip was made by the eighteenth-century clockmaker John Harrison who is generally credited with its invention. He made it for his third marine chronometer (H3) of 1759 to compensate for temperature-induced changes in the balance spring. It should not be confused with the bimetallic mechanism for correcting for thermal expansion in his Gridiron Pendulum. His earliest examples had two individual metal strips joined by rivets but he also invented the later technique of directly fusing molten brass onto a steel substrate. A strip of this type was fitted to his last timekeeper, H5. Harrison's invention is recognized in the memorial to him in Westminister Abbey, England.

Bimetal refers to an object that is composed of two separate metals joined together. Instead of being a mixture of two or more metals, like alloys, bimetallic objects consist of layers of different metals. Trimetal and tetrametal refer to objects composed of three and four separate metals respectively. A bimetallic sheet is usually made of combinations of Copper-Aluminium, steel-Copper. It is achieved by cladding, roll bonding, explosive welding.

S. Nagarjuna and M. Srinivas[1] investigated the high temperature tensile properties of Cu–1.5 wt.% Ti alloy in the temperature range of 100–550 °C. Substantial increase in yield and tensile strengths of solution treated alloy is observed with increasing temperature, with a peak at 450 °C and decrease in strength beyond this temperature. Cu–Ti alloys have been developed with the aim of substituting them for the toxic and expensive Cu–Be alloys. It reports the results obtained on high temperature tensile properties of a Cu–1.5 wt. % Ti alloy in solution treated (ST) and peak aged (PA) conditions . Radovic et al [2] investigated that the tensile response of Ti3SiC2 is a strong function of strain rate and temperature. Increase in testing temperature and decrease in testing strain rate leads to large tensile plastic deformations. The high value of strain rate sensitivity (0.42 to 0.56) of Ti3SiC2 was obtained from tensile tests and confirmed by strain rate jump/drop test and stress jump creep tests. That value is equal to or greater than the strain rate sensitivity of most superplastic ceramics. The deformation of fine-grained Ti3SiC2 also has another aspect in common with superplastic ceramics -- significantly larger elongation to failure that are typically observed in ceramics. The large elongation to failure appears to result from a high degree of damage, not from a structure that remains self-similar throughout deformation.J. O'norca et al.[3] studied The mechanical properties of particulate-reinforced metal matrix composites based on aluminium alloys (6061 and 7015) at high temperatures . Boron carbide particles were used as reinforcement. All composites were produced by hot extrusion. The tensile properties and fracture analysis of these materials were investigated at room temperature and at high temperature to determine their ultimate strength and strain to failure. Rao, K.P.et al [4] suggested that an understanding of the plastic behaviour of various metals and alloys is necessary for their successful forming. Flow curves facilitate understanding of the plastic behaviour of materials. The determination of the flow curves at different temperatures and strain rates is equally important for both the researcher and the production engineer. The different test methods used for determining the flow curves, together with their relative merits and demerits and the influencing parameters, are discussed.

2 Methodology:

2.1 Experimental procedure for bimetallic strip at room temperature

The bimetallic strip that is used for testing is obtained by roll bonding process-the combination of bimetallic strip is Copper on one side and Aluminium on other side. The bimetallic sheet is cut according to the ASTM E8

Analysis on Manufacturing Automated Guided Vehicle for MSME Projects and its Fabrication

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Abstract
Automated Guided Vehicle (AGV) is the material handling equipment that is utilized broadly in maximum manufacturing company, nowadays as it gives more flexibility to system. The fundamental perception of AGV includesdriverless &battery-powered vehicles with programming abilities for path selection and locating. They are equipped to navigate a flexible guide path network, which might be simply changed and extended. This project may be concentrating on model, unloading & loading mechanism for AGV have been required to define specific criteria, which is automatic operated, lightweight & capable to transport acrylic. This unloading & loading system worked utilizing ball screw as development system & suction cup with vacuum pump as adhering instrument. The outline and fundamental material to manufacture this AGV model would utilize aluminum to decrease the AGV weight. The AGV application in real world application is support human & decreasing price in repetitive movement transportation actions. This manuscript suggests a survey on control & design of AGV frameworks. We locate many key related problems incorporating guide-path design, vehicle scheduling, assessingnumber of vehicles, battery management, conflict determination, idle-vehicle positioning, &vehicle routing.Furthermore, we suggest a decision system for design and execution of AGV frameworks, & propose few fruitful study directions. It will be designed for importantly less price &exorbitant efficiency. The expenditure of overall build is Rs.90,000/- which is cost worthy.
Keywords: UGV, AGV, MSME's, Arduino, IOT, Industry 4.0, Fork Lift, genetic algorithm (GA)

1 Introduction

For general, every last one of results would generated all the for the particular provisions that must be advantageous. Every last one of results would make Eventually Tom's perusing the key material. That material may be known as "Raw material". Without crude materials, there need aid no items. These crude materials perhaps different sorts In light of provisions. These crude materials are changed over under helpful items Eventually Tom's perusing those commercial enterprises. There would parts about labors or laborers to machining these crude materials.

Also, there are a number specialists utilized for transporting these materials. There are a significant number rooms for example, such that storage facility or warehouse, different workshops, Furthermore also a few inventories for holding or carrying the completed alternately mostly completed merchandise. A considerable measure about specialists make those helter skelter work cosset to the holder of the business. Percentage specialists must worth of effort there to machining these crude materials that need aid inescapable. However huge numbers specialists utilized for transporting ought to be avoided a direct result it diminishes those work cosset.

The recommended one task might functional for transporting materials starting with one spot then onto the next put without mankind's intercession. Those suggested venture will be constructed straightforward What's more proficient person Toward presenting mechanization there. Those universal methodology of transporting those crude materials and additionally completed items includes no less than 2 alternately 3 laborers in that field. On account of you quit offering on that one individual if detract the materials from the storage facility et cetera someone else ought to load this material of the vehicle which carries that materials and someone else ought further bolstering drive those vehicle of the fitting spots, for example, machine section, cutting section, penetrating section, processing section, work

Examination and Analysis of Thermal Stream Boiler using Power Plants

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Abstract
The steam evaporator may shut holder where water or different liquids are warmed under tension and the steam discharged by the kettle is utilized for different warming applications. The fundamental contemplations in planning a kettle for a specific application are structure and warm investigation, structure for creation, physical measurements and cost. In this postulation, the progression of steam in the steam kettle (without diverters and with redirectors) is displayed utilizing the CREO parametric plan programming. The postulation will concentrate on warm and CFD examination with various info speeds (20, 30, 40 and 50 m/s).In this theory, CFD investigation decides the warmth move coefficient, the warmth move rate, the figure stream rate and the weight drop. Warm inspection to choose the temperature movement, the warmth stream for the two models of steam kettle without diverters and steam evaporator with redirectors. Discover which model is the best.3D displaying in the parametric CREO programming and dissects acted in ANSYS.
Keywords: Thermal Stream Boiler, CFD, Ansys

1 Introduction

Boilers are pressure Vessels proposed to warm water alternately make steam, which might in this route a chance to be used will provide for space warming or water warming should a structure. Over the benefits of the business building warming applications, those warming sourball in the evaporator may be a vaporous petrol copier. It will be moreover possible on use oil burners What's more electric block warmers. Steam over warmed water will be favoring in sure applications, including maintenance cooling, kitchens, laundries, sterilizers Furthermore steam machines.

Boilers bring Different qualities that bring made them an ordinary part from structures. They have a long life, could finish efficiencies of up to 95% or more, provide for an effective techno babble to warming a structure and, because from claiming steam frameworks, require practically no siphoning vitality. For any case, fuel liabilities can make impressive, standard backing is required, What's more assuming that upkeep may be postponed, fix can a chance to be exorbitant.

Those aide to the development, movement and more upkeep about boilers conveys the going with assets:. Tenets for the advancement about warming boilers, evaporator code Furthermore weight vessels, segment IV-2007. Prescribed models to that attention also action of warming boilers, evaporator code furthermore weight vessel, and segment VII-2007. Boilers are every now and again a standout amongst those best vitality customers done a structure. For consistently a warmer schema may be left unattended, pot costs can augment toward around 10% (1). Along these lines, evaporator movement What's more help will be a OK start stage The point when seeking to methodologies to diminish vitality usage and put aside money.

How boilers work

Gas and oil boilers utilize controlled fuel burning to warm water. The key parts of the kettle engaged with this procedure are the burner, the ignition chamber, the warmth exchanger and thecontrols.

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Green Mediated Synthesis of Macroporous Hierarchical CeO_2 Nanoparticles using *Mimosa pudica* Leaf Extract for Humidity Sensing Application

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Metal oxide nanoparticles are popular candidates for chemiresistive sensors application. Cerium oxide (CeO_2) based semiconducting gas sensors have gained rapid interest in recent years. In this study, an environment-friendly green synthesis approach was employed for the synthesis of macroporous CeO_2 nanoparticles using *Mimosa pudica* leaf extract. Later the performance of CeO_2 nanoparticles for humidity sensor is demonstrated. X-ray diffraction studies revealed the cubic fluorite crystal structure with no impurities, scanning electron microscopy analysis revealed the macroporous morphology of CeO_2 hierarchical nanoparticles. Humidity sensing properties were studied using interdigitated electrode coated with CeO_2 nanoparticles. The results showed the sensing response of 0.5 times for 10% RH (relative humidity) and seven times for 90% RH. The response and recovery times were found to be as low as 12 s and 15 s, respectively. The experimental results provided an environment-friendly approach for the synthesis of CeO_2 particles and revealed promising results in humidity sensing application.

Keywords: *Mimosa pudica*, Sensing response, Humidity sensor, Interdigitated electrode, Response time.

INTRODUCTION

In the flourishing industrial era where there is a prime necessity of monitoring operating ambiance and pollutants released to the environment, sensors play a vital role in providing the qualitative and quantitative analysis of chemical effluents [1]. Ambient humidity is one of the crucial factors affecting the performance and efficiency of industrial operations. Hence, humidity sensors are extensively used for keeping a check of ambiance in industries and day today's life [2].

Semiconductor metal oxide gas sensors are the most promising ones among different types such as electrochemical, optical, calorimetric gas sensors, *etc*. because they offer advantages like high sensitivity, durability, low cost, and simplicity in function. A variety of materials are used as sensing material in humidity sensors, such as ceramic [3], organic polymers [4], metal oxide [5], carbon nanotubes [6] and various other composites are tailored and equally used. To know, the general working principle of chemiresistive sensors is the change in impedance of sensing material on exposure to humidity [7].

Nanotechnology offers a unique opportunity to tailor and enhance the overall performance of the above-said materials [8]. Because of their small grain size and large surface area, nanomaterials are advantageous for producing chemical sensors. The properties that attract nanomaterials for sensing applications are the availability of more surface-active sites and stronger absorption and adsorption ability than other materials [9]. As humidity sensing is a surface phenomenon, a material with a high surface area is preferable. Hence, porous materials are gaining importance in chemical sensing applications due to the presence of pores (voids) and ease of creation and functionalization of those voids for specific applications [10].

Among the metal oxide nanoparticles in the lanthanide series, cerium is the second and the most reactive element. By virtue of its electro positivity, cerium exhibits dual oxidation states, Ce^{3+} and Ce^{4+}. Ce^{4+} state is considered as stable over Ce^{3+}, hence cerium oxide or ceria (CeO_2) is the most stable oxide of cerium [11]. Cerium oxide is a popularly used semiconducting material having wide bandgap energy of 3.19 eV and high

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Numerical and experimental evaluation of near-wake cavitation flow around axisymmetric cavitators

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ABSTRACT

The primary objective of this research is to study the cavitating effects of fluid flow past different axisymmetric cavitator in the upper sub-critical flow regime, which corresponds to the Reynolds number (2×10^4 to 2×10^5). Experiments are conducted in a water tunnel with a fluid flow velocity of 30 to 60 m/s at a constant rate of injection. The commercial software tool, ANSYS Fluent 18.1, is used to simplify three dimensional Reynolds averaged Navier Stokes equation with the compressible fluid flow by considering the pressure-based solver with standard k–ε turbulence model. A comparison of the numerical and experimental results shows that the numerical method can predict accurately the shape parameters of the natural cavitation phenomena such as cavity length, cavity diameter, and cavity shape. Results reported that with an increase in velocity, the cavity length and diameter increased to 250% and 20% respectively.

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KEYWORDS
Wake cavitation; conical body; finite volume method; drag coefficient and cavity length

1. Introduction

Cavitation is the formation of vapour inside a liquid when the liquid's local pressure falls below the vapour pressure (Arndt 2012; Kandula et al. 2016). Cavitation can occur in internal flow in systems like venturi, or machines like pumps and hydraulic turbines and also due to fluid flow of high-speed bodies underwater (Luo et al. 2016). Many times, these bodies are in axisymmetric shape (Kandula et al. 2020; Gugulothu 2020). The flow past axisymmetric bodies presents exciting features due to both longitudinal and circumferential pressure gradients. From a practical point of view, such flow is of considerable importance in aerospace engineering and underwater hydrodynamics.

Feng et al. (2020) investigated the cavitating flow past conventional models to alternatively develop an appropriate model by simplifying the Rayleigh–Plesset equation on turbulent flows at a different mass flow rate and reported that the proposed model developed better results in comparison with the experimental data. Gogate and Pandit (2010) conducted an exhaustive literature review on hydrodynamic cavitation to understand how well it fits as a replacement for acoustic cavitation and reported similarity between hydrodynamic and acoustic cavitation but with better efficiency. Bai et al. (2018) developed a theoretical analysis to study bubble interactions and conducted an experimental analysis with a piezoelectric sensor to observe the various impacts and amplitudes and reported that the maximum impact loads are developed within a range of 0.5–0.8 mm. Mancuso (2018) investigated the swirling jet reactor by adopting a computational fluid analysis code to study the influence of various geometries, injection slots, and fluid pressure distribution. They reported that the maximum flow velocity and minimum pressure gradient are observed with the smaller injection slot diameter. Huang et al. (2019) conducted an exhaustive literature review on the unsteady cavitating mechanism in terms of both qualitatively and quantitatively by considering different cavitation regimes and reported that the development of cloud cavity and subsequent collapse due to recirculation of the fluid particles are discussed. Setareh et al. (2020) presented a numerical analysis by developing specific user-defined solvers in OpenFoam and carried out an experimental investigation in an annulus by developing ultrasonic waves in the fluid flow. They reported that with an increase in the Reynolds number, acoustic cavitation's impact decreased, and the obtained results are found to be in good agreement. Zhang et al. (2017) investigated the unsteady cavitating flow past the underwater body to study the effect of dynamic pressure and reported that mass flow rate has a significant effect on ventilated cavitation that adverse pressure gradients emphasized due to periodic shedding in the downstream. Carrat et al. (2019) investigated the unsteady cavitation erosion phenomena over hydrofoil by implementing a user-designed solver k–ε RNG turbulence model and reported that numerical results are in good agreement with the experimental results. Subburaj et al. (2018) conducted a numerical investigation on cavitating flow past an elliptical cylinder at a constant Reynolds number to study the effect of a different angle of attacks, aspect ratio and other non-dimensional parameters and reported that varying the aspect ratios does not bring a

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Numerical Investigation of Cavitating Flows in the Step Nozzle

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Abstract. Cavitation is the structure of water foam in a liquid molecules and consecutive partition in its flow. When the vapour pressure at certain temperature is less than the absolute pressure the air molecules are formed. Cavitation processes have lots of troublesome in turbo machinery reducing capability and generating noise. The process of control measures is considered when the negative approaches are done to control it. The simulations are done by varying the diameter of the circular disk by choosing some fixed cavitation numbers and by varying flow pressures. The tendency of the cavity such as diameter, length, and drag coefficient are to be studied and compared with the laboratory information or data and diagnosticsimilarity. The analysis which is done is based on the pressure and velocity as we observe from the graphs pressure contours where the fluid is entering the step part in the nozzle there is an increase in pressure at one phase, but as we observe it clearly there in a low pressure area that is created in between the flow where there is a gradual pressure drop. This low pressure area is the region where the bubbles are going to form and when these bubbles meet the high pressure region, due to the pressure difference these bubbles are going to explode and damage the internal surfaces. Plot the velocity contours and static pressure contours at different pressures (2 bar, 3 bar and 5 bar), increase in pressure and velocity the value of cavitation increases.

Keywords: Cavitation, Step nozzle, CFD and Axisymmetric bodies.

INTRODUCTION

Cavitation is the formation of vapor cavities in a liquid, small liquid-free zones ("bubbles" or "voids"), that are the consequence of forces acting upon the liquid the water evaporates within the liquid and small bubbles are formed. Pressure of the liquid all over the place the bubbles causes the bubbles to then breakdown which releases energy. In a hydraulic system, cavitation releases so much energy that destruction and corrosion can occur on the solid aspects of the system. We can see the undesirable results of cavitation in pumps, turbines and dams. Cavitation is an unnecessary appearance in many processes. In many equipment's like propellers and pumps, cavitation becomes route case for noise, damages the equipment's, vibrations, and a loss of reliable working functionality.

Hydrodynamic cavitation is nothing but the process of evaporation, bubble making and bubble breakdown which occurs because of the moving liquid as a result of a reduced and subsequent improvement in local pressure. Cavitation will only occur if the local of fluid dynamics it is sometimes useful and is not cause damage when the bubbles collapse away from machinery, such as in supercavitation. The technique of bubble generation, and the

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FATIGUE AND DYNAMIC ANALYSIS OF CONTROL ARM

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Abstract:*The suspension system is one of the most important components of vehicle, which directly affects the safety, performance, noise level and style of it. The objectives of this study are to characterize the dynamic behavior, to investigate the fatigue life of upper suspension arm using FEM. This paper looks at the design of a front suspension control arm component using modern design techniques and compares the end product to that of the model control arm component, which was designed using more traditional techniques. Control arm is designed in 3d modeling software then imported in to Altair Hypermesh for preprocessing; to solve Altair Optistruct is used. Aim is to increase the fatigue life of control arm by making changes in design as well as material. First static analysis is performed using ground impact to the control arm as well as brake force. Later fatigue analysis is carried out to check the life of present running design. Fatigue and static analysis are performed again after the design changes are made for the existing control arm. Dynamic analysis is carried out for the dynamic behavior .The time vs load input will be applied to the control arm by this it shows the dynamic behavior at each time frame. The results shows significant increase in fatigue life cycles.*

1.INTRODUCTION

The vehicle suspension system is responsible for driving comfort and safety asthe suspension carries the vehicle-body and transmits all forces between body and road. In order influence these properties, semi-active or active components areintroduced, which enable the suspension system to adapt to various driving conditions.From a design point of view, there are two main categories of disturbances on a vehiclenamely the road and load disturbances. Road disturbances have the characteristics oflarge magnitude in low frequency (such as hills) and small magnitude in high frequency(such as road roughness). Load disturbances include the variation of loads induced byaccelerating, braking and cornering. Therefore, a good suspension design is concernedwith disturbance rejection from these disturbances to the outputs. A conventionalsuspension needs to be “soft” to insulate against road disturbances and “hard” toinsulate against load disturbances. Consequently, the suspension design is an art ofcompromise between these two goals (Wang, 2001).The suspension arms are the essential elements in the vehicle as shown in Figure 1.1 (Milliken, 2002) conventionally these parts made of steel, which is a heavy metal then today try to use aluminum, a lighter metal, economic and easy to produce.Uncertainty propagation and quantification are a challenging problem in engineering. Indeed, the analyst often makes use of complex models in order to assess the reliability or to perform a robust design of industrial structures. The goal of the project is to check the fatigue life of present running design and design changes are required based on the fatigue life results. The design changes will happen and then maximize the fatigue life which should be more than the base control arm design. Most applications of robust

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Comparative FE Thermal Analysis of Copper Coated 2-Stroke SI Engine Components over Conventional Engine

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Abstract — In SI engines, the engine performance can be improved by changing the composition of fuel (alcohol-gasoline blends) and by coating the engine components (Piston, Liner and Cylinder Head) with high thermal conductive material like copper. Copper coated engine (CCE) consists of copper coated piston, liner and copper coated cylinder head. The lubricating oil used in the engine should not be deteriorated, as the deterioration causes mechanical damage to the engine and decreases the efficiency. Hence, in a modified engine (CCE) with alcohol-gasoline blends, the performance of lubricating oil is to be checked. Across the components of CCE, the temperature distribution and heat flow rate along the axis (depth) and along the radius can be determined with the help of Finite element analysis (FEA) using ANSYS software package. FEA estimated an increase in the temperature and heat flow rate along the axis (depth) and along the outer radius of the catalytic coated piston, liner and cylinder head over conventional engine (CE) components.

Keywords — Alcohol-gasoline blends, ANSYS, Copper coating, FEA, Heat flow rate, Lubricating oil, Temperature distribution

I. INTRODUCTION

In order to understand the phenomena of heat flow through the piston, liner and cylinder head, the temperature distribution within these components will come handy for the designers. The transient nature of heat flow involving more than single variable, complicated method of measuring temperature across these components and ambiguous boundary conditions pose serious problems for the analysis of heat flow through the piston, liner and cylinder head of CCE. Added to this, the composite structure of the copper coated piston, liner and copper coated cylinder head consisting of a separate material for the piston crown, liner and cylinder head will bring in variation of material properties within these components. The piston ring grooves, the varying properties of copper coated crown, liner and copper coated cylinder head with differing boundary conditions call for accurate analysis for predicting temperature distribution and heat flow rate across the piston, liner and cylinder head.

In such complex situations with complex shape of the objects, the finite element analysis is best suited and hence the temperature distribution in copper coated piston, liner and cylinder head are studied by employing finite element based software using ANSYS programme.

The major difficulty faced by the users of the finite element analysis will be identifying the proper boundary conditions and choosing the appropriate type of mesh so that the results generated are not too far from the truth (experimental results). It is also well known that all computer predictions are to be validated on the basis of either experimental data or theoretical methods.

II. EXPERIMENTAL PROGRAMME

In the catalytically activated engine, by flame spraying technique, a high thermal conductive catalytic material like copper was coated on the cylinder head inside surface and top surface of piston crown. For 100µ thickness, nickel-cobalt-chromium bond coating was sprayed. On this coating, for another 300µ thickness, an alloy of copper (89.5%), aluminium (9.5%) and iron (1%) was coated with a METCO (Trade name of the company) flame spray gun. The bond strength of the coating was so high that it does not wear off even after operating it for 50 hrs continuously [1], [2], [3], [4].

Fig. 1 shows the Photographic view of copper coated piston, liner and copper coated cylinder head.

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DESIGN AND NUMERICAL STUDY OF PISTON FOR DIFFERENT ALLUMINIUM ALLOYS

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Abstract: *In this study structural Analysis investigated on conventional piston made of Al Alloy A2681. Secondly analysis is performed on Piston made of Al- GHY1250 and Al-GHS1300. The material used for the design of Piston should have light weight, low cost, structurally and thermally withstand at very high pressure and temperature condition that will occur in the combustion process. It has been decided to study a particular Piston design and its capability for maximum gas pressure. In this work, initial planning is to make a system model using solid modelling software Solidworks. It has been mesh the geometry analyze using Ansys. For the analysis of piston input conditions and process of analysis, a high combustion gas pressures will act as mechanical loads and cause major stresses in the critical region of the piston. Detailed static structural and thermal analysis is carried out for various loading conditions like maximum gas pressure load. Comparative study is done to select the best material.*

Keywords: **We would like to encourage you to list your keywords in this section**

1. INTRODUCTION

Piston is one of the most important components in an internal combustion engine which reciprocates within the cylinder. The main function of the piston is to transfer force from gas in the cylinder to the crank shaft through the connecting rod. It is very important to calculate temperature distribution on the piston in order to control thermal stresses and deformation in working condition, Piston produces stresses and deformation due to periodic load effects which produces from high has pressure, high speed reciprocating motion of inertia force. Lateral force by the chemical reaction of burning the gas high pressure generates which makes the piston expand which generates thermal stresses and thermal deformation. The thermal and mechanical deformation causes piston cracks. Swati S. Chougule et. al (2013). Therefore it is very essential to analyze the stress distribution, temperature distribution, heat transfer, mechanical load in order to minimize the stress at different loads on the piston.

ventilation, and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics and heat transfer. "Refrigeration" is sometimes added to the field's abbreviation, as HVAC&R or HVACR or "ventilation" is dropped, as in HACR (as in the designation of HACR-rated circuit breakers).

1.1 Components of piston

Following are the main components of the of the Piston:

Piston Head or crown: it is flat, convex or concave depending on the design of the combustion chamber. It withstands pressure of gas in the cylinder.

Piston rings: It is used to seal the cylinder in order to prevent leakage of gas past the piston.

Skirt: It acts as a bearing for the side thrust of the connecting rod on the walls of the cylinder.

Piston Pin: It is also called a gudgeon pin or wrist pin. It is used to connect the piston to the connecting rod.

Computational Study on the Flexural Properties of E-Glass Fibre Reinforced Composites with Nano-Clay as Filler Material

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Abstract:*Polymers are replacing conventional metals for a variety of applications because of the advantages offered by them. The properties of polymers are modified by using fibres to suit the high strength/high modulus requirements. The high performance of continuous fibre (e.g. carbon fibre, glass fibre) reinforced polymer matrix composites is well known and documented. Epoxy resins are widely used for high-performance applications and are characterized by excellent mechanical and thermal properties, high chemical and corrosion resistance, low shrinkage on curing and the ability to be processed under a variety of condition. With an additional filler material to a polymer can improve not only the stiffness, toughness, hardness, heat distortion temperature, and mould shrinkage, but also reduces the processing cost significantly. This work has been a great need in finding the exact mechanical properties of glass fibre reinforced epoxy composites with nano-clay as filler material.*
Keywords: *Nano clay, Filler ,composite material*

1 INTRODUCTION

Composite materials are known to be ideal replacement for traditional engineering materials and their unique properties have made them to find varied applications though prone to damage in terms of structural integrity.
Nanomaterials ,when reinforced with composites finds many applications due to their unique properties as there is significant improvements in fracture toughness and damage tolerance. Nanomaterials available as nanoparticles, nanotubes, and nanolayers have at least one dimension that is less than 100 nm. One of the Polymer based nanocomposites studied widely is the one reinforced with nano-clay.

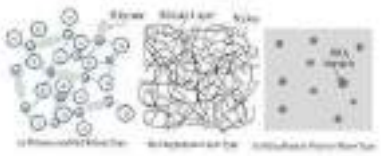

Figure 1: Morphology in Inorganic/Organic Hybrid composite materials

(a) polymer-modified silicate type, (b) clay/polymer layer type (c) silica particle-polymer matrix type.

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REDUCTION OF POLLUTANTS FROM COPPER COATED SPARK IGNITION ENGINE WITH ALCOHOL BLENDED GASOLINE

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ABSTRACT

Exhaust emissions of carbon mono oxide (CO), ub0burnt hydro carbons (HC) emissions and nitrogen oxide (NO_x) levels from spark ignition (SI) engine cause health hazards, environmental impact and green-house effect. Alcohols are important substitutes for gasoline, as their properties are comparable to gasoline fuel. If engine is run with alcohol, aldehydes, which are carcinogenic in nature, are also to be checked. Investigations were carried out to control pollutants from a four─ stroke, variable speed, variable compression ratio, single─ cylinder, spark ignition (SI) engine, with normal butanol blended gasoline (80% gasoline and 20% butanol by volume) and methanol blended gasoline (80% gasoline and 20% methanol by volume) having copper coated combustion chamber [CCE, copper-(thickness, 300 μm) coated on piston crown, inner side of cylinder head and on liner] provided with catalytic converter with copper as catalyst and compared with conventional SI engine (CE) with neat gasoline operation. Exhaust emissions of CO, HC, and NO_x were evaluated at different values of brake mean effective pressure of the engine. A microprocessor-based analyser was used for the measurement of nitrogen oxide levels and CO/HC in the exhaust of the engine. The engine was provided with catalytic converter with copper as catalyst along with air injection. Copper coated combustion chamber with butanol blended gasoline considerably reduced pollutants in comparison with CE with neat gasoline operation. Catalytic converter with air injection significantly reduced pollutants with test fuels on both configurations of the engine.

Keywords: S.I. Engine, copper coated combustion chamber, Alternative fuels, Exhaust Emissions, Catalytic converter, Air injection.

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RESEARCH ARTICLE-MECHANICAL ENGINEERING

Experimental Investigation and Comparative Study of Sintering of Microcrystalline Nickel Using Microwave and Conventional Method

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Abstract
The present work has been conducted to investigate and compare the mass transport mechanism of Ni-powder particles in conventional and microwave sintering process. The linear shrinkage method was used to investigate the mass transport mechanism on the basis of estimated sintering exponent (n) at different temperatures. Both types of sintering were carried out at various temperatures, and the results revealed that microwave sintering provides better results of densification and shrinkage as compared to conventional sintering. Field emission scanning electron microscopy (FESEM) and energy-dispersive X-ray spectroscopy (EDX) analysis were carried out for the characterization of Ni-powder for microstructural and elemental analysis. The value of sintering exponent found through linear shrinkage method for conventional was 9.4791, 8.1836, 6.9013, 7.3286, 5.2006 and 4.9531 at 500 °C–1000 °C, respectively, and microwave sintering was 7.0972, 5.2957,5.2942 and 6.0934 at 500 °C—800 °C, respectively.

Keywords Mass transport · Microwave sintering · Microcrystalline nickel · Densification · Shrinkage · Conventional sintering

1 Introduction

Sintering is a process of agglomeration in which powder particulates are compacted and converted into a solid mass by heating below fusion point in order to achieve strength. There are various types of sintering process which are used in agglomerating the powder particulates such as plasma, laser, radiation, induction, and microwave sintering [1–4]. The microwave heating and radiation heating process are being popularly used for sintering of varieties of powder particulates. Here, microwave sintering is the process in which microwaves are used as a heating source to heat the powder particles to form sintered compact [5]. This microwave sintering process ensured diffusion enhancement, decreased sintering temperature, reduced energy consumption, and reduced processing time [5–11]. Microwaves are coherent and polarized electromagnetic (EM) radiation of which frequency lies between the radio and visible light frequencies in EM spectrum as shown in Fig. 1. Generally, microwaves are used in food processing, textile, communication, wood products, vulcanization of rubbers, and drying the ceramic powders [12–14]. Material processing is one of the recent applications of microwaves [15, 16].

Sintering is a three-stage process. In the initial stage, when the heat is provided, the particles which are in immediate contact with each other start forming small neck. As the sintering proceeds, this small neck enhanced itself as shown in Fig. 2. This stage eventually results in creating a pore inside the specimen. The intermediate stage creates an impact on the densification and on the final properties of the sintered part. This stage corresponds to grain growth, pore rounding and densification. The intersection of three or four grain boundaries results in creating the pores and pores remain interconnected in 3 dimensions in this stage. The final stage of the sintering is a slow process that includes

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3D Printing Technology for Biomedical Practice: A Review

Pankaj Kumar, Dipen Kumar Rajak, Muazu Abubakar, Syed Gazanfar Mustafa Ali, and Manowar Hussain

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3D printing or additive manufacturing is an emerging technique for the fabrications of biomedical components. Several researchers are working on fabrications of the biomedical components, future prospective of implantation, and transplantation aspects. The current review presents a meticulous summary of research work done so far by the researchers in the view of design and fabrications about biomedical components by using 3D printing technology such as fused deposition modeling (FDM), inkjet printing, stereolithography, and selective laser sintering (SLS). The design and fabrications of biomedical components include 3D printing of bone, low-cost high-quality prosthetics, intervertebral disks, medical equipment, heart valve, building tissues using blood vessels and drugs. The objective of this review article is to explore different additive manufacturing processes, challenges, and future developments for 3D printing for biomedical components.

Keywords additive manufacturing, biomedical components, bioprinting, implants, tissue engineering

1. Introduction

Additive manufacturing is a technique where a 3D product is created by adding material in successive layers (as opposed to removing material from a block). It is a material joining process to make objects from 3D model data layer-by-layer. This process is one of the main constituents of industry 4.0 where industrial practices are executes using smart technology Internet of things, cloud computing, cybersecurity, big data analytics, autonomous system, simulation, system integration, etc. (Ref 1). There are various types of additive manufacturing state-of-the-art and techniques in the design and development of various 3D components. In this technique, one can create different components using CAD software and then fabricate the components using 3D printers. Common materials for 3D parts fabrication include polymer, metal, ceramic, composites, functionally graded materials, etc, whereas the form of these materials could be powder, filament, sheet, and liquid. Manufacturing of 3D parts can be carried out through direct energy deposition, powder bed fusion, binder jetting, material extrusion, material jetting, sheet lamination, and vat polymerization. Post-processing of the fabricated parts includes support removal, surface finishing, defects removal, destructive/non-destructive testing. There are many applications of additive manufacturing in the fabrication of 3D-printed products such as tooling components, production parts, biomedical implants, devices, structures, and artificial organs. The key barrier to the implementation of this technology is a lack of awareness about the process, and it fits in the design and development process. Figure 1 shows various constituents of industry 4.0 in which 3D printing is a fabrication method for products with very complex shapes and sizes.

Recently, biomedical applications have been evolved progressively drastically due to the dedications of scientists, medical practitioners, engineers, and researchers around the globe. With continuous development in technology, researchers are making their effort to decrease the cost of the 3D-printed parts and easing the fabrication process. Some of the examples of 3D printing include fabrication of bones, spinal implants, prosthetics, skin, organs, etc. The main objective of this technology is to potentially print replacement body organs to treat a patient's specific defects due to accidents or misshaping. Researchers use laser technology to build complex customized components using different layers of powder of biocompatible materials. Chronic back problems because of the intervertebral disk can be resolved using a spinal implant created on a 3D printer. Nowadays, it becomes possible to treat multiple trauma injuries and braking of the top jaw, nose, cheekbone, and fracture using facial reconstructive surgery. 3D printing can be used to rebuild the patient's face and other body parts. At present, doctors and researchers can develop a new 3D scaffold that regenerates real bones (Ref 2). In this technique, the building of the scaffold happens to be the same materials that build up the bone. This scaffold is bone-friendly and helps in bone healing. Another aspect of the biomedical application of 3D printing is to produce a patient's anatomy as a visual aid for surgical planning. The fabricated physical model gives the surgeon ability to conceptualize the ideal course of action before surgery. Figure 2 represents scaffold and tissue formation surrounding the scaffold.

This review article mainly focused on the research work that has been published on additive manufacturing of 3D biomedical components such as 3D printing of bone, low-cost high-quality prosthetics, intervertebral disks, medical equipment, heart valve, building tissues using blood vessels, and drugs.

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Effect of Number of Passes on Surface Properties of Burnished Aluminium Alloy

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Abstract: Basically, roller burnishing process is one of the surface finishing processes. In this process, a hard and highly polished roller will be pressed against a rotating specimen,thiscauses plastic flow on specimen surface from the peaks of surface irregularities into the valleys, which results in a reduction in the surface roughness considerably. This is a type of cold working whichalso results in improvementof micro-hardness, refinement of microstructure on the surface of the specimen under consideration. This work aims to understand the versatility of roller burnishing processand to understand the effect of the number of burnishing passes to enhance surface properties. Surfaceroughness, electrical conductivityand microhardness were studied in the present work. Experimental work was done on aluminium AA7075- T6 alloy. The parameters under which the burnishing was done were burnishing force, spindle feed and speed and are kept constant in the present work.

Keywords: Roller burnishing, microhardness, surface roughness, AA7075-T6.

1. Introduction

Finishing processes are becoming predominant in the production of machines and instrument components, the burnishing process has fascinated great interest among the engineers and researchers due to the versatility involved in the process.To increase productivity, and to reduce machining times and to sustain competitiveness in the market of machining production systems, it is becoming crucial to improve existing technologies. Burnishing process is one surface finishing technique applied widely to improve surface properties. Many researchers are working in this area and developed analytical models, for studying surface properties. Lars Hiegemannet.al.,[1] conductedvarious experimentson ball burnishing and developed an analytical model which was used to predict the roughness after ball burnishing for a thermally sprayed coating. Kable et.al., [2] examined surface roughness, microhardness on medium carbon steel by changing different parameters like speed, feed andnumber of passes on the drilled hole, by using Taguchi analysis, a significant improvement in hardness was observed i.e., from 377Hv to 528Hv and surface roughness was reduced from 2.44 μm to 0.13 μm. Recently, a newlydesigned ball burnishing tool made of HSS ball of 8mm diameter have been employed on AA6061 using a conventional lathe and process parameters have been optimized using Taguchi method [3]. Many researchers have worked on roller burnishing using lathe on various ferrous and non-ferrous materials [4-9]. In reference [10] roller burnishing is carried on Al_2O_3/A356 composite specimens with varying process parameters, it is clearly evident from this reference that multi passing improves surface roughness and also by this process microhardness and subsurface hardness improves. Even in mild steel roller burnishing increases hardness, Malleswara Rao et.al, [11] has investigated surface hardness by varying process parameters. After the third pass hardness slightly decreased. Surface finish has a positive and longevity effect on the functioning of the machined parts. When compared to permanent metallic alloys, the biodegradable magnesium-calcium (MgCa) alloy proved to be an attractive orthopaedic biomaterial [12]. A correlation was developed between mechanical, structural properties and corrosion resistance of 18-9 stainless steel after burnishing [13]. To improve the

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Optimization of dry sliding wear parameters of Al4Mg system reinforced with high strength alloy particulate (HSAp)

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Abstract: The dry sliding wear behaviour of Al4Mg binary alloy and Al4Mg reinforced with Al20Cu20Mg composites was examined using pin on disc apparatus. The composites were synthesized by the reinforcement of different weight % (5, 10 and 15) of the high strength alloy particulate (HSAp) in the base binary alloy Al4Mg using stir casting technique followed by hot extrusion. In this way, composites were prepared with metal particulate reinforcement which are termed as metal-metal composites which is a novel idea instead of reinforcement of ceramic particulate. These extrudates of non-reinforced base alloy and composites were characterized to optimise dry sliding wear parameters, wear resistance and coefficient of friction under the load conditions of 0.5, 1 and 1.5 kgf at the sliding velocities is of 100, 120 and 140 metre per second and sliding times of 15, 30 and 45 seconds respectively. The wear parameters were optimised using Grey relational analysis (GRA) and ANOVA techniques and obtained the optimal combination of input parameters.

Keywords: High strength alloy particulate (HSAp), metal-metal composites, stir casting, hot extrusion, GRA, ANOVA.

1. Introduction

'Wear' is the property that acts on both ends positive and negative when considered in engineering applications. For anecdotal reasons the wear property intentionally induced or reduced depending on the application. Wear may be because of corrosion, adhesion, and abrasion. Each of these has their own advantages and disadvantages that lead to benefits and troubles depending on the type of application for a particular purpose. The benefits or problems may be influenced by the factors type of material, type of lubrication and amount of surface finish. Among Metal matrix composites (MMCs), Aluminium matrix composites (AMCs) hold more than 69% by weight for industrial functions as they holds excellent mechanical and thermal properties couples with better tribological properties [1-2]. Under dry lubrication conditions, the Aluminium based matrix composites are exhibiting poor wear resistance. These are confined to very limited applications due to this inadequacy [3]. It is examined that the strength of matrix alloy AA7075 was enhanced by 6%, on addition of hybrid particulate (SiC+ Al2O3) [4]. Among the hybrid reinforcement particulates RHA (Rice Husk Ash), Al2O3 and graphite in AA6063, the graphite influenced more on the wear rate. As graphite composition increases from 0% to 1.5% the rate of decreases drastically, as the graphite particulates are soft in nature [5]. The AMMCs with inclusion of hard metallic or ceramic particulates are greatly influenced by wear mechanisms like abrasive and adhesive [6-8]. In the global scenario, due to increasing competition for manufacturability with reduced weight to strength

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Anfis-Based Defect Severity Prediction on a Multi-Stage Gearbox Operating Under Fluctuating Speeds

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Abstract

Previous research investigators have exploited machine-learning algorithms to diagnose the defects in rotating machinery. However, with increasing complexity in the design of rotating machinery, it is quite challenging to quantify the faults precisely. In this present study, an attempt has been made to predict the defect severity of the rotating machinery using Adaptive Neuro-Fuzzy Inference System (ANFIS). This ANFIS algorithm employs artificial neural networks to define the membership functions, rules and weights to construct the fuzzy inference system. Experiments are performed on a multi-stage spur gearbox model while it is subjected to fluctuating operating speeds. Two local defects on bearing race as well as on gear tooth with four different severity levels are seeded intentionally. Three condition monitoring (CM) strategies, namely, vibration, lubrication oil and acoustic signal analyses are executed, and the raw data is recorded synchronously. The raw vibration and acoustic waveforms are decomposed through discrete wavelet transform to extract the descriptive statistics from the wavelet coefficients. Among them, most discriminating features are selected and given as input to ANFIS classification tool to train the network for obtaining the Sugeno-type FIS, which in turn estimates the severity of the component. Later, the features from the individual CM strategies are combined to devise an integrated feature dataset which is further channelled as input to the ANFIS for predicting the defect severity levels. The investigation reveals that, the proposed integrated feature set in conjunction with ANFIS can discriminate between the defect severity conditions of the gears as well as bearings under fluctuating speeds.

Keywords Condition monitoring · Multi-stage gearbox · Fluctuating speeds · Adaptive-neuro fuzzy inference system

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RESEARCH ARTICLE-MECHANICAL ENGINEERING

Detection of Local Gear Tooth Defects on a Multistage Gearbox Operating Under Fluctuating Speeds Using DWT and EMD Analysis

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Abstract
Contemporary fault diagnosis algorithms constitute advanced signal processing techniques integrated with the data-driven feature classification algorithms which make an effective fault diagnosis scheme for rotating machinery such as gearboxes and motors. Feature extraction is a prevalent task which is intended to assist the fault diagnosis process by eliciting a set of condition indicators (features) from the input raw signal. In actual scenario, the gearboxes may have multiple stages and are rather operating under fluctuating speeds. The feature extraction technique employed at medium and high ranges of operating speed may not be adequate during low operating speeds. In this present study, the feature extraction abilities of discrete wavelet transform (DWT) and empirical mode decomposition (EMD) in terms of their relative effectiveness while ascertaining the local gear tooth defects of a multistage gearbox are compared. Two local gear tooth defects, namely root crack and tooth chip with three severity levels, are seeded artificially. The experiments are carried out on a three-stage spur gearbox experiencing fluctuating operating speeds. Vibration analysis is performed, and the recorded raw vibration signatures are decomposed using DWT and EMD analyses separately. Mother wavelet selection is done using the criteria of *energy-to-Shannon entropy ratio*. The identification of intrinsic mode functions (IMFs) is made by examining the Pearson correlation coefficient. Various descriptive statistics are obtained from the wavelet coefficients and IMFs and the potential indices among them are chosen by implementing the decision tree algorithm. Finally, support vector machine (SVM) algorithm is executed to distinguish among the various defect severity levels. It has been observed that the SVM in conjunction with DWT has resulted in better classification than SVM in conjunction with EMD.

Keywords Multistage gearbox · Vibration analysis · Fault diagnosis · DWT · EMD

1 Introduction

Gearboxes are essential components in the transmission of torque/power and have prolific applications such as in helicopters, wind turbines, mining machinery and conveyors. The gearbox is rated as one of the most critical components because it is having the longest downtime among the other subsystems in machinery [1]. The gearbox failures are reported quite often as it is subjected to fluctuating loads and speeds. They act as the fundamental sources of vibration because of the discrete shifting of the load resulting from meshing of teeth. Gear failures are classified as lumped/local defects and distributed defects. Tooth breakage and root crack are lumped defects, whereas misalignment and eccentricity are the examples of distributed defects [2]. It was reported that the spectrum corresponding to lumped defects contains the side bands across the entire spectrum [3]. However, the spectrum pertaining to distributed defects shows peaks having high energy contribution at gear mesh frequency and its harmonics. These defects have to be diagnosed at the nascent levels, which otherwise may protrude to fatal failures.

Condition monitoring (CM) is intended to identify the defect of a system and it is also capable enough to predict the defect from its symptoms. Condition monitoring has three stages: (a) data collection—acquisition of data which describes the condition of the component; (b) signal processing extraction and interpretation of diagnostic information from the acquired data; and (c) decision making—diagnosing the fault and estimating the remaining lifetime of the

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Heat Transfer Analysis of Gas Turbine Blade by Varying Number of Cooling Holes and at Suitable Coolant Speeds Using CFD

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Keywords:
turbine blade, internal cooling, cooling holes, Nusselt number, heat transfer coefficient, CFD simulation, FLUENT 14.5

ABSTRACT

In the present work, heat transfer analysis of a gas turbine blade consisting of 5, 7, and 10 holes, coolant flowing with suitable velocities 40 m/s, 75 m/s, and 110 m/s. From the results of several investigations, the suitable velocity ranges of coolant fluid have been taken. The coolant fluid used in this work is air, as it is suitable for aircraft engines working on open cycle gas turbines, and of course, it is cheaply available, and the blade material used is Inconel 718. Simulations are carried out using Computational Fluid Dynamics (CFD) software, ANSYS FLUENT 14.5. An analysis is being done on how the temperature is varying in blade with different configurations. Temperature distribution in the blade is studied and variation of different parameters like velocity, Nusselt number, heat transfer coefficient is observed. It is found that the blade cooling is maximum in the case of a blade with 10 holes and coolant inlet velocity 110 m/s. The average Nusselt number with the coolant inlet velocity of 40 m/s, 75 m/s, and 110 m/s is around 11, 19, and 21, respectively. The lowest temperature attained by the blade on the coolant inlet surface is 1152 K and the coolant exit surface is 1334 K. These two temperatures are observed when the blade has 10 cooling holes and coolant inlet velocity is 110 m/s.

1. INTRODUCTION

A turbine is a rotating component that uses a fluid action to produce work. In a gas turbine, compressed, high-temperature gas is the conductor. In power generation and marine applications, it is often referred to as a power turbine. For aviation purposes, it is referred to as a gas generator. One of the reasons why gas-powered engines are used to power aircraft is that they are lightweight and compact and have a high degree of power to weight ratio. The distinctness between gas turbine blades and rocket nozzles is the wall curvature. Turbine blade walls are curved in the stream-wise direction, and rocket nozzles walls can be curved in both stream-wise and span-wise directions [1]. Gas turbines are used extensively for aircraft propulsion, land-based power generation, and industrial applications. One of the critical areas of gas turbine engines is the blade tip region, concerning durability and cooling air use [2].

2. PROBLEM STATEMENT AND METHODOLOGY

The higher operating temperatures of hydroelectric power are used to increase the power as well efficiency of a gas turbine. The motivation behind this is that higher temperature gases yield higher energy potential. As a result of the rotation, the local heat transfers in turbine blade internal cooling passages are different from those of stationary channels [3]. However, the components and the gas system meet the high thermal load, which can cause damage [4]. HPT (High-Pressure Turbine) blade is one of the components continuously exposed to hot gas. Turbine blades are operated at temperatures between 1200°C to 1500°C [5]. This temperature is far beyond the melting point of current materials technology. Hot gases from the combustor enter the turbine increasing heat load on the turbine components. The flow field becomes more complex when the turbine is rotating and there are differences between the high and low-pressure walls [6]. One of the components more prone to thermal failure is the blade tip region due to its intense environment and difficulty in cooling [7]. The heat transferred to the blades in the turbine depends on the turbine inlet temperature and is directly proportional [8]. Turbine blades are required to work for a longer period operating at temperatures above their melting point.

Various cooling techniques are used to reduce the ambient temperature of the blade below the melting point [9]. The way to provide acceptable cooling of the blade tips is to extract some cooling air from various coolant passages, to protect the tip surface from the hot leakage gas [10]. The performance of cooling holes placed along the pressure side tip was good for a small tip gap when compared to a large tip gap [11]. An overall benefit to the tip obtained by releasing coolant from the pressure side holes [12]. Film cooling effectiveness for the coolant injection from both tip and pressure side holes case was higher potential due to the pressure side injected coolant-carrying over the tip surface [13]. Rib arrays inside an internal cooling channel are often used in heat exchanger systems to improve the heat transfer rate [14]. Heat transfer data in internal coolant channels with film cooling extraction is important to the design of a cooling system [15]. Internal

Multi carrier IPD-PWM Technique for Three Phase Diode Clamped and Cascaded H-Bridge Multilevel Inverters

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Abstract: *Power quality plays an important role in the transmission and distribution of electrical power. Power quality is highly interrupted due to the increase in power demand and its consumption. Therefore to address this problem of power quality, popular device- Multilevel Inverters have come in to existence and are much used for medium and high power applications. The three main multilevel inverter topologies are Neutral Point Clamped, Flying Capacitor and Cascaded H Bridge. The aim of this paper is to develop a Multi carrier In phase Disposition Pulse Width Modulation technique (IPD-PWM) for Three Phase Diode Clamped and Cascaded H-Bridge Multilevel Inverters using MATLAB Simulink. In this paper, Total Harmonic Distortion (THD) is performed for 3 level Neutral Point Diode Clamped and 5 level Cascaded H-Bridge Inverters using MATLAB Simulink. THD calculations are done using Multi carrier IPD-PWM as they possess less switching losses compared to other control schemes. The THD calculations carried out in this paper shows how the reduction of THD increases the efficiency of inverter as the level of inverter increases. FFT analysis is presented to calculate THD for the Inverters of concern.*

Keywords: **Neutral Point Clamped Inverter, Cascaded H-bridge Inverter, level shift modulation, IPD-PWM, THD**

1. INTRODUCTION:

The carrier-based modulation schemes that are used for multilevel inverters are phase-shifted and level-shifted modulations [1]. The level-shifted multicarrier modulation scheme requires $(k-1)$ triangular carrier signals having the same frequency and amplitude for a k-level inverter [2-3]. Different PWM techniques, such as In Phase Disposition (IPD), Phase Opposition Disposition (POD), and Alternate Phase Opposition Disposition (APOD), are used to evaluate the inverter's performance (APOD). This control methods or carrier signals are used for a comparative investigation of pulse width modulation approaches for various multilevel inverters in order to improve performance and reduce harmonic content [4-9].

These carrier signals are vertically disposed so that they occupy continuous bands. The frequency modulation index and the amplitude modulation index is given as

$$m_f = \frac{f_{cr}}{f_m}$$

$$m_a = \frac{\hat{v_m}}{\hat{v_{cr}}(m-1)} \text{ For } 0 \leq m_a \leq 1$$

Where

V_m = maximum amplitude of modulating wave

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Article

Solid-State Transformers: Fundamentals, Topologies, Applications, and Future Challenges

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Abstract: Solid-state transformers (SSTs) have emerged as a superior alternative to conventional transformers and are regarded as the building block of the future smart grid. They incorporate power electronics circuitry and high-frequency operation, which allows high controllability and enables bi-directional power flow, overcoming the limitations of conventional transformers. This paper presents a detailed analysis of the solid-state transformer, expounding the fundamentals, converter topologies, applications, and future challenges of the SST in a systematic manner. The paper discusses the necessity of improved replacement of the low-frequency transformers (LFTs) and presents the configuration of SST. It presents SST fundamentals in individual stages and explores its origin and evolution. The basic topologies, their specifications, and control strategies are also described. The applications of SST as a replacement of LFTs are discussed along with recent applications. The future challenges for real-time implementation of SSTs are explored, and research directions are proposed.

Keywords: solid-state transformer (SST); low-frequency transformer (LFT); power electronic converters; future smart distribution grid; SST topologies; renewable energy sources

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1. Introduction

Transformers are the most vital component of the power system, as they play an essential role in the transmission and distribution of electrical power [1]. Being the fundamental components of the power distribution system, the conventional transformers were researched extensively and hence were developed to be cost-effective, exceptionally reliable, and highly efficient. Although they are fairly advantageous, they still have certain drawbacks, including power loss and temperature rise due to harmonics, poor voltage regulation under load, inadequate protection from abnormal currents, over-voltages, and overload. In addition to this, inadequate protection of the transformer from internal faults caused by breakdowns or arising from the core, the reflection of various unwanted input characteristics like voltage dip on the output side, and arduous efforts for the integration of renewable energy sources are of great concern. Along with having a large size and being bulky, the traditional transformers also lack adequate controllability and have an adverse impact on the environment due to excessive usage of transformer oil [2], which has contributed to the looming energy crisis we are facing around the globe.

To enable the power-grid for fulfilling the growing technological requirements such as integration with distributed renewable energy resources (DRER), distributed generation sources (DG), and distributed energy storage devices (DESD); charging techniques for electric vehicles (EVs), etc., the limitations of conventional transformers must be eliminated.

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Review

Review of the Estimation Methods of Energy Consumption for Battery Electric Buses

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Abstract: In the transportation sector, electric battery bus (EBB) deployment is considered to be a potential solution to reduce global warming because no greenhouse gas (GHG) emissions are directly produced by EBBs. In addition to the required charging infrastructure, estimating the energy consumption of buses has become a crucial precondition for the deployment and planning of electric bus fleets. Policy and decision-makers may not have the specific tools needed to estimate the energy consumption of a particular bus network. Therefore, many state-of-the-art studies have proposed models to determine the energy demand of electric buses. However, these studies have not critically reviewed, classified and discussed the challenges of the approaches that are applied to estimate EBBs' energy demands. Thus, this manuscript provides a detailed review of the forecasting models used to estimate the energy consumption of EBBs. Furthermore, this work fills the gap by classifying the models for estimating EBBs' energy consumption into small-town depot and big-city depot networks. In brief, this review explains and discusses the models and formulations of networks associated with well-to-wheel (WTW) assessment, which can determine the total energy demand of a bus network. This work also reviews a survey of the most recent optimization methods that could be applied to achieve the optimal pattern parameters of EBB fleet systems, such as the bus battery capacity, charger rated power and the total number of installed chargers in the charging station. This paper highlights the issues and challenges, such as the impact of external factors, replicating real-world data, big data analytics, validity index, and bus routes' topography, with recommendations on each issue. Also, the paper proposes a generic framework based on optimization algorithms, namely, artificial neural network (ANN) and particle swarm optimization (PSO), which will be significant for future development in implementing new energy consumption estimation approaches. Finally, the main findings of this manuscript further our understanding of the determinants that contribute to managing the energy demand of EBBs networks.

Keywords: battery electric buses; well-to-wheel (WTW) model; energy consumption forecast; transportation networks; data analysis

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1. Introduction

In the last few decades, environmental pollution, global warming, depletion of fossil fuels, increasing fuel costs, and growing consumer expectations have led automobile

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An Enriched RPCO-BCNN Mechanisms for Attack Detection and Classification in SCADA Systems

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ABSTRACT Providing security to the Supervisory Control and Data Acquisition (SCADA) systems is one of the demanding and crucial tasks in recent days, due to the different types of attacks on the network. For this purpose, there are different types of attack detection and classification methodologies have been developed in the conventional works. But it limits with the issues like high complexity in design, misclassification results, increased error rate, and reduced detection efficiency. In order to solve these issues, this paper aims to develop an advanced machine learning models for improving the SCADA security. This work comprises the stages of preprocessing, clustering, feature selection, and classification. At first, the Markov Chain Clustering (MCC) model is implemented to cluster the network data by normalizing the feature values. Then, the Rapid Probabilistic Correlated Optimization (RPCO) mechanism is employed to select the optimal features by computing the matching score and likelihood of particles. Finally, the Block Correlated Neural Network (BCNN) technique is employed to classify the predicted label, where the relevancy score is computed by using the kernel function with the feature points. During experimentation, there are different performance indicators have been used to validate the results of proposed attack detection mechanisms. Also, the obtained results are compared with the RPCO-BCNN mechanism for proving the superiority of the proposed attack detection system.

INDEX TERMS Supervisory control and data acquisition (SCADA), Markov chain clustering (MCC), preprocessing, security, rapid probabilistic correlated optimization (RPCO), block correlated neural network (BCNN) and attack detection.

I. INTRODUCTION

In the recent days, the Supervisory Control and Data Acquisition (SCADA) [1], [2] is one of the widely used control systems in the industrial sectors like traffic maintenance, electric power generation, nuclear systems, water/waste water treatment oil mining, and space stations. It is highly important to secure the SCADA systems against the attacking activities of malfunctioning and threatening [3]–[5]. The present SCADA systems comprise certain security features (such as user interfaces, communication, and control logic), which helps to increase the system complexity, but maintaining those features is one the critical task [6]. Moreover, controlling the large amount of data in SCADA systems is highly difficult due to the data loss availability, which makes the architecture is more vulnerable to the attackers. The general communication structure [7] of SCADA systems is depicted in Fig 1, which contains the components of master station unit, sub-control unit, Programmable Logic Controller (PLC), Remote Terminal Unit (RTU) and Intelligent End Device (IED).

Typically, the attack detection [8]–[10] in SCADA network or mining system is performed based on the dynamic update of data obtained from the network database. In the traditional works, there are different optimization and classification methods [11]–[13] have been developed for attach prediction in SCADA systems. Also, the matching prediction

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A robust parameter estimation approach based on stochastic fractal search optimization algorithm applied to solar PV parameters

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ABSTRACT

Modeling of solar photovoltaic (PV) cell/modules to estimate its parameters with the measured current–voltage (I–V) values is a very important issue for the control, optimization, and effectiveness of the PV systems. Therefore, in this research work, a robust approach based on Stochastic Fractal Search (SFS) optimization algorithm is introduced to estimate accurate and reliable values of solar PV parameters for its precise modeling. To assess the excellence of the proposed SFS algorithm, different solar PV equivalent circuit models, i.e. single-diode model (SDM), double-diode model (DDM), and PV module model are taken into consideration. The introduced algorithm is examined under three different case studies; (i) first case study: an experimental standard dataset of a commercial R.T.C. France silicon solar cell working at 33 °C, and solar radiance of 1000 W/m^2; (ii) second case study: using a polycrystalline solar panel STP6 120/36 with 36 cells in series working at 22 °C, and (iii) third case study: an experimental dataset of ESP-160 PPW PV module working at 45 °C, this experimentation were carried out in the Laboratory of Renewable Energy at Assiut University, Egypt. The results obtained using the proposed method are compared with other recently published works, and hence, the achieved results show the superiority, perfectness, and effective modeling concerning various performance parameters. Thereby, the proposed SFS approach can be used for effective PV modeling to improve the efficiency of the PV system.

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1. Introduction

The reduction of global warming is a great challenge these days to build a sustainable environment. Reduction or complete elimination of fossil fuel usage and turning into renewable energy sources are the key factors to overcome global warming (Charfi et al., 2018). Renewable energy includes solar, wind, tidal, biomass, wave, and geothermal energies. Among the different accessible sustainable power sources, solar PV energy is the one cleanest, plenty available, can use maximum days in a year, and low running/maintenance costs for the implementation (Vinod et al., 2018). However, the solar PV system depends on the environmental aspects, *i.e.,* ambient temperature, solar radiance, the efficiency of solar PV panels may reduce (Bawazir and Cetin, 2020). Therefore, to achieve a better level of efficiency, the accurate modeling of solar PV is necessary and it is a well-known fact that any systems outcome completely depends on its effective modeling. With this observation, the modeling of solar PV has attained high interest by researchers and industrial experts. While the modeling of solar PV parameters is a challenging task due to its non-linear characteristics. After performing rigorous research, the authors identified various techniques for the effective modeling of solar PV.

To model an effective solar PV, the mathematical modeling of solar PV has been introduced. These models have been mainly classified into three types that are single-diode model (SDM), double-diode model (DDM), and three diode model (TDM). These three models have been evolved based on their structure of the circuit, the involvement of parameters, and application. Among these models, SDM has been a widely used model due to its simplicity in structure and involvement of fewer parameters. However, to overcome the drawback of SDM by considering the recombination losses, DDM has been introduced by adding an additional diode to SDM (Rezk et al., 2019a; Messaoud, 2020).

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Review

Electric Buses in Malaysia: Policies, Innovations, Technologies and Life Cycle Evaluations

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Abstract: A large-scale adoption of electric buses (EBs) is a promising solution to mitigate greenhouse gas emissions from the transportation sector. In the upcoming decades, the development of EB technologies will be initiated worldwide, including in Malaysia. Government policies to support EB deployments have been widely established. Therefore, Malaysia's National Automotive Policy has stated a roadmap of policies to promote a national groundwork accordingly. Following the elaboration of Malaysia's goals for EBs deployments by 2014 and 2020, there are crucial associated topics for EBs implementation, including EB innovations and technologies adoption. This study presents a deep discussion about the groundwork of EB innovations that have been initiated in Malaysia to meet the roadmap targets. This paper also comprehensively reviews the technical specifications of EB innovation technologies, including Electric Bus Innovation Malaysia, Malaysia Automotive Institute, and Go Auto prototypes. In addition, this study outlines the EB technologies that have been launched in three states in Malaysia, known as Putrajaya, Melaka, and Sarawak. Furthermore, a generic framework for life cycle assessments of EB is presented, focusing on the economic and environmental impacts. This framework provides the necessary groundwork for further studies on charging infrastructure requirements.

Keywords: electric bus technologies; greenhouse gas emissions; energy demand; life cycle assessments; electric bus deployments in Malaysia

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1. Introduction

With industrial activities and power and heat generation, the transport sector is considered one of the significant energy-demanding sectors globally. In 2015, International Energy Agency (IEA) reported that the worldwide transport sector consumed around 31,310 TWh of the total energy demand, which approximately represented 14% of global greenhouse gas (GHG) emissions [1,2]. In 2010, Malaysia's transportation accounted for 40% of total energy use and 22.9% of Malaysia's GHG emissions. To meet Malaysia's

energies

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Review

Induction Heating in Domestic Cooking and Industrial Melting Applications: A Systematic Review on Modelling, Converter Topologies and Control Schemes

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Abstract: In the current scenario, power electronic device-based induction heating (IH) technologies are widely employed in domestic cooking, industrial melting and medical applications. These IH applications are designed using different converter topologies, modulation and control techniques. This review article mainly focuses on the modelling of half-bridge series resonant inverter, electrical and thermal model of IH load. This review also analyses the performance of the converter topologies based on the power conversion stages, switching frequency, power rating, power density, control range, modulation techniques, load handling capacity and efficiency. Moreover, this paper provides insight into the future of IH application, with respect to the adaptation of wide band-gap power semiconductor materials, multi-output topologies, variable-frequency control schemes with minimum losses and filters designed to improve source-side power factor. With the identified research gap in the literature, an attempt has also been made to develop a new hybrid modulation technique, to achieve a wide range of power control with high efficiency. A 100 W full-bridge inverter prototype is realised both in simulation and hardware, with various modulation schemes using a PIC16F877A microcontroller. The results are compared with existing techniques and the comparisons reveal that the proposed scheme is highly viable and effective for the rendered applications.

Keywords: induction heating; power control; domestic application; industrial application; medical application

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1. Introduction

New-era residential induction heating appliances pave the way for the replacement of conventional electrical and gas heating technologies. IH systems have inherent advantages, such as higher conversion efficiency, being cleaner and having a lower time constant in attaining heat [1]. The predominant source for heating, cooking and electric power generation applications is natural gas [2,3], which is a fossil fuel, which in turn aggravates looming global warming. On the other hand, IH incurs clean energy disposal with higher efficiency [4,5]. Compared to conventional heating techniques such as resistive heating, flame heating or arc furnaces, IH is more appropriate for industrial applications since it is more effective and efficient [6–9]. More importantly, the inherent safe and convection methodologies in IH are very conducive for many medical applications [10–14]. The portability, plug and play aspects of IH-aided gadgets mean it is in high demand regarding household applications [15–17].

The operating principle of IH is demonstrated through a diagrammatic representation shown in Figure 1. Here, a high-frequency alternating current (HFAC) is supplied to the

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Impact of Uneven Shading by Neighboring Buildings and Clouds on the Conventional and Hybrid Configurations of Roof-Top PV Arrays

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ABSTRACT Partial shading is the commonly encountered scenario of building roof-top based PV arrays that mainly occur due to the shadow of the neighbouring buildings and clouds resulting in unexpected losses and deteriorated system performance. The arrays are connected in various configurations to enhance the system performance during shading. In this paper, various conventional and hybrid interconnection configurations based on series-parallel (SP), bridge-linked (BL), and total cross tied (TCT) topologies of the roof-top PV arrays are examined under various partial shading scenarios caused by the neighbouring building and clouds. The investigation is done for a 9×9 roof-top array in MATLAB/Simulink environment considering various comparison parameters. It has been found that during 1.23%, 7.40%, 11.11%, 17.75%, 18.51%%, 22.22%, and 24.69% of total array shading, SP generated the maximum power whereas, during 30.86%, 61.72% shading, TCT has the generated only a slightly higher power as compared to SP. Hence, the study concludes that the configurations have a puny effect on the power generation of the arrays during uneven shading patterns caused by buildings and clouds.

INDEX TERMS Array configurations, mismatch loss, partial shading, photovoltaic, power generation, and roof-top PV system.

LIST OF ABBREVIATIONS

PV	Photovoltaic.
SP	Series-Parallel.
BL	Bridge-Linked.
TCT	Total Cross Tied.
SP-SP	Series Parallel-Series Parallel.
SP-BL	Series Parallel-Bridge Linked.
SP-TCT	Series Parallel-Total Cross Tied.
BL-SP	Bridge Linked-Series Parallel.
BL-BL	Bridge Linked- Bridge Linked.
BL-TCT	Bridge Linked-Total Cross Tied.
TCT-SP	Total Cross Tied-Series Parallel.
TCT-BL	Total Cross Tied-Bridge Linked.
TCT-TCT	Total Cross Tied-Total Cross Tied.
P∼V	Power∼Voltage.
STC	Standard Testing Condition.
G	Solar Irradiance.
$\mathbf{G_{STC}}$	Solar Irradiance at STC.
D	Diode.
$\mathbf{I_{Ph}}$	Photo-generated Current.
$\mathbf{I_O}$	Diode Current.
k	Boltzmann Constant.
T	Module Temperature.
q	Electron charge.
$\mathbf{K_I}$	Short-circuit current temperature co-efficient.
MPP	Maximum Power Point.
MPPT	Maximum Power Point Tracking.
$\mathbf{P_M}$	Power at MPP.

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Innovation in Electrical Power Engineering, Communication, and Computing Technology pp 197–208

Bypass Diodes Configurations for Mismatch Losses Mitigation in Solar PV Modules

Priya Ranjan Satpathy, Pritam Bhowmik, Thanikanti Sudhakar Babu, Renu Sharma & Chiranjit Sain

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Abstract

Partial shading among the photovoltaic modules is the most commonly observed scenario that can permanently damage the modules by creating mismatch among cells, hotspot, and unexpected losses in the system. Basically, modules are provided with bypass diodes for prevention from destructive effect of the hotspot. Bypass diodes configuration plays a crucial role in the operation and performance of the modules during shading. In this paper, the sensitivity of PV modules with no bypass diode,

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A New Alternate Method to Reuse Rehashed Edible Oil for the Betterment of Society - Dual Benefit Approach in Photovoltaic Modules

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ABSTRACT The Photovoltaic (PV) cell converts a portion of incident irradiation of visible wavelength into electricity and the remaining into heat, thereby decreasing the electrical efficiency. Hence, it is necessary to transfer the heat generated in the module by a cooling medium, thereby maintaining the operating temperature within the operating limit. This study discusses the feasibility of cooling the monocrystalline and polycrystalline modules by using rehashed edible oil (coconut oil, sesame oil, and peanut oil) with an integrated oil tank attached to the backside of the module. This study has used the environmentally friendly rehashed edible oil as a coolant, which can be used as an alternate to the toxic mineral oil. Hence, this study can prevent the consumption of reused edible oil along with the food, which causes harmful effects on human health. The rehashed edible oil flows from the storage tank through the backside of the module and is collected in another storage tank, which can be reused. Also, the performance of the monocrystalline and polycrystalline modules under different rehashed edible oil shows a significant reduction in module temperature and improvement in the efficiency of the module. The performance of the peanut oil is found to be superior in improving the performance by 14.0 % and 16.8 % on monocrystalline and polycrystalline modules respectively.

INDEX TERMS Module temperature, rehashed edible oil, environmental friendly, cooling, output power, efficiency.

NOMENCLATURE

P_m	Maximum power.
V_{mp}	Voltage at maximum power.
I_{mp}	Current at maximum power.
V_{oc}	Open circuit voltage.
I_{sc}	Short circuit current.

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I. INTRODUCTION

The incident irradiation of visible wavelength ranges from 400 nm to 1200 nm is absorbed by the PV cells and converted into electricity [1]. The incident solar irradiation outside the visible range is converted into heat, thereby increasing the operating temperature of the module. The commercial efficiency of the monocrystalline module is 11-17%, compared to a laboratory efficiency of 24% [2]. Ortega *et al.* [3] have observed that the average efficiency of the monocrystalline

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A reliable approach for modeling the photovoltaic system under partial shading conditions using three diode model and hybrid marine predators-slime mould algorithm

Dalia Yousri [a], Ahmed Fathy [b, c], Hegazy Rezk [d, e], Thanikanti Sudhakar Babu [f], Mohamed R. Berber [g]

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Abstract

In this article, the triple diode model (TDM) is studied for modeling the Canadian-Solar-CS6P-240P poly-crystalline PV module, Kyocera Solar KC200GT multi-crystalline PV module, Sharp NU-(Q250W2) mono-crystalline PV module, and Pythagoras Solar Large PVGU Window mono-crystalline PV module. A novel hybrid algorithm of the marine predator's algorithm (MPA) and slime mould algorithm (SMA) (HMPA) is proposed to enhance the MPA exploitation phase while identifying the TDM parameters. The HMPA results are compared to several recent algorithms that are equilibrium optimizer (EO), manta ray foraging optimization (MRFO), transient search optimization (TSO), jellyfish optimizer (JS), and forensic-based optimizer (FBI), besides the basic versions of MPA and SMA. For unbiased comparison, several statistical analyses and non-parametric tests are applied. The convergence curves are used to evaluate the convergence property of the proposed algorithm compared to their counterparts. The HMPA confirms its efficiency in handling the complex multi-modal and multi-dimensional optimization process of identifying the TDM parameters. HMPA provides the least root mean square error (RMSE) between the measured and estimated datasets with the least standard deviation (STD). For Canadian Solar (CS6P-240P) module, the proposed HMPA achieves the minimum RMSE of 0.00037313 with STD of 0.0030488; for Kyocera Solar (KC200GT) module, HMPA attains RMSE ± STD of 0.0033042± 0.0061813. For SharpNU-(Q250W2) PV module and Pythagoras Solar Large PVGU Window, HMPA outperforms the other counterparts with RMSEs ± STDs of 0.00027661± 0.0053002 and 0.00285± 0.0020075, respectively. Accordingly, the HMPA provides the slightest deviation between the estimated datasets and the experimental ones with high consistency over several independent runs. The convergence curves of the proposed HMPA affirm its fast response while handling the optimization problem of TDM. The reliability of the identified parameters is tested to emulate the PV modules' characteristics at different irradiation levels. Furthermore, the robustness of the identified parameters is examined for integrated systems of series string and series–parallel arrays under partial shading conditions. The PV solar modules/strings/arrays characteristics confirm the accuracy of the identified parameters as the attained main points on the characteristics are defined with high quality.

Previous Next

Keywords

Triple diode model; Photovoltaic; Parameters estimation; Marine predators algorithm; Slime mould algorithm

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RESEARCH ARTICLE

Sensor angle-based control strategy and dynamic analysis of a sinusoidal pulse width modulation-operated permanent magnet synchronous machine drive for electric propulsion unit

Chiranjit Sain, Atanu Banerjee, Pabitra Kumar Biswas, Sudhakar Babu Thanikanti ✉, Chitti Babu Baladhanautham

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Power Enhancement in Partial Shaded Photovoltaic System Using Spiral Pattern Array Configuration Scheme

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ABSTRACT Partial shading causes mismatch losses in the solar PV system. In the PV array, the power output from the healthy PV modules is gone in vain due to the mismatch losses. The PV array construction with the high resistivity to the mismatch loss generation is the progressing research work in the research field. In this work, a new kind of array configuration scheme is framed for the PV system for overcoming the effect of partial shading. The proposed array configuration has a high resistivity to the mismatch loss generation over the other conventional array configuration methods. The array configuration is framed in a pattern that is similar to the spiral step pattern. Each row of the PV array is constructed with the PV modules from each row of the conventional Total Cross Tied configuration with the optimized distance. This row construction allows the system to uniformly disperses the partial shading over the PV array. The simulation analysis is carried out by applying various shading patterns in MATLAB/Simulink®. The performance of the proposed array configuration is also analyzed in the experimental setup and the results were presented.

INDEX TERMS Array configuration, mismatch loss, maximum power point (MPP), partial shading, PV array reconfiguration, total cross tied (TCT), spiral pattern, sudoku pattern.

I. INTRODUCTION

Photovoltaic (PV) system accelerates its development in the global energy market in recent years because of its eco-friendly characteristics, reliability, and renewability.

Population growth and the depletion of fossil fuels paves the way for utilizing non-conventional energy resources for the world's energy demand. The feasibility of solar energy attracts the energy market for utilizing it. The solar photovoltaic (PV) system is firstly introduced in 1954 by the Bells Laboratory in the United States. The first PV cell is fabricated with the impurities of silicon which directly converts the sunlight into electricity by the photovoltaic effect. The efficiency of the first PV cell is around 4% that is developed to 24% in recent years by various researches [1]–[8]. There are various factors such as partial shading, hotspots, diode failure, etc., were affecting the efficiency of the solar PV system. Partial shading is the most common issue in the PV system which cannot be predicted and avoided. This partial shading causes mismatch losses in the PV system, which vainer the power generation of unshaded healthy PV modules [9]–[14]. Many research works approach the various ways of mitigating the consequences of partial shading. Earlier the bypass diode method is been introduced in [13], [15], [16] which extracts the power output of the unshaded healthy cells at the load terminal by bypassing the faulted or shaded or mismatch loss

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Scenario-Based Investigation on the Effect of Partial Shading Condition Patterns for Different Static Solar Photovoltaic Array Configurations

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ABSTRACT This paper presents an in-depth analysis and investigation on the performance of static photovoltaic (PV) array configurations subjected to various partial shading conditions (PSCs). Under PSCs, the electrical characteristics of the PV modules are critically monitored and reasons for their behavioral changes are highlighted. By doing so, this study aims to improve the efficiency of PV systems by minimizing mismatch losses and determining the optimum array configuration which is characterized by the highest maximum power and lowest relative losses under PSCs. Besides, this study complements and carries forward the previous studies through the detailed analysis of each configuration subjected to various practically probable PSCs. Three different PV array sizes (5 × 4, 5 × 5, and 3 × 10) are used to analyze the results and performance under considered shading scenarios. MATLAB/Simulink platform is used to model and simulate the PV array using the single diode (5-parameters) model. In-depth analysis of current flow across cross-ties and bypass diodes activation shows that the diagonal shading pattern leads to lower power loss (PL). Besides, the Total Cross-Tied (TCT) configuration demonstrates superior performance under most of the PSCs compared to other configurations. These results provide valuable information about the performance of PV array which may lead to better estimation and prediction of global maximum power (GMP) generation of a PV system.

INDEX TERMS Single diode solar cell model, photovoltaic array, PV reconfiguration schemes, total cross tied configuration, performance of static photovoltaic array, partial shading conditions, energy loss.

I. INTRODUCTION

Over the last decades, power generation has shifted heavily towards renewable sources due to environmental concerns and the increasing efficiency of renewable technologies. PV systems have offered good results and have been largely integrated into the power networks of many countries. Development and improvements in semiconductor technology have further boosted the popularity of PV systems as a reliable renewable source. Researchers have targeted other

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Single Source Multi-Frequency AC-AC Converter for Induction Cooking Applications

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Abstract: In recent years, induction heating (IH) applications aided by electronic power control have gained significance. Particularly, for cooking applications, an appropriate control technique is required to feed power from a single source to multiple loads with minimum switching losses. Additionally, when multiple loads are used, it requires independent control and operation for each of the loads. The main idea of this work is to develop a single-stage AC-AC converter topology to feed power to multiple loads independently with a single source, with a reduced number of switching devices and with minimum switching losses. The proposed topology uses a frequency bifurcation concept to feed power to multiple loads by placing the transmitting coil and work coil at a distance of 3 cm. The source is resonated at a 25 kHz switching frequency, with the designed bifurcated frequencies of 20 kHz and 33 kHz. The resonant capacitors are appropriately chosen to operate at those frequencies. For real-time applications, simultaneous and independent power control are inevitable in multi load-fed IH applications. This is achieved through a pulse density modulation scheme with minimum switching losses. The simulation of the proposed system is performed in MATLAB/Simulink, and also the 1 kW system is validated using a PIC16F877A microcontroller. The real-time thermal variation in the load is also recorded using a FLIR thermal imager. The experimental and simulation results are observed, and the obtained efficiency of the system is plotted for various duty cycles of pulse density modulation control.

Keywords: frequency bifurcation; induction heating; independent power control; pulse density modulation; single source multi-frequency

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1. Introduction

In the new era, domestic Induction Heating applications are replacing the traditional electric and gas heating technology. The induction heating system has the inherent benefits of higher conversion efficiency with a lower time constant to achieve the required cleaner heating. Based on the IH application, it requires a high bandwidth inverter ranging from 20 kHz to 100 kHz. A typical IH system has a very high-power handling capacity of up to 500 kW [1,2]. In two-power conversion, commercial 50 Hz AC is rectified, filtered, and converted into High-Frequency AC (HFAC). This results in more power losses, and further, the bulky capacitor increases the system time constant with a lesser source side power factor [3,4]. Thus, a selective harmonic elimination control technique is used to improve the source side power factor [5].

Various converter topologies, such as class E, class D, and full-bridge inverter fed topologies, were proposed in [6,7] and various power control techniques were used to

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Different Control Mechanisms of a PMSM Drive for Electrified Transportation—A Survey

Chiranjit Sain, Atanu Banerjee, Pabitra Kumar Biswas, Sudhakar Babu Thanikanti & Karthik Balasubramanian

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449 Accesses

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Abstract

With the availability of permanent magnet materials, the concept of modern industrial electronics with some integrated signal processing applications Permanent Magnet Synchronous Motor Drive (PMSM) is an essential competitor in the area of electrified transportation. It offers numerous approaches to PMSM control techniques, inclusive of manipulating strategies primarily based on sensible

energies

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Review

A Comprehensive Survey on Different Control Strategies and Applications of Active Power Filters for Power Quality Improvement

Soumya Ranjan Das [1], Prakash Kumar Ray [2], Arun Kumar Sahoo [3], Somula Ramasubbareddy [4], Thanikanti Sudhakar Babu [5,*], Nallapaneni Manoj Kumar [6,*], Rajvikram Madurai Elavarasan [7] and Lucian Mihet-Popa [8,*]

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Abstract: Power quality (PQ) has become an important topic in today's power system scenario. PQ issues are raised not only in normal three-phase systems but also with the incorporation of different distributed generations (DGs), including renewable energy sources, storage systems, and other systems like diesel generators, fuel cells, etc. The prevalence of these issues comes from the non-linear features and rapid changing of power electronics devices, such as switch-mode converters for adjustable speed drives and diode or thyristor rectifiers. The wide use of these fast switching devices in the utility system leads to an increase in disturbances associated with harmonics and reactive power. The occurrence of PQ disturbances in turn creates several unwanted effects on the utility system. Therefore, many researchers are working on the enhancement of PQ using different custom power devices (CPDs). In this work, the authors highlight the significance of the PQ in the utility network, its effect, and its solution, using different CPDs, such as passive, active, and hybrid filters. Further, the authors point out several compensation strategies, including reference signal generation and gating signal strategies. In addition, this paper also presents the role of the active power filter (APF) in different DG systems. Some technical and economic considerations and future developments are also discussed in this literature. For easy reference, a volume of journals of more than 140 publications on this particular subject is reported. The effectiveness of this research work will boost researchers' ability to select proper control methodology and compensation strategy for various applications of APFs for improving PQ.

Keywords: active power filters; harmonics; power quality; current controlling techniques; custom power devices

1. Introduction

Improvement in PQ has now become an essential task for researchers and engineers working in the utility network [1]. With the advancements in power electronics technology [2], it has become easier to balance PQ within the capacity of the IEEE standard. If the quality of power is poor, it may cause several hazards, such as the unwanted process of the

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L-Shape Propagated Array Configuration With Dynamic Reconfiguration Algorithm for Enhancing Energy Conversion Rate of Partial Shaded Photovoltaic Systems

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ABSTRACT Partial shading is an unavoidable factor that reduces the performance of solar PV systems. The PV system receives uneven irradiation due to partial shading which causes the mismatch loss. The partial shading distracts the irradiation from the PV modules that makes the healthy modules as idle or low performing modules. The mismatch loss can be mitigated by uniformly distributing the partial shading over the PV array. In this work, L-shaped propagated array configuration method with a new dynamic reconfiguration algorithm have proposed for enhancing the energy conversion under the partial shading conditions. A new kind of array configuration is implemented in a 4×4 PV array for the better shade dispersion. Further, a dynamic reconfiguration algorithm is employed to disperse the effect of partial shading. The combination of new array configuration and reconfiguration method is simulated in MATLAB/Simulink®and implemented in hardware. The outputs are measured under all possible shading patterns and validated with the outputs of convention methods for observing the enhanced energy conversion rate of the proposed system.

INDEX TERMS Array configuration, futoshiki puzzle pattern, mismatch loss, partial shading, PV array reconfiguration, total cross tied (TCT), sudoku pattern.

I. INTRODUCTION

Photovoltaic (PV) system accelerates its development in the global energy market in recent years because of its eco-friendly characteristics, reliability and renewability [1], [2]. Many countries prefer the solar PV plant for future energy demand. The structure of a PV cell is made with the bonding of n-type and p-type semiconductors with a PN-junction. The energy of photons in the sunlight breaks the bonding electrons in n-type and makes it flow to the load by through the p-type. The amount of free electrons liberated by the photons is the actual amount of current generated by the PV cell [3]. Some environmental factors like partial shading due to clouds, shadows of nearby objects, dust accumulation, dropping of birds, etc., will distract the rate of incident photons, which directly reduces current generation [4], [5]. The partial shading distributes non-uniform irradiation over the PV array which causes the mismatch losses. The power generation by the un-shaded PV cell will not be available at the load because of the shaded PV cells is the effect of

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Power Losses Reduction of Solar PV Systems Under Partial Shading Conditions Using Re-Allocation of PV Module-Fixed Electrical Connections

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ABSTRACT The paper gives a review of the investigation, which is being imported under different shading scenarios on the solar photovoltaic (PV) array arrangements. Under non-uniform irradiations, the authors pursue voluminous interpretation to scrutinize the mismatch power losses (PL) in PV array systems. In addition to power, the partial shading also reveals non-linearity along with multiple maximum power points (MPP) on performance curves *i.e.* power-voltage (P-V) and current-voltage (I-V). The inspection of the optimal layout of PV modules during the study helps us to extract maximum power and reduce the number of power peaks, when arranged in an array under partial shading conditions (PSCs). In the vicinity of PV array configurations such as series-parallel (SP), honey-comb (HC), bridge-link (BL), total cross-tied (TCT), and hybrid series-parallel-Total cross-tied (SP-TCT), bridge link-honey comb (BL-HC), and bridge link-total cross-tied (BL-TCT) are considered to investigate the performance under shadowing conditions. Moreover, Latin square (LS) puzzle is introduced to reconfigure the PV array and extensive comprehensive comparison with conventional is presented and entitled as "LS-TCT" configuration. The MATLAB/Simulink environment helps in modelling all the considered PV array configurations. The recommended LS-TCT configuration is turned out to be superior (for MATLAB/Simulink study) among all configurations during PSCs in terms of location of global maximum power point (GMPP), minimized PL and improved fill factor (FF). To show the superiority of proposed Shape-do-Ku (SPDK) puzzle based configuration, an experimental comparison is shown with conventional TCT and LS-TCT, Su-do-Ku (SDK) puzzle based configurations under new shading pattern-4. In addition, presented experimental study is validated the results obtained during MATLAB/Simulink study.

INDEX TERMS Solar energy, photovoltaic system, shading effect, maximum power, and shade dispersion.

I. INTRODUCTION

In this era, when the repository of fossil fuels is a deficit and limitedly constrained, the rejuvenated analyst needs to explore productive renewable energy (RE) sources. In the framework of the optimum availability of bio-fuel cell energy, wind turbines, and PV systems are emerging RE sources of energy without denying the fact that they have their own limitations towards environmental aspects [1].

PV technology confronts enormous issues due to numerous known and un-acquainted causes' e.g. mal-function and climatic contaminants. In the modern consequence,

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Empowering smart grid: A comprehensive review of energy storage technology and application with renewable energy integration

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Highlights

- Review of energy storage type.
- Energy storage technology to support power grid operation.
- Energy storage services for renewable energy support.
- Energy storage framework for renewable energy integration.
- Challenges and future prospect of energy storage technology.

Abstract

The rapid growth in the usage and development of renewable energy sources in the present day electrical grid mandates the exploitation of energy storage technologies to eradicate the dissimilarities of intermittent power. The energy storage technologies provide support by stabilizing the power production and energy demand. This is achieved by storing excessive or unused energy and supplying to the grid or customers whenever it is required. Further, in future electric grid, energy storage systems can be treated as the main electricity sources. Researchers and industrial experts have worked on various energy storage technologies by integrating different renewable energy resources into energy storage systems. Due to the wide range of developments in energy storage technologies, in this article, authors have considered various types of energy storage technologies, namely battery, thermochemical, thermal, pumped energy storage, compressed air, hydrogen, chemical, magnetic energy storage, and a few others. These energy storage technologies were critically reviewed; categorized and comparative studies have been performed to understand each energy storage system's features, limitations, and advantages. Further, different energy storage system frameworks have been suggested based on its application. Therefore, this paper acts as a guide to the new researchers who work in energy storage technologies. The future scope suggests that researchers shall develop innovative energy storage systems to face challenges in power system networks, to maintain reliability and power quality, as well as to meet the energy demand.

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Proceedings of International Conference on Communication and Computational Technologies pp 301–316

Optimal Combined-Coordination of Overcurrent and Distance Relays Using Jaya Algorithm

Saptarshi Roy, P. Suresh Babu & N. V. Phanendra Babu

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Part of the Algorithms for Intelligent Systems book series (AIS)

Abstract

The overcurrent relay in combination of distance relay is the best strategy for the high voltage transmission lines protection in the inter-connected power systems. Therefore, they should be operated in a coordinated manner with a definite time interval so that the total damage that occur during the failure of primary, be reduced. This paper suggests an approach for obtaining the Time Multiplier Settings for these overcurrent relays using eight intelligent

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Comparison of Analytical and Software Based Design of Energy Efficient Induction Motor

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Abstract: ***Energy Efficient Induction motor is playing a vital role in current scenario. Due to rising electrical energy demand, increased awareness of global warming, and rising fossil fuel prices, energy efficiency has become increasingly important. Apart from adding capacity, the only practical approach to deal with this situation is to make optimal use of the available energy, which may be done by using energy efficient Motors. The main objective of this paper is to calculate and Compare the Analytical and Electromagnetic Software based design for a 5HP Energy Efficient Motor.***
Keywords: Energy Efficient Motors, Analytical Method, Design, Induction Motor

I. INTRODUCTION

The most common motors found in industry are three-phase induction motors. They have been widely employed in industry in almost all applications because to their simple, durable, and easy to maintain structure. These engines are known as the industry's workhorses. Induction motors are frequently employed in industrial and domestic appliances [1]. In recent decades, both producers and end-users have become increasingly concerned about the energy efficiency of electric motors. New approaches to improve the efficiency of three-phase induction motors have been developed, and other technological solutions are emerging that could lead to even higher efficiency levels. Even though energy saving has been the most important factor in the design of general-purpose industrial motors, this was not done at the price of durability or overall motor performance. Some people believe that the drive for more efficiency would reduce motor life, and that the higher flux densities may cause application issues with the starting current [2]. The ever-increasing interest in high-efficiency motors can be attributed to two key factors nowadays. Electric motors are a large consumer of electricity. The first is the necessity of addressing ever-increasing energy demand by significantly reducing energy use in order to reduce Carbon dioxide emissions. The second benefit is the cost savings that come with using high-efficiency motors [3]. Over the life of the motor, a small increase in efficiency can save a lot of energy and money. Because Energy Efficient Motors have been demonstrated to be a durable and reliable technology [4].

II. BACKGROUND

There is a clear link between motor life and the challenges that it faces. The desired motor performance and lifespan will usually be attained as long as these stresses are suitably accommodated and controlled within stated design and operation limits [5]. The first significant lines of energy efficient motors were produced in the mid-1970s for the designated product range, with projected penetration of less than 20% of the entire population purchased during this period prior to the Energy Act of 1992.

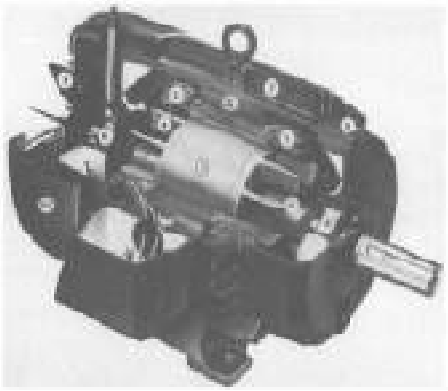

Fig. 1.Cross-sectional view of Electric Energy Efficient Motor : 1-Stator laminated steel; 2-stator windings; 3-rotor; 4-rotor fan blades; 5-shaft; 6-bearings; 7-frame; 8-brackets; 9- external fan; 10-fan cover. (Source: Reliance Electric Company.)

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MULTI-MOTOR CONDITION MONITORING SYSTEM USING IoT

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Abstract

As per the present scenario, the main reason for the improper functioning of the vehicles is due to failure of the working condition of motor. Malfunctioning of the bearings is the main cause for the failure of motor which cause temperature to exceed motor predetermined level and vibration. The main objective of the paper is implementation of the wireless IoT that can be applied for multi-motor system. The design and testing of prototype Arduino UNO module will be carried out to acquire information related to motor's temperature and vibration required for multi-motor parameters. The experimental results will reveal that IoT system is capable of capturing and reporting vital motor's parameter to cloud server and an automatic operation will take place when fault is detected. Thus, with the help of IoT technology, the maintenance of multi-motor system can be effectively and remotely planned with rich data collection and analysis.

Keywords: *Wireless IoT, Arduino UNO, Cloud server, Condition monitoring and Motor.*

1. Introduction

In the evolution of electrical technology, the dc motors were widely used for different industrial applications. After the invention of ac motors especially ac induction motors the view of industry become changed due to the wide advantage of induction motors. The different faults occur in induction motors are:

Electrical-related faults: The electrical faults may occur due to the following factors such as unbalanced 3phase supply, over voltage, over loading

Mechanical-related faults: The mechanical fault may occur due to rotor bar broken, air gap eccentricity, damage in bearing, rotor and stator winding failure. According to the survey done by Institution of Electrical and Electronic Engineer (IEEE) 44% of motor's faults are from bearing and 24% are from stator[2].

The performance of the induction motor depends upon the above electrical and mechanical parameters. So, the continuous monitoring of induction motor is needed for safe and reliable operation of industrial induction motors. The electrical and environmental parameters such as voltage, current, temperature and surrounding humidity of the motor, affects the good performance of motor. And also, the mechanical factors such as vibration and abnormal speed affect the good performance of the motor. Some electrical and mechanical factors cause the severe damage to the health of induction motor and also cause severe problem to application where the induction motor is used. Hence, to prevent the motor's abnormalities there is still need for the development of the continuous monitoring of the system as to improve reliabilities and effective operation with an early warning with instant notification. Vibration and temperature are the two parameters that is well studied and widely accepted in detecting motor's failures.

Assessment and Evaluation of Professional Skills in Engineering Education

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Abstract: In the 21st century, professional skills have emerged as important attributes of a graduate engineer and employers consider these skills as essential for an onboarding engineer. These skills are difficult to assess through our conventional examination system. To overcome this difficulty Rubrics with good resolution can be introduced. To assess the professional skills in courses like labs, seminars, projects etc. Rubrics are the way of explicitly stating the expectations for student performance. They provide a description of what is expected at each level of performance, a common "language" to help faculty and students talk about expected learning and a powerful tool for assessment and grading of student work. Rubrics increases reliability of the assessment when using multiple rates. This papers focus on the design and development of rubrics for project and seminar courses in engineering education.

Key words: Rubrics, professional skills, project, seminar and lab.

I. Introduction:

In the 21st century, professional skills(also known as soft skills, generic skills or transferable skills have emerged as important attributes of a graduate engineer. Studies show that Industry/ employer's around the world value these abilities more than the disciplinary knowledge. This is also reflected in the NBA graduate attributes wherein six out of twelve attributes [1] belong to this category, viz. (1) Communication, (2) team work, (3) understanding ethics and professionalism, (4) understanding global and societal contexts, (5) lifelong learning, and (6) knowledge of contemporary issues. Further higher -order abilities like critical thinking, problem solving and making informed decisions are also crucial for a graduate to succeed in the emerging word. Though the employers consider these professional skills and higher abilities as important, students are week in them. The main challenge surrounding them is they are difficult to assess through existing conventional examination system.