# Performance of hybrid composites laminates under various loads

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**Abstract:** polyester-based composites and made up with three types of textures, E-glass, basalt, and carbon, were created by Hand-Lay Up (HLU) method at room temperature, with different fiber setup. Monotonic mechanical properties of mixture composites cover, for example, the pliable, flexural, between laminer shear strength and effect strength were examined. The powerful reaction of mixture covers composite under beat load was concentrated hypothetically and tentatively. In the hypothetical part, the legitimacy of the hypothetical model for assessing normal frequencies, mode shapes and dynamic reaction of cross breed composite covers at different marking succession has been analyzed by using of the limited component programming (ANSYS). In the exploratory part, the reaction of half breed composite examples with different sorts of fiber setup and four kinds of limit obsessions was estimated by hammer test strategy "recurrence reaction capability" (FRF).

The results show that the reinforcement by adding the basalt fabric and carbon fabric based unsaturated polyester composites as a fiber configuration $[2C/B/2C]_S$ enhanced the mechanical properties of the hybrid composite laminates among other various stacking sequences. For the stacking sequence $[2C/B/2C]_S$, it was found that the largest values of tensile, flexural strength and interlaminar shear strength (ILSS) were 128.76 MPa, 405 MPa, 20.25 MPa, respectively. The results show the good bonding adhesion at the  interface between the fibers and matrix of the hybrid composite laminates. The impact properties with stacking sequences [C-C-G-C-C]s have the largest value at 3.73 Joule as compared with the other composites and stacking sequences of all hybrid composite laminates. Also, the BFRP composites specimen gives the best vibration resistance compared to the other stacking sequences of hybrid composite laminates. The comparison between experimental and numerical model shows the efficiency of the proposed mathematical model of the composite structural specimen with bonded joints.

**Keywords:** Hybrid composite laminates, Carbon fiber, Hand-Lay Up (HLU) technique, Frequency response function (FRF), Bonded joint.

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# Optimization and Analysis of Solar Light Trap for Supervising The Pest Population

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## ABSTRACT

Traditional light snares are generally utilized in the field to oversee major coleopteran and lepidopteran bug vermin of date palm. A sun based fueled bug light snare was planned, created, and assessed to further develop catching productivity. Three light sources with various frequencies were tried; in particular bright (UV-A) dark light fluorescent cylinders (BLF) with 350-400 nm frequency, white minimized glaring light (CFL) with 400-500 nm frequency, and light-emanating diode bulb (LED) comprised of various frequencies of 633 nm Red, 585 nm Yellow, 560 nm Pure Green, and 470 nm Blue. Moreover, two snare levels in particular 155 cm and 195 cm were likewise remembered for tests as variables influencing the light snare productivity. The overall catch of bugs by the three light sources was utilized to assess the presentation of the planned snare. BLF tubes, pulled in additional bugs than CFL and LED bulbs. There was no tremendous contrast in fascination rate between LED bulbs and CFL bulbs for Lepidoptera and frond drill; be that as it may, LED

*Key words:* *Solar-powered, Light trap, Black light, Date palm pests*

## INTRODUCTION

Solar energy is one of the most promising renewable energy resources. It is one of the fastest growing industries worldwide with high reliability of production technologies (Hajian, 2013). Arab countries belong to the sun-belt countries with 3000-4000 h/y of highest average of annual sunshine hours and 2000-2200 kWh/$m^2$ y of average annual irradiation rates (Al-Sakaf, 1998). Photovoltaic are solar cells that directly produce solar energy from sunlight in areas where electricity is unavailable (Duffie and Beckman, 2006). Solar energy is sufficient, to meet all demands of energy for agricultural uses including products drying, irrigation, and provision of power for pest management through light trapping (Chedid and Chaaban, 2003).

Different insect species exhibit behavioral periodicities during the 24 hours of the day and accordingly, they are called diurnal (day active species), nocturnal (night insects), and crepuscular which are active during twilight (Schmoller, 1971).

# A Critical Review on Ceramic Composites with Nano Technology

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**ABSTRACT:** artistic network composites also known as Ceramic composites (CMCs) are immensely loved materials for tenders with testing mechanical and warm prerequisites. Notwithstanding the way that earthenware lattices frequently present fragile way of behaving, CMCs have been created to accomplish semi flexible break conduct and keep up with any remaining benefits of solid pottery at high temperatures. For example, CMCs can be developed areas of strength for as metals, yet they are bounteous lighter and can endure a lot higher temperatures. These benefits prompted their application in auto and aeronautic design. Artistic network composites (CMCs) are propitious materials for use in high temperature underlying applications. This class of materials offers high solidarity to thickness proportions. Likewise, their higher temperature ability over traditional super amalgams might take into account parts that require practically zero cooling. This advantage can prompt more straightforward part plans and weight reserve funds. These materials can likewise contribute in developing the working effectiveness because of higher working temperatures being accomplished. Utilizing carbon/carbon composites with the assistance of Nanotechnology is more helpful in primary designing and can diminish the creation cost. They can endure high anxieties and temperatures than the customary alumina, silicon carbide which break effectively under mechanical burdens Fundamental work in handling, portrayal and examination is significant before the primary properties of this new class of Nano composites can be upgraded. The creation of such composites involving Nano innovation can make an upheaval in the field of material science designing and can make the composites ready to be utilized in lengthy durable applications.
**KEYWORDS:** ceramic, composite, nano composite, CMC.

## I. INTRODUCTION

As we know that Composite materials are the type of materials that are shaped by combining two or more materials of different physical and chemical properties. The material formed has totally different characteristics from the separate materials. Ceramic materials in general have high strength and can withstand very high temperatures.

Also their chemical inertness and low density increases their application in many fields like in aerospace shuttle designing, material casting, etc. But they are prone to failure in case of thermal shock and are easily damaged during fabrication or service. Therefore, it is necessary now to make these composites overcome this problem.

Particles with different shapes such as spherical, uneven and faceted are commonly used during the processing of CMCs. The schematic of morphology of the different particulate reinforcements is shown in Figure 1.

# Performance of radial drilling machine parameters in processing of glass fiber epoxy composite

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A B S T R A C T

Network breaking, fiber harm, expanded opening surface harshness, delamination, circularity, and warm decay, in addition to other things, all happen all through the boring system, decreasing opening quality. The most unsettling of the negative impacts is delamination. Delamination can be diminished and opening qual-ity improved by utilizing the ideal cutting boundaries and boring tool type. While penetrating glass fiber/nano rock powder built up epoxy composites, the impact of bore covering material, bore speed, and boring tool feed rate on surface quality is explored. The Taguchi L9 rotationally symmetric exhibit is utilized to foster the tests. Accordingly, to agree spiral penetrating boundaries of the interaction and reaction boundaries, the measurable investigation of the trial results is finished utilizing ANOVA. The consequences of the tests show that, high shaft speeds and a bronze oxide covered bore produce better opening quality and are likewise the main elements impacting the penetrated opening quality.

Keywords: Glass fibre/nano granite powder compositesRadial drilling machine
Drilling process parametersOptimization

## 1. Introduction

The aerospace, automotive, and machine tool industries all use glass fibre reinforced polymer (GFRP). Durability, less weight, increased specific strength specific modulus, resistance to chemicals and corrosion are just a few of the advantages [1]. Aerospace, defence, automobiles, and transportation are just a few of the industries that use GFRP composites. High specific stiffness/ strength, superior resistance to corrosion, high fatigue strength, construction of light weight, thermal conductivity is low, charabil-ity, and chemical inertness and microbial infections are just a few of the benefits of GFRP composites [2]. Due to its superior features, such as low weight, high modulus, high specific strength, and strong corrosion resistance, glass fibre reinforced polymer composites have become broadly used in many industries in recent years

[3]. The widespread use of GFRP composites in industries like aerospace, defence, automobiles, construction, and railways has increased demand for precision machining processes and complicated fabrication methods. Polymer-based composites have had a considerable impact in the aerospace, defence, and automotive industries [4]. In a range of industries, GFRP composite materials are becoming more common. They are employed in industrial industries such as aerospace, aeroplanes, vehicles, sporting goods because of their qualities such as high specific strength, high specific modulus of elasticity, light weight, corrosion resistance, and so on [5]. FRP composites are displacing traditional materials in a range of disciplines and applications due to their enticing features [6]. GFRP composites are becoming more popular in a variety of fields. The composite in question is made from chopped E-glass fibreandisophthalic polyester resin, and it's intended for use in the marine environment [7]. In recent years, GFRP composite materials have grown in popularity in a variety of engineering applications, including automobiles, aerospace, spaceships, and maritime vessels [8], due to their unique properties. Due to their

# Mechanical property performance of Marble (Caco3) 21x Filled C25600 Alloy For Boiler Application

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**Abstract**- In our present study the fabrication of marble (CaCo3) filled copper based alloy C93200 composites is focused with the aid of liquid metal stir casting techniques at different weight percentages (0wt%, 1.5wt%, 3wt%, 4.5 wt% and 6wt% of marble).unreinforced C93200 matrix alloy sample is also prepared to compare with fabricated composites. The microhardness, tension test and 3 point bending test followed by void fraction of fabricated composites are also evaluated and compared with unreinforced C93200 base matrix alloy. During the experiment it is observed that tensile strength, flexural strength and hardness of C93200-Marble composites increases (but the toughness of composites was adversely affected) as weight % of Marble particles increases up to certain limit then decreases. Also it is seen that the void fraction of fabricated composites decreases from 0.785% to 0.497% for 0wt% to 4.5wt% of marble ($CaCO_3$). Similarly the hardness value of marble filled C93200 copper based alloy composites initially increases from 115.49 Hv to 128.97 Hv for 0wt% to 4.5wt% of marble but on further addition of marble particulates (6wt%) the hardness value decreases to 121.51 Hv.

**Keywords**: Bearing material, C93200, Marble, MMCs, Stir casting, mechanical properties.

## I. INTRODUCTION

For the last several decades, there has been conspicuous interest in the fabrication and use of copper based metal matrix composites. However very limited literatures exist on copper based metal matrix composites for bearing applications. The most common materials used for bearing are Brass, Bronze and white metal, in addition to these bearing material aluminium and zinc based alloy are also used as a bearing material. The materials which are used for bearing should have high compressive strength, good fatigue strength, good corrosion resistance, minimum coefficient of friction, minimum thermal expansion, and excellent in thermal conductivity. In addition to these properties bearing materials should also have enough hard. One of the most important property is high strength to weight ratio that should posses the bearing materials and this glamorous property may be achieve by developing the MMCs.

Tin bronze (SnBr) based alloys are generally used for main spindle bearing, machine tool bearing, bearing for cranes, roll neck bearing, roll mill bearing, thrust washer, pump, bushing etc. Generally rolling element bearings are used in high precision machine parts in rotational machine for different area of application [1]. To support the spindle and shaft rolling element bearings are preferred for the conversion of load on an application via rotational motion. Basically rolling element bearings are employed in industries and it generally fails due to malfunction or calamitous failures of machineries which results in machine breakdown [2]. Also rolling element bearings are employed in grinding machine, wind turbine, gearbox, gas turbine and lathe machine [3]. In many tribological fields Bronze based Cu-Sn has been used because of self lubricating, higher strength and good

corrosion resistant properties [5-10]. These types of copper based alloy (Bronzes) have been used in chemical industry, navigation, pivots, spring in electro technology, corrosion resistant gear and crank pivot bearing [10-12]. During fabrication of metal matrix composites the probability of particle segregation, undesirable brittleness phase formation, casting defects, and inconsistent distributions are some common issues. So to overcome these issues powder metallurgy route is preferred [13-15]. According to Gangwar et al. [16] hardness of SiBr composites increases as wt% of CaO increases and void content decreases as wt% of CaO increases up tocertain limit. Authors Yih et al. [17] developed the brass metal matrix composites reinforced with silicon carbide whiskers with the aid of powder metallurgy route and they concluded that hardness and compressive yield strength of composites were improved and thermal expansion of composites was reduced as compared to base alloy. Authors Zhou et al. [18] developed the $MgAl_2O_4$ spinel whiskers reinforced Aluminium MMCs with the aid of powder metallurgy techniques and there results showed that hardness of composites was increased as amount of $MgAl_2o_4$ whiskers increases as compared to unreinforced aluminium base alloy.

The main motive of metal matrix composites is to combine the desirable properties of base metal alloy and reinforcing materials. Some common ceramic material like SiC, Al2O3, MgO, Whiskers and fibre have generally used as reinforcement material to enhance the properties of MMCs [19-22]. The major task in developing the metal matrix composites is the insertion of reinforcing particulate or materials into the base alloy. The desired strength of composites is greatly influenced by interfacial bonding strength between matrix alloy and reinforcing particles.

# Estimating the effect of 5S Implementation in Industrial Department: An Approach of Case Study

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**ABSTRACT :** *5S is a precise procedure utilized by associations comes from five Japanese words; Seiri (sort), Seiton (put together), Seiso (sparkle), Seiketsu (normalize), and Shitsuke (maintain). This framework assists with sorting out a work environment for effectiveness and diminishing squandering and streamline quality and efficiency by means of observing a coordinated climate. It additionally gives valuable visual confirmations to get all the more firm outcomes. There is a genuine requirement for experimental examinations in field of new administration frameworks and their effect on organization's presentation. As significance job of nonstop improvement in the present associations, and absence of adequate proof to show the positive effect of 5S on authoritative execution, this paper expects to decide execution elements and attributes in modern associations and distinguishing the viability of 5S execution on hierarchical execution also. Looking over strategy is utilized and information assortment is finished by dispersing poll among five objective associations which have executed 5S methods. The objective associations are looked over changed ventures and different field of work. The consequences of this exploration got from a similar estimation of hierarchical execution when 5S execution. The outcomes show that 5S is a powerful apparatus for development of authoritative execution, paying little mind to association type, size, its creation or its administration. Subsequently, 5S methods would unequivocally uphold the targets of association to accomplish ceaseless improvement and better execution.* **Keywords:** *5S, performance, total quality management, productivity.*

## I.        INTRODUCTION

### 1.    Background of the Studies

Nowadays in this dynamic and technological world, the secret of surviving for any kind of organization is to be competitive and pioneer in its products or services. One of the main parts of this way to succeed is continuous improvement and increasing the quality of product or service. Usually, this improvement has been achieved through implementation of best practices which are chosen to meet a particular objective. With increasing of the competition in the world, two major challenges are in front of organizations' managers:

Firstly, in this competitive environment, managers have to make the best decisions and choose the best methods to achieve their objectives and not to lose very finite opportunities. Secondly, lack of knowledge is one of the most important problems of managers about familiarity with an appropriate method to successfully improve the performance of organization.  In addition, the quality of performance also is vital to be evaluated and recognized. Such an evaluation can help managers to identify the improvement of performance. 5S is a way to improve the performance and organize the whole system which has been used first time by Japanese. It comes from five Japanese words start with S which is translated into English words to give the best explanation for them.As it will be discussed later, using 5S as a total quality management method is very effective and efficient for improvement of whole organization. It has dramatic impact on safety and environmental issues, lossof resources and many others that this study is going to investigate and prove.

### 2.    Problem Statement

In recent years, researchers and practitioners are paying increasing attention to the phenomenon of new management systems and their impact on company's performance. There is a real need for empirical studies in this field. However, there is lack of knowledge in some improving methods and tools like 5S and the challenge is much greater [1, 2]. The most important problem and the primary reason for this research is lack of sufficient empirical evidence to prove that 5S has a positive impact on organizational performance.

Although some previous researchers are agreed with 5S positive impact on safety [3] and  somebelieves it helps quality of product [4], but some acknowledges 5S as housekeeping [5-8]. Some links 5S with

# A HYBRID GENETIC ALGORITHM FOR JOB SHOP SCHEDULING PROBLEMS

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**ABSTRACT:** An optimization issue known as the Job Shop Scheduling Problem (JSSP) involves allocating the best jobs to resources at specific periods. Many attempts at solving this problem utilising a variety of tools and strategies have been made in recent years. The hybrid genetic algorithm (HGA) for JSSP is presented in this research. The hybrid algorithm combines local search with genetic algorithms (GA). First, a brand-new initialization technique is suggested. It makes use of the modified crossover and mutation operators. Second, the GA result applies local search based on neighbourhood structure. Finally, a set of representative situations from the literature are used to test the approach. The computation outcomes have confirmed the proposed algorithm's efficacy**.**
**KEYWORDS: Genetic algorithm, Job shop scheduling problem, Local search.**

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**1. INTRODUCTION:** Scheduling has become a critical factor in many job shops especially for real-world industrial applications [(1)-(3)]. Finding scheduling to achieve the work in a minimum time and more efficiently is called JSSP. The JSSP can be described in the following way: we are given a set of jobs and a set of machines. Each machine handles, at most, one job at a time. Each job consists of a chain of operations, each of which needs to be processed during an uninterrupted time period of a given length on a given machine. The purpose is to find a schedule, that is, an allocation of the operations to time intervals on the machines, that has a minimum duration required to complete[(4)]. The JSSP is among the hardest combinatorial problems. Not only is it complicated, but it is one of the worst NP-complete class members. In general, scheduling problems are NP; NP stands for non-deterministic polynomial, which means that it is not possible to solve an arbitrary instance in polynomial time. So, the JSSP has garnered attention due to both its practical importance and its solution complexity [(5), (6)].

At present, the method for the JSSP mainly includes two kinds, one of which is exact methods and the other approximation methods. Exact methods, such as branch and bound, linear programming and decomposition methods, guarantee global convergence and have been successful in solving small instances[(7)]. In manufacturing systems, most scheduling problems are very complex in nature and very complicated to be solved by exact methods it becomes increasingly important to explore ways of obtaining better schedules that include priority dispatch, shifting bottleneck approach, local search, and heuristic methods. Recently, number of high-level strategies is used to guide other heuristics, known as meta-heuristics led to better and more appreciated results [(8) -(16)]. Therefore, a number of meta-heuristics were proposed in literature for JSSP such as GA [(17) -(18)], simulated annealing (SA) [(19), (20)],ant colony optimization (ACO) [(21)-(23)],tabu search (TS) [(24),(25)], particle swarm optimization (PSO) [(26),(27)], and Consultant Guided Search algorithm (CGS) [(28)].

One of meta-heuristics methods is the GA. GA inspired by the process of Darwinian evolution, has been recognized as a general search strategy and an optimization method which is often useful for attacking combinational problems. In contrast to other meta-heuristics methods the GA utilizes a population of solutions in its search that is not easy to fall into local minima. GA has been used with increasing frequency to address scheduling problems. In [(29)] Lazár introduced a review of frequent approaches and methods for JSSP which most commonly are used in solving this problem. From this review we can say that GA is an effective metaheuristic to solve combinatorial optimization problems, and has been successfully adopted to solve the JSSP. How to adapt GAs to the JSSPs is very challenging but frustrating. Many efforts have been made in order to give an efficient implementation of GAs to the problem. In [(30)], a new GA is presented to solve the JSSP, while in [(4)] the impact of random initialization on solving the JSSP is addressed and using GA as an optimization technique.

Due to the NP-hard nature of the JSSP, using simple GA to solve the difficult problem may not be more efficient in practice. Much effort in the literature has focused on hybrid methods [(31)-(36)]. Ren and Yupingin [(31)] design some GA operators (mixed selection operator, new crossover operator and mutation operator based on the critical path) and solve JSSP more effectively. In [(32)] Athanasios and Stavros proposed a new hybrid parallel GA

# Chapter 2
# Design of Wrung Order Layout Using Advanced Optimization Techniques with Integrated Variable Batch Scheduling

**K. Mallikarjuna and Y. Hariprasad Reddy**

**Abstract** Universally, specialists and scientists accept that flexibility assumes a elementary play in modern factory segment. Only associated with modest parcel size generation since agility adaptable is an indispensable part to be incorporate into course of action of racks in format plan among the assembling fragment. In view of such conditions, considering NP hard double target issues is, regularly, a lumbering responsibility. In this work, researchers tended to about a populace-based high end search techniques like differential development (DE) and sheep run technique (SRT) for making wrung structure configuration matters in lithe system of manufacturing location. The instigators focused on twofold aim headway connected with fundamental objective is stressed over the versatile slot (FJSP) arranging issue, the accompanying objective focused on wrung order layout matters where expelling the interest of machineries within lead-ins of wrung steps to control rigid transference cost and hoarding working time of employments on machineries. The accomplishment of the estimation (SRT and TS) is crisscross by standard issues. At long last, it is pondered that SRT yields better outcomes at the point on par with TS.

## 2.1 Introduction

In the present situation, mechanized assembling ventures are under prodigious stress which brought about by the increasing expense of vitality, materials, works, capital, and strengthening overall challenge. While these patterns will stay for quite a while, the issue fronting producing today runs much cavernous. By and large, they come

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# Optimization of Process Parameters for EN31 Steel in CNC Milling"

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**Abstract:** It is projected that the Taguchi technique is an excellent method for optimization of various machining parameters as it decreases the number of experiments. Scientists are always producing new materials, and for each new material, we require economical and efficient machining. In the current study, EN-31 steel alloy is end milled using the Taguchi approach in order to reduce surface roughness and improve the milling process parameters. The optimization of specific milling process parameters, including feed rate, depth of cut, and coolant flow, is the subject of this research. Using the L9 (34) orthogonal array, which has four columns that represent four factors and nine rows, various experiments are conducted using the Taguchi orthogonal array, which is constructed with three levels of milling parameters.

**Keywords**: Taguchi Method, Milling Process, Signal to Noise Ratio (S/N), EN-31 material.

## I. INTRODUCTION

The objective of this project work is to find out the set of optimum values for the selected control factors in order to reduce surface roughness using Taguchi's robust design methodology and to develop the prediction models for surface roughness considering the control factors. In the present work, Taguchi method is used to determine the optimum cutting milling parameters more efficiently. Four control factors viz. cutting speed, feed rate, depth of cut and coolant flow are investigated at three different levels. The work piece material used is EN-31 steel alloy. Taguchi method is used to optimize the process parameter i.e. surface roughness using signal-to-noise ratio for milling process of the work piece materials. Experiments are carried out using $L_9$ ($3^4$) orthogonal array.

### 1.1. MILLING PROCESS

Milling is the process of removing extra material from the work piece with a rotating multi-point cutting tool, called milling cutter. The machine tool employed for milling is called milling machine. Milling machines are basically classified as vertical or horizontal. These machines are also classified as knee-type, ram-type, manufacturing or bed type, and

planer-type. Most milling machines have self- contained electric drive motors, coolant systems, variable spindle speeds, and power-operated and table feeds. The three primary factors in any basic milling operation are speed, feed and depth of cut. Other factors such as kind of material and type of tool materials have a large influence, of course, but these three are the ones the operator can change by adjusting the controls, right at the machine.

## COMPUTER NUMERICAL CONTROL

Numerical Control is the automation of machine tools that are operated by precisely programmed commands encoded on a storage medium, as opposed to controlled manually via hand wheels or levers, or mechanically automated via cams alone. Most NC today is computer numerical control (CNC), in which computers play an integral part of the control. In modern CNC systems, end-to-end component design is highly automated using computer-aided design (CAD) and computer-aided manufacturing (CAM) programs. The programs produce a computer file that is interpreted to extract the commands needed to operate a particular machine via a post processor, and then loaded into the CNC machines for production. Since any particular component might require the use of a number of different tools drills, saws, etc., modern machines often combine multiple tools into a single "cell". In other installations, a number of different machines are used with an external controller and human or robotic operators that move the component from machine to machine.

CNC (Computer Numerical Control) is the general term used for a system which controls the functions of a machine tool using coded instructions processed by a computer. The application of CNC to a manual machine allows its operation to become fully automated.

Combining this with the use of a part program enhances the ability of the machine to perform repeat tasks with high degrees of accuracy.

Preparatory functions, called G codes, are used to determine the geometry of tool movements and operating state of the machine controller;

functions such as linear cutting movements, drilling operations and specifying the units of measurement. They are normally programmed at the start of a block. Miscellaneous functions, called M codes, are used by the CNC to command on/off signals to the machine functions. i.e. M03 - spindle forward (CW), M05 – spindle stop, etc. The functions allocated to lower M code numbers are constant in most CNC controls, although the higher M code number functions can vary from one make of controller to the next.

## 1.2. SURFACE ROUGHNESS

# Analysis of Piston of Internal Combustion Engine on Engineering Materials by Using ANSYS

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**Abstract:-** **Pistons play a crucial role in the conversion of energy in IC engines. In comparison to other internal combustion engine components, the piston's functioning state is extremely poor. The investigation and analysis of the piston's stress distribution is the primary goals of this work. This assignment involves the design and study of a piston made of four different materials. For the structural and thermal examination of the piston, materials such as Ti-6Al-4V, aluminium alloy 4032, copper, and aluminium alloy 2024 are used. On the piston head, 13.6 Mpa of pressure and 1500 degrees were applied. Finite Element Analysis is used to perform the structural and thermal analysis while Solid Works is used to design the piston. following the examination of several materials**

## 1.INTRODUCTION

Piston is one of the mechanical component, invented by German scientist Nicholas August Otto in the year 1866. Piston is considered to be one of the most important parts in a reciprocating Engine, reciprocating pumps, gas compressors and pneumatic cylinders, among the other similar mechanisms in which it helps to convert the chemical energy obtained by the combustion of fuel into useful (work) mechanical power. The purpose of the piston is to provide a means of conveying the expansion of gases to the crankshaft via connecting rod, The piston acts as a movable end of the combustion chamber Piston is essentially a cylindrical plug that moves up & down in the cylinder .It is equipped with piston rings to provide a good seal between the cylinder wall.

### 1.1 Objectives of the projectare as follows

☐ To develop structural modeling ofpiston

☐ To develop structural and thermalanalysis of the piston

### 1.2 Major Force Acting OverPiston

☐ Due to explosion of fuel gases
☐ Due to compression of fuel gases
☐ Side wall friction and forces
☐ Thermal load
☐ Inertia force due to high frequencyof reciprocation of piston
☐ Friction and forces at crank pinhole

### 1.3 Functions Of Piston

☐ To reciprocate in the cylinder as a gas tight plug causing suction, Compression , expansion, and exhaust strokes.
☐ To receive the thrust generated by the explosion of the gas in the cylinder and transmit it to the connecting rod.
☐ To form a guide and bearing to the small end of the connecting rod and to take the side thrust due to obliquity of the rod.

### 1.4 Factors Considered For Proper Functioning Of Piston

☐ The piston should have enormous strength and heat resistance properties to withstand gas pressure and inertia forces. They should have minimum weight to minimize the inertia forces.
☐ The material of the piston should have good and quick dissipation of heat from the crown to the rings and bearing area to the cylinder walls. It should form an effective gas and oil seal.
☐ Material of the piston must possess good wearing qualities, so that the piston is able to maintain sufficient surface-hardness unto the operating temperatures.
☐ Piston should have rigid construction to withstand thermal, mechanical distortion and sufficient area to prevent undue wear. It has even expansion under thermal loads so should be free as possible from discontinuities
☐ The Piston Rings must be in good condition to provide maximum sealing during the stroke of the piston. There must be no Leakage between the piston and the walls of the combustion chamber.
☐ Intake and Exhaust valves must close tightly so that there is no loss of compression at these points.
☐ Each piston design must have a provision for returning oil to the oil reservoir and the crankcase. During operation, a significant amount of oil is accumulated in the piston oil ring groove. This oil is returned to the reservoir through piston windows or through a machinedchannel near the piston pin.

## LITERATURE REVIEW

☐ In this paper [1], the coated piston undergone a Von misses test by using ANSYS for load applied on the top. Analysis of the stress distribution was done on various parts of the coated piston for finding the stresses due to the gas pressure and Journal of Engineering and Science Vol. 01, Special Issue 01, July 2016 Copyright @ JES www.jes.ind.in 40 thermal variations. Von misses stress is increased by 16% and deflection is increased after optimization. But all the parameters are well with in design consideration.

☐ Design, Analysis and optimization of piston [2] which is stronger, lighter with minimum cost and with less time. Since the design and weight of the piston influence the engine performance. Analysis of the stress distribution in the various parts of the piston to know the
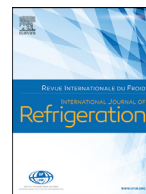
Review

# A critical review on nanorefrigerants: Boiling, condensation and tribological properties

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## ARTICLE INFO

## ABSTRACT

A major amount of domestic energy consumption is spent on refrigeration and space cooling appliances. The performance of the refrigeration system depends on the thermophysical properties of the refrigerant. Altering the properties by additives such as nanoparticles has proven to be an effective solution to improve the performance of the system. This work swivels around flow boiling, pool boiling, tribological and condensation characteristics of nanorefrigerants in Vapour Compression Refrigeration System (VCRS) and Vapour Absorption Refrigeration System (VARS). An evolutionary timeline of nanorefrigerants is presented. Energy savings on compressor work by addition of nanolubricants is discussed. A sum of thirteen refrigerants and twelve nanoparticles in various combinations were encountered during this review process. CNTs performed better than metallic (Al, Cu, Au, Ag) and ceramic ($Al_2O_3$, $TiO_2$, $SiO_2$, ZnO) counterparts. Majority of the work reported enhancement in heat transfer rate and coefficient of performance (COP), however, few studies presented that CuO nanoparticles have shown negative correlation between HF, COP and volume fraction of nanoparticle. The review presents a broad idea on dispersion techniques, stability, properties of boiling and condensation, migration phenomenon of nanoparticles and various novel techniques to improve the performance of the refrigeration systems.

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# Une revue critique des nanofrigorigènes: propriétés d'ébullition, de condensation et tribologiques

## 1. Introduction

Vapour compression refrigeration cycle is the widely used technology for comfort cooling and refrigeration. Refrigerant fluid charged in the system is the blood and heart of the VCRS. Many refrigerants pose a serious danger to the stability of the ozone layer and aids global warming. Phasing out of such refrigerants demands a similar substitute with low GWP and ODP values. Nanoparticles are used as additives to enhance the thermal properties of the basefluid. Nanofluids are being used in various applications these days such as Electronic cooling systems, Nuclear reactors, Surface

engineering, Bio-reactors, Automotive HVAC, Space cooling, Cryogenics, Heat-exchangers so-on and so-forth (Bhattacharyya et al., 2009; Serrano et al., 2009; Abdin et al., 2013; Azmi et al., 2017).

Researchers in the field of nanofluids have shown that introducing dilute concentration of nanoparticles into basefluid presents enormous potential of improving the thermophysical properties of the basefluids (Murshed et al., 2005; Choi and Eastman, 1995; Eastman et al., 1996). From then on, most of the research work is being focused on nanoparticles suspension in the refrigerants. A study showed that the usage of nanorefrigerant-based domestic refrigerators in Malaysia can 10,863 MWh by the year 2030 (Javadi et al., 2013). Celen et al. (2014) extensively reviewed on the thermal performance of nanorefrigerants, whereas, many reviews have been conducted on nanofluid and their thermo-physical

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# investigation on performance of Refrigeration System Designed for Low Temperature

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## ABSTRACT

Refrigerants are the basic working fluids in refrigeration, air conditioning and heat pumping systems. A number of climate-friendly alternatives to CFC/HCFC/ HFC refrigerants are, or will become, available. An evolutionary machine learning hybrid lightning search algorithm-simplex method (LSA-SM) is proposed.

**Keywords**: Linde- Hampson refrigeration system; Vapour absorption refrigeration systems; Hybrid lightning search algorithm-simplex method (LSA-SM); Mat Lab.

## 1. INTRODUCTION

Evolution of fast growing population, urbanization, a need to even out seasonal variations in production,sales, and food industry that needs to produce in locations distant from the consumers are all factors that create a large demand for refrigerated storage space. Hence, refrigeration as a food preservation technology has become an important industry over the last century by Prabha. Refrigeration system's energy consumption and costs are among the most important items on the agenda of future strategy for some industries and a number of commercial sectors, such as food, drink and chemicals. By contrast with these high demands and costs, even a small optimization in the system performance can offer significant cost savings, resulting in increased profits by Palanisamy (2017). Therefore, depending on the system requirements, various configurations can be made in refrigeration systems consideringthe conditions of the environment and energy savings by Bolaji (2014). For instance, somecommercial refrigeration systems use one compressor and multi evaporator because of their ability to meet various refrigerating loads at different temperatures in different zones within the same system, such as large office buildings and hotels, food preservation industries, supermarkets, etc. The rapid industrialization has led tounprecedented growth, development and technological advancement across the globe by Bolaji and Huan (2014). Today, global warmingand ozone layer depletion on the one hand and spiraling oil prices on the other hand have become

main challenges. Excessive use of fossil fuels isleading to their sharp diminution and nuclear energyis not out of harm's way. In the face of imminent energy resource crunch there is need for developing thermal systems which are energy efficient by Sathish (2017).

Evaporating heat transfer is very important in the refrigeration and air-conditioning systems. HFCs such as R134a, R404Al and R407C have dominatedthe replacement of CFCs and HCFCs, mainly because they broadly possess similar chemical, thermodynamic and flammability/toxicity characteristics as well as having been extensively marketed by manufactures by Joudi (2014). However HFCs are more difficult to apply because of poor compatibility with construction materials and in particular mineral oils, which has meant that certain synthetic lubricants, typically polyesters (POEs) and polyalkylglycols (PAGs) have to be used instead. Moreover, they are less tolerant tocontaminants within the system by Sanz (2014). HFCs tend to have low toxicity and are largely non-flammable, although a couple of fluids, such as R32and R152a that are used in several blends are flammable. In terms of environmental impacts, although HFCs have a negligible ODP they do retain the high GWP characteristic of most fluorinated refrigerants, hence the introduction of certain legislation. There are a number of available mixtures that may contain various components including HFCs, HCFCs, HCs, FICs, HFO, and PFCs by Chayhan (2015). These mixtures are generally produced for the purpose of drop-in or retrofit refrigerants. The inclusion of HCFCs or HCs is to provide some solubility with the mineral oils that are used in existing CFC (or) HCFC systems. In other cases, such mixtures are developed to match particular characteristics of a specific refrigerant that it is intended to replace, orto achieve an improvement in cycle efficiency by Kumar (2014). HFC is the mostly widely used alternative refrigerant in refrigeration equipment such as domestic refrigerators and air conditioners. Though the global warming up potential of HFC is relatively high, it is affirmed that it is a long term alternative refrigerants in lots of countries.

Thermal systems like refrigerators and air conditioners consume large amount of electric power. It is essential to developing energy efficient refrigeration and air conditioning systems with nature friendly refrigerants by Jerald (2014).

# Performance of the Portable Robotic Vaccum Cleaner with Remote Control

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*Abstract*—**In this project the proposal concept is to replace the manual work in cleaning by automated system. A vacuum cleaner is a device that uses an axial fan to create a partial vacuum to suck of dirt and dust particles from a given surface. Universal motor is used suction motor across vacuum cleaner. The universal motor is a series DC motor that is specially designed to operate on alternating current (AC) as well as on direct current (DC).The developed robot is disk-shaped, equipped with vacuuming and cleaning technology and controlled by Arduino UNO controller. Where fully charged, it will works continuously for three hours and cleans floor efficiently.The vacuum cleaner absorbed the dust. The dust free place is cleaned by the water. The directions of robotic vacuum cleaner controlled by using Wi-Fi.**

*Index Terms:* **Arduino, HC-05 Bluetooth, Axial fans, cylinder, DC motor, Wi-F,**

## I.INTRODUCTION

Vacuum Cleaner is a device that causes suction in order to remove dirt from floors, and other surfaces. It is generally electrically drivenThe dirt is collected by either a dust bag or a cyclone for later disposal. Vacuum cleaners, which are used in homes as well as in industry, exist in a variety of sizes and models.Axial flow fan allows the vacuum cleaners to suck the dirt and dust from the floor it collects while cleaning the space. And the inhaled dust will be removed from the suction cylinder and decomposed into the dust collectors or dust bins.

## II. WORKING PRINCIPLE

In the robotic vacuum cleaner the axial fan is used to create a negative pressure for creating vacuum in order to suck the dust or dirt on the environmental surfaces. The sucked dirt will be collected in the cylinder of the vacuum cleaner. The collected dirt will be disposed manually into the dust collectors or dust bins.

## III. HARDWARE REQUIREMENTS

1. Arduino UNO board:
The Arduino is a microcontroller board is used for control the robotic vacuum cleaner directions. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogy inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. In this, robot we are using seven analogy input pins and they are 3, 5, 6, 8, 9, 10, 11.
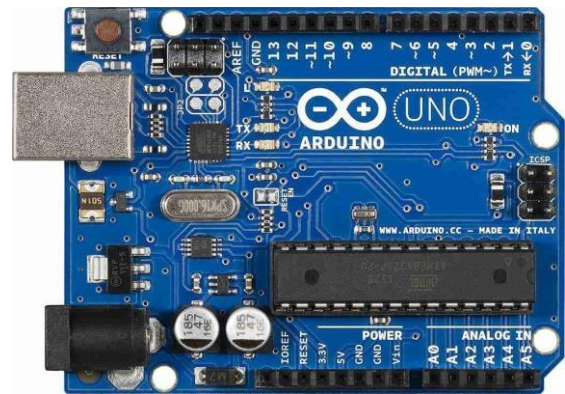


Programme of AURDINO board in Embedded C:
```
String voice;
inti;
void led1_on() {//F
digitalWrite(8, HIGH);
digitalWrite(9, LOW);
digitalWrite(10, HIGH);
digitalWrite(11, LOW);
```
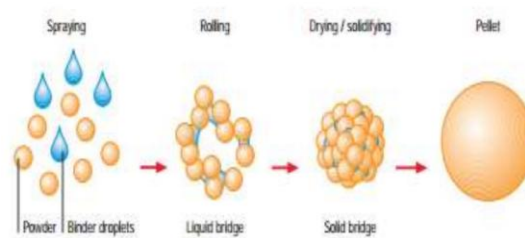
# Fabrication of Granules Making Machine for Agriculture Purpose

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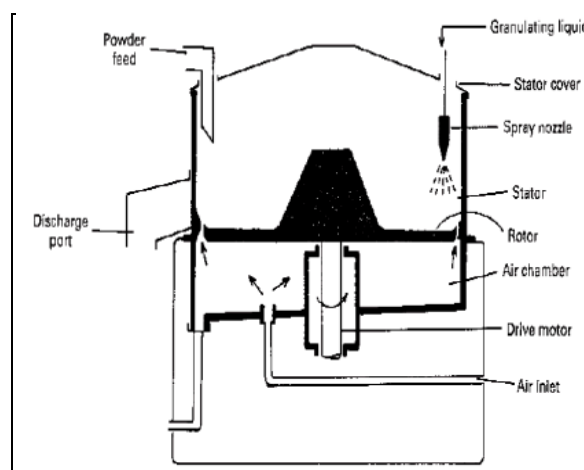
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*Abstract*— **The main objective of this project is to convert the powder fertilizers like(Urea, Calcium Cyanamide, Ammonium Sulphate, etc.) into granules.Granulation is defined as the size enlargement process in which fine and smaller particle are aggregated to form strong and stable particles called granules.Granulation process transforms fine powders into free-flowing, dust-free granules that are easy to compress.Granulation process can be divided into two types: Wet granulation that utilize a liquid in the process and Dry granulation that requires no liquid.In this project we are using Wet granulation technique.**

*Index Terms*—Motor, Drum, Pellete, Stepped Pully, fly Wheel, Drum

## I. INTRODUCTION

Granulation is a process of forming grains or granules from a powdery substance producing a granular material. It is applied in several technological processes in the chemical, agriculture and pharmaceutical industries.The conversion of powder into granules avoids powder segregation, enhances the flow properties of powders, produces uniform mixtures, produces dust free formulations and improves compaction .Granulation involves agglomeration of fine particles into large granules, typically of size range between 2 and 5mm depending upon their requirement. Wet granulation method is a process in which fine powder particles are agglomerated or brought together into larger, strong and relatively permanent structure called granules using a suitable non-toxic granulating fluid such as water, isopropanol or ethanol.

*Figures*



*Schematic diagram:*



## II. METHODOLOGY

The model was designed using consists of a static cylinder, bearings, frame and a rotating friction plate or disk at the base. The friction plate, a rotating disk which has a grooved surface, is the most important part of the equipment that initiates the granulation process. A standard friction plate has a cross-hatch pattern, where the grooves intersect at a 90o angle.

# Automatic Braking System

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*Abstract— An automatic Braking system is an intelligent mechatronic system includes an Ultrasonic wave emitter provided on the front portion of a car producing and emitting Ultrasonic waves. An Ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective Ultrasonic wave signal.*

*Indexed Terms— Aurdino Board, Solar Panal, Ultrasonic Sensor, Braking System, D. C. Motor*

## I. INTRODUCTION

Nowadays, the number of accidents is so high and uncertain. Accident will occur every time and everywhere and cause worst damage. Serious injury and dead. These accidents are caused by mostly delay of the driver to hit the break.

The project is designed to develop a system that can solve this problem where drivers may not brake manually but the vehicles can stop automatically due to obstacles. Using ultrasonic as a ranging sensor, its function based on ultrasonic sensor. After transmission by transmitter, the wave can reflect when obstacle detected and received by the receiver The Arduino board is used by creating and dumping the required c program, which consists the PIC microcontroller in it. Then PIC (programable Interface Controller) microcontroller is used to control the servo motor based on detection pulse information and the servo meter in turn automatically controls the braking of the car.

Thus, this new system is designed to solve the problem where drivers may not be able to brake manually exactly at the required time, but the vehicle can still stop automatically by sensing the obstacles to avoid an accident.

Figure A:
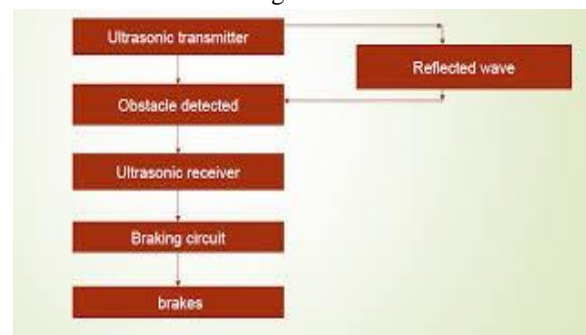


## II. PROPOSED SYSTEM

In this project we are using ultrasonic sensor & solar system. The ultrasonic sensor is used to detect the obstacle and sends it to aurdino board receives the signals and controls the braking system.

The vehicle we solar energy for the working of the vehicle where the solar panel is placed at the top of the vehicle. And also total functioning of the braking system is controlled by the aurdino board which receives the signal from the sensor

## III. WORKING PRINCIPLE

- Each car manufacturer has it's own automatic braking system technolog, but they all rely on some type of sensor input .
- Ultrasonic sensor contains transmitter and receiver units, and as ultrasonic transmitter detects the obstacle by transmitting the signals and reflects back to ultrasonic receiver unit.

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# A nanofluids and nanocoatings used for solar energy harvesting and heat transfer applications: A retrospective review analysis

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## ARTICLE INFO

## ABSTRACT

It is known that harvesting the solar power is key issue in current scenario because of scarcity of non-renewable energy in future days to come. Hence the solar harvesting systems takes an important stand globally. Grabbing the solar energy is difficult task due to low thermal conductivity of fluids which are carrying heat and poor optical coatings of solar power devices. In order to enhance the heat transfer rate of fluids there should be an alternative, such alternative is nanofluid. Nanofluids are having nanoparticles suspended in base fluids stably. This paper critically reviewed and conveyed the up to date literature of usage of nanofluids and nanocoating's in solar energy harvesting operating in low, medium and high temperature ranges for effectiveness in performance. Further solar energy conversion systems efficiencies can be raised by using the additives in base fluids termed as nanofluids and nano selective coatings for solar concentrators to improve optical performance.

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## 1. Introduction

Renewable sources are perfect alternative to bridge the gap between scarcity of power and conservation of power globally in current situations. There has been latest development in solar harvesting [2] leads to consider favourable actions pointing towards better projections in solar energy applications. The dearth of the conservative energy sources such as fossil fuels like petrol, gas etc and their perilous influence on the human society is key factor in which researchers are focusing their research in the field of solar energy which can be replenished continuously Fig. 1. Table 1.

Hence, we need to harvest the solar energy by constructing solar collecting systems such as parabolic shaped and flat shaped solar collectors. It is known that coating on the absorber surface greatly influence the performance of solar thermal energy conversion system. Mainly solar absorptance ($\alpha_s$) and low thermal emittance ($\varepsilon_T$) of selective coatings during operating condition can effectively convert solar energy in to useful energy. Solar absorber selective coatings are bifurcated in to three segments with respect to thermal emittance such as

a) low-temperature (T < 100℃),

b) mid-temperature (100℃ < T < 400℃),

c) high temperature (T greater than 400℃)

The main aim of this paper is to discuss about direct energy conversion, here figure 2 shows that solar energy is utilised as direct and indirect conversion. But here we are focusing on direct conversion, let us focus on it. It is clear that solar harvesting can be done through thermal energy and photovoltaic energy. Many industries have been practicing the Rankine power cycle for power production by means of thermal energy only. It has been known that the photovoltaic solar cell is another source of generating of power for house hold applications. Below Figure 2 shows that how solar energy utilization is categorised into direct and indirect conversion.

## 2. Nanofluids in solar energy conversion and heat transfer applications

The harvesting of Solar Energy can be possible using high end heat carrier fluids such as water or oil. For process heat applications, base fluid [Reddy k s et al 2016] is either water or oil been used to harvest heat from renewable energy using solar collectors.

# An Overview of the Impact of 5S Implementation in automobile industry using optimization methods

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**Abstract** Lean is becoming a world class word that represents continuous improvement and most of all the importance of focusing on creating value. The implementation of *Lean Manufacturing* will lead us to improve quality, reducing costs and at the same time the elimination of non-value-added activities. For these reasons several organizations try to adopt the philosophy. Although the application of Lean principles brings numerous benefits to organizations, at this time the optimization of the productive process is not enough. Ensuring optimal safety conditions of all the employees has been one of the top priority, exceeding "quality" or "performance" as indicators of success. In this paper a case of study in one industrial unit of one of Europe's  largest car producers is tested and then it is evaluated how the implementation of lean tools, more specifically *5S*, can contribute to the occupational safety conditions. The present work demonstrates another of the several advantages that is obtained from the use of *5S*. Apart from being a powerful tool to organizing and optimizing the workplace environment this study demonstrates that it is also essential to ensure occupational safety.

**Keywords:** Occupational safety, lean manufacturing, *5S*, risk evaluation, automotive industry, *6S*

## 1    Introduction

In the wake of the competitive environment that organizations are facing, several companies are attempting to reinvent and adopt innovative practices that would allow them to surmount the various obstacles they encounter along the way [1]. One of the most popular practices adopted by the business world is the *Lean Manufacturing*, which is a result of the success story of Toyota. That despite the difficulties experienced at the time, it managed to promote sustainable and continuous growth through the maximization of the value of the product by through the reduction of the waste, through the maximization external and internal variability, among others [2–4].

# Comparative Analysis Of Engine Cylinder Through Design Modification Using Catia V5 &Ansys

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## ABSTRACT

**Aim:** Analysis and optimization of piston which is stronger, lighter with minimum cost and with less time.Since the design and weight of the piston influence the engine performance.Study Design: Analysis of the stress distribution in the various parts of the piston to know the stresses due to the gas pressure and thermal variations using with Ansys.

**Methodology**: The Piston of an engine is designed, analyzed and optimized by using graphics software.

The CATIA V5R16, CAD software for performing the design phase and ANSYS 11.0 for analysis and optimization phases are used.

**Brief Results:** The volume of the piston is reduced by 24%, the thickness of barrel is reduced by 31%, width of other ring lands of the piston is reduced by 25%, Vonmisses stress is increased by 16% and Deflection is increased after optimization.   But all the parameters are well with in design consideration.

**Key Words:** CATIA V5R16, ANSYS, Vonmisses Stress, Computer CAD, CAE, Optimization.

Corresponding Author: P.V.K.Murthy

## INTRODUCTION

Automobile components are in great demand these days because of increased use of automobiles. The increased demand is due to improved performance and reduced cost of these components. R&D and testing engineers should develop critical components in shortest possible time to minimize launch time for new products.   This necessitates understanding of new technologies and quick absorption in the development of new products [1]**.** A piston is a moving component that is contained by a cylinder and is made gas-tight by piston rings. In an engine its purpose is to transfer from expanding gas in the cylinder to the crank shaft via piston rod and or connecting rod. As an important part in an engine piston endures the cyclic gas pressure and inertia forces at work and this working condition may cause the fatigue damage of the piston. The investigations

# Investigation of Jatropha Oil-Based Biodiesel In A CI Engine

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**Abstract**: This study investigates whether jatropha oil and its mixtures with diesel are suitable for CI engines. Jatropha volume proportions of 10%, 20%, 30%, 40%, 50%, and 100% with Diesel were tested.Brake Thermal Efficiency (BTE), Brake Specific Energy Consumption (BESC), and Engine Exhaust Gas Temperature (EGT) are predicted using an artificial neural network model. An ANN model was created using the common Levenberg-Marquardt back-propagation training procedure.

The overall regression coefficient for the ANN model appears to be 0.99121,  while the MSE and MAPE  coefficients are 0.000893 and 3.1192 percent, respectively.

**Keywwords**-Jatropha,ANNModel,Blends,Jatropha

## 1. Introduction

Majority of Worlds energy needs to be fulfilled by petrochemical sources, coal & Natural gas. Internal combustion engines using diesel fuel play a significant role in an industrial economy of the emerging countries. Due to a variation in crude oil prices, limited sources of fossil fuels and the environmental issues there has been a transformed focus on vegetable oils and animal fats for the manufacturing of bio-diesel [1]. Vegetable oils are biodegradable and non-toxic in nature. Many researchers tested bio diesel on compression ignition engine with small or fewer modifications [2,3,4,5]. The higher viscosity of biofuel creates complications in use of biofuel directly in available engines. The viscosity of oil reduces by using exhaust gas before oil fed to the engine [6].  Jatropha is the key source of bio-diesel production in India. It is easy to harvest and seed collection period of jatropha does not overlap in the rainy season [7,8]. Jatropha bio-diesel formed by acid esterification and transesterification method [9].

### Nomenclature

| | | | |
|---|---|---|---|
| ANN | Artificial Neural Network. | PM | Particulate Matter |
| BTE | Brake Thermal Efficiency. | AI | Artificial Intelligent |
| BSEC | Brake Specific Fuel Consumption | CO | Carbon Monoxide |
| EGT | Exhaust Gas Temperature. | MSE | Mean Square Error |
| NOx | Oxides of Nitrogen | PPM | Parts per million |
| SFC | Specific Fuel Consumption | R | Regression Coefficient |

Trans-esterification is done on the Jatropha oil by the predictable based catalytic reaction. Properties of Biodiesel found by Trans-esterification are in good agreement with ASTM Standards [9,10,11,12]. Advancement in fuel injector and injection system recovers not only the performance but also decreases the emissions from the engine. Self-ignition temperature, viscosity of fuel and injection timing produces an adverse effect of engine performance and emissions [13,14].

Chauhan et al. [15] studied performance and emissions of preheated jatropha oil. The viscosity of oil decreases with rise in fuel inlet temperature. An growth in the temperature brake thermal efficiency rises and BSFC reduces. Paul et al. [16] tested Diesel-CNG, Diesel-ethanol blends for reducing exhaust emissions of the engine. D95E5 gives higher brake thermal efficiency and lesser BSFC with the drop in NOx emissions than Diesel-CNG, Diesel-ethanol, and Diesel-CNG combinations compared with Diesel. Ayetor et al. [17] examined the performance of an engine using pure Bio-diesel blends of palm, jatropha and coconut Bio-diesel. Results show enhancement in performance and emission of pure Bio-diesel blends. Lensik et al. [18] inspected the results of rapeseed Bio-diesel and its blends on the performance, combustion, and emissions of a Diesel engine. The engine torque and brake mean effective pressure lowers with the growth of Bio-diesel percentage in blends due to lesser calorific value. Jiaqiang et al. [19] examined the effect of water additive and metal-based additive in the Bio-diesel-Diesel blend on a marine engine. The results show that water additives in the Bio-diesel-Diesel blends are beneficial to improve air-fuel mixture. Datta et al. [20] investigated experimental and numerical performance and emissions of jatropha Bio-diesel. As cylinder pressure increases which increases CO2 and NOx emissions and decreases particular matters. AI-based ANN model has constancy in forecasting the performance-emission standards of the Diesel fuelled engine in an actual period. It decreases the time of research, price and acts as a mapping tool in ICE platforms, as it requires inadequate numbers of computing resources than other models [21,22,23].

Lenin et al. [24] formulate the ANN model for forecasting performance, combustion and emissions of Pongamia Bio-diesel. It shows R-value for training data, test data and validation were 0.99966, 0.99589 and 0.9873. Ahmed et al. [25] examined the suitability of ANN model on free piston linear engine. ANN model reduces the number of test data and avoids the detailed experimental study of the engine. Liu et al. [26] compare the experimental results and ANN Model results of Spark-Ignition Engine fuelled with butanol gasoline blends. ANN found a suitable technique for simulating engine constraints. The objective of work is to relate and study the Brake Thermal Efficiency, Brake Specific Energy Consumption and Exhaust gas Temperature of CI engine fuelled by Jatropha and its blends Using ANN model. ANN model is used to compare the relationship between the input and output parameters of the engine.

# CHARACTIZATION INVESTIGATION OF MECHANICAL  STRENGTH ON HONEYCOMB HYBRID COMPOSITS METERIALS USING PYTHON PROGRAMMING

## N.Govinda Rao[1] & A.Srikanth[2]

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***ABSTRACT***

*Honeycomb structures are often natural or artificial assemblies, which have the similar geometrical shape of a honeycomb. Honeycomb sandwich structures when compared to conventional structures are that it provides: very low weight, production cost savings, durability and high stiffness. It is fabricated by using Acrylic honeycomb sheet as a core material along with carbon fiber reinforced polymers.*

## 1. INTRODUCTION

Nowadays,  Python  is one of the mostly used  Object  Oriented  Programming Languages and more libraries are being developed for various purposes. This has edge over  other  programming languages in such a way that the length or lines code is lesser when compared to its counterparts. For calculating the  Flexural  strength  of Honeycomb composite structures availability of many libraries used. The advantages of honeycomb sandwich structures, when compared to conventional structures, are that it provides: very low  weight,  production  cost savings, durability, and high  stiffness.  Honeycomb cores  find wide applications in  sandwich  structures  where there is primary function is to resist transverse shear loads similar to the web in the I-section beam. Generally, an aluminum honeycomb core is used in  applications requiring sandwich  construction  with  Fiber-reinforced composite face sheets. Composite materials, such as glass fiber  or  carbon  fiber  reinforced plastics are suited for sandwich construction methods due to their low weight, high stiffness, high strength, dimensional stability, and ease of manufacture. Sandwich panels are used for design and construction of  lightweight transportation systems such as satellites, aircraft, missiles, high speed trains and biomedical applications. R Cimrmana et al. [1] have investigated SfePy (Simple finite elements in Python) is a software for solving various kinds of problems described by partial differential equations in one, two or three spatial dimensions by the Finite element method. Borden MJ et al. [2] have  worked  on  a two-scale piezoelastic model is presented, showing both the mathematical definition of the problem and it corresponding code implementation. Bradshaw  et al. [3]  have implemented the core functionality of  the  Python compiler which

# Analyzing the Impact of scheduling using metaheuristics on industries

*N.Govind rao* [a]*,S.Javeed* [b]

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**ABSTRACT:** Scheduling Problem (SP) is a streamlining issue in which ideal positions are appointed to assets at specific times. Lately many endeavors have been made at the arrangement of this issue utilizing a different scope of instruments and procedures. This paper presents half and half hereditary calculation (HGA) for JSSP. The half and half calculation is a mix between hereditary calculation (GA) and neighborhood search. Right off the bat, another introduction strategy is proposed. A changed hybrid and transformation administrators are utilized. Also, nearby pursuit in view of the local design is applied in the GA result. At last, the methodology is tried on a bunch of standard occurrences taken from the writing. The calculation results have approved the adequacy of the proposed calculation.
**KEYWORDS:** Genetic algorithm, Job shop scheduling problem, Local search.

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**1. INTRODUCTION:** Scheduling has become a critical factor in many job shops especially for real-world industrial applications [(1)-(3)]. Finding scheduling to achieve the work in a minimum time and more efficiently is called JSSP. The JSSP can be described in the following way: we are given a set of jobs and a set of machines. Each machine handles, at most, one job at a time. Each job consists of a chain of operations, each of which needs to be processed during an uninterrupted time period of a given length on a given machine. The purpose is to find a schedule, that is, an allocation of the operations to time intervals on the machines, that has a minimum duration required to complete[(4)]. The JSSP is among the hardest combinatorial problems. Not only is it complicated, but it is one of the worst NP-complete class members. In general, scheduling problems are NP; NP stands for non-deterministic polynomial, which means that it is not possible to solve an arbitrary instance in polynomial time. So, the JSSP has garnered attention due to both its practical importance and its solution complexity [(5), (6)].

At present, the method for the JSSP mainly includes two kinds, one of which is exact methods and the other approximation methods. Exact methods, such as branch and bound, linear programming and decomposition methods, guarantee global convergence and have been successful in solving small instances[(7)]. In manufacturing systems, most scheduling problems are very complex in nature and very complicated to be solved by exact methods it becomes increasingly important to explore ways of obtaining better schedules that include priority dispatch, shifting bottleneck approach, local search, and heuristic methods. Recently, number of high-level strategies is used to guide other heuristics, known as meta-heuristics led to better and more appreciated results [(8) -(16)]. Therefore, a number of meta-heuristics were proposed in literature for JSSP such as GA [(17) -(18)], simulated annealing (SA) [(19), (20)],ant colony optimization (ACO) [(21)-(23)],tabu search (TS) [(24),(25)], particle swarm optimization (PSO) [(26),(27)], and Consultant Guided Search algorithm (CGS) [(28)].

One of meta-heuristics methods is the GA. GA inspired by the process of Darwinian evolution, has been recognized as a general search strategy and an optimization method which is often useful for attacking combinational problems. In contrast to other meta-heuristics methods the GA utilizes a population of solutions in its search that is not easy to fall into local minima. GA has been used with increasing frequency to address scheduling problems. In [(29)] Lazár introduced a review of frequent approaches and methods for JSSP which most commonly are used in solving this problem. From this review we can say that GA is an effective metaheuristic to solve combinatorial optimization problems, and has been successfully adopted to solve the JSSP. How to adapt GAs to the JSSPs is very challenging but frustrating. Many efforts have been made in order to give an efficient implementation of GAs to the problem. In [(30)], a new GA is presented to solve the JSSP, while in [(4)] the impact of random initialization on solving the JSSP is addressed and using GA as an optimization technique.

Due to the NP-hard nature of the JSSP, using simple GA to solve the difficult problem may not be more efficient in practice. Much effort in the literature has focused on hybrid methods [(31)-(36)]. Ren and Yupingin [(31)] design some GA operators (mixed selection operator, new crossover operator and mutation operator based on the critical path) and solve JSSP more effectively. In [(32)] Athanasios and Stavros proposed a new hybrid parallel GA

# Analysis of pivot bearing using metaheuristics

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## Abstract

The huge number of nature-enlivened metaheuristics makes it progressively hard to keep an outline of effective and in-novative turns of events. Particularly original methodologies in view of dark allegories and lacking thorough assessment are frequently — and generally legitimately — dismissed in examination and application. In any case, even among laid out approaches, new advancements are difficult to identify and coordinating them into the ongoing arrangement of techniques is certainly not a simple undertaking. Through and through, finding a reasonable metaheuristic for the main concern is ag-gravated in all application spaces, including Lifelike Com-puting Systems. In this paper, we present ways that can facil-itate separating significant data on metaheuristics. The methodology is revolved around a bound together view on metaheuristics, with an emphasis on their parts as the pertinent parts prevent mining the presentation and the way of behaving of metaheuristic structures and calculations. We besides portray strate-gies for the calculated and experimental examination of those com-ponents. This method can be applied in various degrees of detail and is consequently versatile to the separate objectives of the examination of various metaheuristics. Its benefits and issues are examined and we infer that this is one pos-sible and valuable method for acquiring a superior comprehension of existing metaheuristics and to manage new methodologies.

## Introduction

Metaheuristics are capable of successfully approximating solutions of black-box optimisation problems where exact optimisers are not applicable. This makes them suitable for a number of tasks, from engineering to biology/medicine, but also within more complex computing systems (Hussain et al., 2018). In Lifelike Systems, metaheuristics are of-ten utilised to optimise the parameters of other components, especially machine learning components, enabling the self-improvement mechanism of these systems. These parameter optimisation problems can differ in their often unknown fit-ness landscapes and the task is complicated by the dynam-ically changing environment in which lifelike systems are deployed. Additionally, there can be several areas in the system that require an optimiser, e. g. learning components, other optimisers or the environment itself.

For all application areas of metaheuristics, there arises the same initial question: Which metaheuristic is the most suit-able for the given optimisation problem? This question re-sults from the *No free lunch* theorem, which states that no metaheuristic performs best on all problems (Wolpert and Macready, 1997). To some extent, this also led to an increas-ing amount of different metaheuristics, hybrids and variants, with more than 300 approaches by 2020, summarised in a presumably non-exhaustive list by Molina et al. (2020). As most of those are strongly metaphor-based, it is hard to de-tect innovative and efficient strategies that could be advan-tageous for the given problem. However, falling back to well known approaches, e. g. evolutionary algorithms, might restrict performance as more suitable strategies exist. Al-together, this results in a necessity to facilitate the assess-ment of metaheuristics in terms of their functionality, per-formance and behaviour.

In this paper, we argue on the importance of conceptual and empirical analysis of metaheuristic components, based on a unified framework, and present our research agenda on this behalf. We first specify how such a unified frame-work can be described and utilised. The next section pro-vides insights into conceptual ways to analyse metaheuris-tics based on their components and how this can be comple-mented by empirical studies. The advantages and problems of the approach itself and in relation to Lifelike Systems are discussed and we end on a short conclusion and illustrate options for future work.

## A Unified View on Metaheuristics

The development of a unified concept for metaheuristics ul-timately results from the demand of more standardisation, reusability, knowledge on components and consistency in descriptions (Swan et al., 2015; Sörensen, 2015). In recent years, some detailed unification strategies were presented, each of them with a different goal in mind: from providing a basis for describing metaheuristics (Bandaru and Deb, 2016) to finding inherent strategies in metaheuristics (Chicco and Mazza, 2020), but also to construct new algorithms (Song and Fong, 2016), to compare (de Armas et al., 2021) and evaluate (Cruz-Duarte et al., 2020) metaheuristics in terms of their components. Ultimately, the unification facilitates

# Single stage robust design and Reliability optimization using branch and Bound Method

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**Abstract** Reliability-based Optimization problems are optimization problems con- sidering a constraint that measures reliability of the modelled system: the proba- bility of a safety event with respect to controllable decision variables and uncertain random variables. Most solving approaches use approximate techniques for evalu- ating this reliability constraint. As a consequence, the reliability of the computed optimal decision is not guaranteed.

In this paper, we investigate an interval-based Branch & Bound for solving globally reliability-based optimization problems with numerical guarantee. It com- bines an interval Branch & Bound framework with a certified reliability anal- ysis technique. This technique considers the reliability constraint and induced safety region modelled within Probabilistic Continuous Constraint Programming paradigm. The certified reliability analysis is numerically handled by an interval quadrature algorithm. In addition, a new interval quadrature function for two random variables, based on linear models of the safety region is described. Two implementations of the Branch & Bound, which differ on how the certified relia- bility analysis is handled throughout the optimization process, are presented. A numerical study of these two variants shows the relevance of the interval linear model-based quadrature function.

**Keywords** Reliability-based optimization, Branch & Bound, Interval analysis,

## 1 Introduction

Reliability-Based Optimization (RBO) is the problem of finding the best reliable decision of a problem containing controllable decision variables and uncontrollable uncertain variables. Reliability analysis is used to assess the probability of safety of a decision considering the uncertainty. From the point of view of the optimization problem, this give rise to a particular reliability constraint. The range of applica- tions is wide, in particular in engineering design and structural optimization,

Knowing the probability distribution of the uncertain variables, evaluating the reliability of a decision requires computing the probability of a safety event, viewed as the probability mass of a safety region. A safety region is classically represented as a conjunction of (non-linear) inequality constraints, of both the decision and random variables, each of them modelling a safety condition of a critical element of the system. The computation of the reliability requires the integration of the joint probability distribution function of the random variables over the safety region, which is a challenging numerical problem. In addition to the reliability analysis, the decision must be optimized with respect to a given objective, typically a function of the decision variables. Thus an RBO problem is two-fold: reliability assessment and optimization.

This problem has been tackled with different techniques. Most of these ap- proaches base their reliability analysis on approximate techniques. For example *Monte Carlo* estimation, which is usually subsumed by more advanced techniques when requiring high reliability such as *First Order Reliability Method* (FORM) or *Second Order Reliability Method* (SORM), see e.g. [1, 27] for a survey of recent RBO methods. The use of approximate techniques is motivated by their relatively low computational cost and ease of use. However, when problems are highly nonlinear, they are subject to numerical errors, causing them to under or overestimate the reliability of decisions [6]. This can be a great issue when assessing the reliability is of critical importance.

In this paper, we investigate a global RBO approach based on interval analysis and the recently proposed *Probabilistic Continuous Constraint Programming* (PCCP) paradigm [5, 6]. This approach performs global optimization with rigorous  relia- bility analysis, i.e asserting certainly the reliability of decisions. To the authors knowledge, no similar approach exists in the literature. The reliability analysis presented here can be considered as an interval version of the robust bounding ap- proach [24] in robust optimization, whose idea is to bound the safety region with easier to integrate sets. Note also that although the standard version of the relia- bility analysis described here can be extended to more than

# Study the impact of solid state of electric charge swap current density on the voltage hysteresis of silicon based lithium cells

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**Abstract:** Open circuit voltage (OCV) is an important characteristic parameter of lithium-ion batteries, which is used to analyze the changes of electronic energy in electrode materials, and to estimate battery state of charge (SOC) and manage the battery pack.   Therefore, accurate OCV modeling is a great significance for lithium-ion battery management. In this paper, the characteristics of high-capacity lithium-ion batteries at different temperatures were considered, and the OCV-SOC characteristic curves at different temperatures were studied by modeling, exponential, polynomial, sum of sin functions, and Gaussian model fitting method with pulse test data.   The parameters of fitting OCV-SOC curves by exponential model (n = 2), polynomial model (n = 3~7), sum of sin functions model (n = 3), and Gaussian model (n = 4) at temperatures of 45 °C, 25 °C, 0 °C, and $-20°C$ are obtained, and the errors are analyzed. The experimental results show that the operating temperature of the battery influences the OCV-SOC characteristic significantly. Therefore, these factors need to be considered in order to increase the accuracy of the model and improve the accuracy of battery state estimation.

**Keywords:** lithium-ion battery; high capacity; polynomial fitting; OCV-SOC characteristics; sate of charge estimation

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## 1. Introduction

The battery system is the most prominent energy storage source in electric vehicles (EVs) [1]. Lithium-ion batteries are a promising candidate for EVs due to their high power density, lightweight, long lifespan, and thermal stability. The use of high-capacity lithium-ion batteries as the battery system of EVs is the current development trend [2]. To prolong lifespan and increase safety of the batteries, real-time monitoring of the state of charge (SOC) is indispensable. Since the SOC cannot be measured directly, many approaches have been proposed to estimate the SOC of the battery [3–6]. Among them, the model-based method is widely used in the application for its high accuracy and self-corrective ability [7–9]. These methods commonly used impose or are coupled with a nonlinear curve characterization of the open circuit voltage (OCV) [10–12]. As an important characteristic parameter of the battery, the relationship between SOC and OCV is of great significance

# Effect of laminar phenomena in a Casson rheological fluid from a circular cylinder with slip

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### ABSTRACT

The liquid limit layer stream and intensity move of Casson non-Newtonian liquid from a slanted (sun powered authority) plate within the sight of warm and hydrodynamic slip conditions is dissected. The slanted plate surface is kept up with at a steady temperature. The limit layer protection conditions, which are illustrative in nature, are standardized into non-comparative structure and afterward settled mathematically with the all around tried, productive, certain, steady Keller-box limited distinction conspire. Expanding speed slip actuates speed increase in the stream close to the slanted plate surface. Expanding speed slip reliably upgrades temperatures all through the limit layer system. An expansion in warm slip boundary unequivocally decelerates the stream and furthermore decreases temperatures in the limit layer system. An expansion in Casson rheological boundary acts to lift significantly the speed and this impact is articulated at higher upsides of unrelated direction. Temperatures are anyway somewhat diminished with expanding upsides of Casson rheological boundary.

**Keywords:** Non-Newtonian fluid mechanics; Inclined plate; Solar energy; Yield stress; Slip condition, Keller-box numerical method; Heat transfer; Skin friction; Nusselt number; Boundary layers.

### NOMENCLATURE

| | | | |
|---|---|---|---|
| $C_f$ | skin friction coefficient | $\alpha$ | thermal diffusivity |
| $S_f$ | non-dimensional velocity slip parameter | $\beta$ | non-Newtonian (rheological) Casson parameter |
| $S_T$ | non-dimensional thermal slip parameter | | |
| $f$ | non-dimensional steam function | $\eta$ | dimensionless radial coordinate |
| $g$ | acceleration due to gravity | | |
| $Gr$ | Grashof number | $\mu$ | dynamic viscosity |
| $N_0$ | velocity slip factor | $\nu$ | kinematic viscosity |
| $K_0$ | thermal slip factor | $\theta$ | non-dimensional temperature |
| $Nu$ | Local Nusselt number | $\rho$ | density of fluid |
| $Pr$ | Prandtl number | $\xi$ | dimensionless tangential coordinate |
| $T$ | temperature | $\psi$ | dimensionless stream function |
| $u, v$ | non-dimensional velocity components along the x- and y directions, respectively | | |
| $x, y$ | non-dimensional Cartesian coordinates along and transverse to plate surface | | |

*Subscripts*
$w$      conditions on the wall
$\infty$      free stream conditions

## 1. INTRODUCTION

The heat transfer from inclined surfaces finds numerous applications in solar energy systems, geophysics, materials processing etc. Many studies have appeared concerning natural and also mixed

# FABRICATION OF AIR POLLUTION MONITORING SYSTEM

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*Abstract:* The objective of this project is to measure the purity in the air. This project is designed with air purity sensor analog to digital converter, amplifier and micro controller with LCD Display. In this project we are using air purity sensor to measure the purity in the air. So it measures the purity in the air and generates the corresponding voltage pulse these pulses are in the milli voltage level. Component, Internet of Things (IoT) may be a worldwide system of "smart devices" which will sense and connect with their surroundings and interact with users and other systems. The level of pollution has increased with times by lot of things like the increase in population, increased vehicle use, industrialization and urbanization which ends up in harmful effects on human wellbeing by directly affecting health of population exposed to it. Air quality goes down when enough amount of harmful gases present in the air like carbon dioxide, smoke, alcohol, benzene, NH3, and NO2.  In order to analyses we are developing an IOT Based pollution Monitoring System which we'll monitor the Air Quality over an internet server. It will show the air quality in PPM on the LCD and also as on webpage in order that we will monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile device.

*Index Terms* –**Air purity, analog, digital, lcd display, micro controller, iot, arduino**

## I. INTRODUCTION

Air pollution sensors are devices that monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures. Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human eye. The EPA maintains a repository of air quality data through the Air Quality System (AQS), where it stores data from over 10,000 monitors in the United States. While use of these sensors was expensive in the past, the 2010s saw a recent trend towards the development of cheaper portable air-quality sensors that can be worn by individuals to monitor local air quality levels. These sensors, can then, in turn, help measure the spatiotemporal coverage and variety of chemical species, and empower individuals and communities to better understand their exposure environments and risks from air pollution. The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Due to flexibility and low cost Internet of things (IoT) is getting popular day by day. With the urbanization and with the increase in the vehicles on road the atmospheric conditions have considerably affected. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. Monitoring gives measurements of air pollutant and sound pollution concentration.

# The Fuel Theft detection and Mileage Monitoring System

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*Abstract—* **In this project we have developed an enhancement of the vehicle alarm security system. The safety of vehicles fuel is extremely essential for public so this project came to notice due to the alarming rate at which vehicles fuel are being stolen in our country.**

**In this project we show the amount (distance) of fuel Present in fuel tank digitally by using Ultrasonic Sensor. Also fuel theft is measure problem in all over world. In our project if fuel gets theft then text message will send to owner of bike also buzzer makes noise so that owner of bike get aware.**

**The project works in the field of the fuel management system, which handles the theft alert and sensors, logs which determines the live situation of the fuel tank. Fuel theft is measured only when the engine is in OFF state. The milage will be calculated by help of infrared sensor to infrared sensor to measure the distance and fuel level is measured by Ultrasonic senser and send to vehicle owner.**

*Index Terms:* **Arduino, GSM Module, infrared sensor, Mileage, Ultrasonic sensor.**

## I.INTRODUCTION

As we all know, today fuel is a non-renewable energy on the earth and this makes fuel a precious thing for the humanity. Industries, which use fuel, are having a headache of fuel theft and fuel related problems. The major problem seenby the world of fuel is fuel theft and for that, they do not have any major solution or parameter to have control on it. Our project mainly monitors the fuel in tank with ignition conditions and Milage checking and updating.

Figure A:
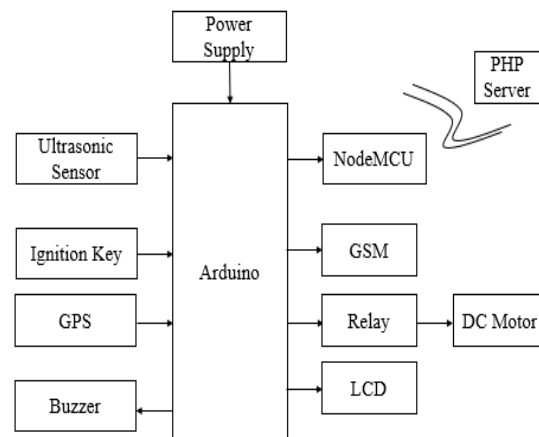


## II. PROPOSED SYSTEM

In this project we are using ultrasonic sensor to detect the fuel level. Initially if we want to start the bike we need to switch ON ignition key at that time it will send the location to the PHP server and when the ignition key is OFF then also the location will be updated to PHP server.

If the vehicle is in off condition but if the fuel level is reduced then automatically an message alert will be sent to the concerned owner whose number is defined in the coding.

## III. WORKING PRINCIPLE

Fuel theft in parked vehicles is increasing day by day these days. Moreover increasing fuel prices adds to the frustration of a fuel theft. this project focuses on the fuel theft problem and mileage problems puts forward an effective solution for these problems.

# DESIGN AND FABRICATION OF AUTOMATIC BRAKING SYSTEM

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*Abstract :*   I.C Engines have been advanced a lot such that its speed is becoming a major catastrophe. Advanced automatic braking system improves braking techniques in vehicles. It changes complete braking systems in an automotive and deals with the concept of Automatic Braking System giving the solution. This model is designed with ultrasonic transmitter, ultrasonic receiver, Arduino UNO R3 board with PIC microcontroller, DC gear motor, Servomotor and mechanical braking arrangement. The Ultrasonic Sensor generates (0.020-20) KHZ frequency signal. It is transmitted through ultrasonic transmitter. The ultrasonic receiver is used to receive the reflected wave present in front of the vehicle, then the reflected waves is given to the ultrasonic wave generator unit in which the incoming wave is amplified and compared with reference signals to maintain a constant ratio and this signal is given to microcontroller and through which the working of DC gear motor and Servomotor may takes place, which results in application of brakes.

*Index Terms* – **Automobile, braking system, servomotor, ultrasonic transmitter .**

## I. INTRODUCTION

Driving is a common activity for most of the people. The number of vehicles is increasing day by day. Now a days, the technology has got vast changes which leads increase in speed. The speed plays a vital role to maintain time for longer distances. But, this speed also getting a major problem for causes of road accidents. The common braking is not sufficient for avoidance of accidents when driver is not active. Further improvement has to done in braking system in order to brake a vehicle when driver is not able to brake i.e., it may needs automatic braking system. This automatic braking system allows the vehicle to brake without support of the driver.

The main target of the ultrasonic braking system is that, vehicles should automatically brake when the sensors sense the obstacle. This is a technology for automobiles to sense an imminent forward collision with another vehicle or an obstacle, and to brake the vehicle accordingly, which is done by the braking circuit. This system includes two ultrasonic sensors viz. ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter provided in front portion of an automatic braking system vehicle, producing and emitting ultrasonic waves in a predetermined distance in front of the vehicle. Ultrasonic wave receiver is also provided in front portion of the vehicle, receiving the reflected ultrasonic wave signal from the obstacle. The reflected wave (detection pulse) is measured to get the distance between vehicle and the obstacle. The DC gear motor is connected to the wheels of vehicle and power input is given to it from Arduino board. Then PIC microcontroller is used to control the servo motor based on detection pulse information and the servo motor in turn automatically controls the braking of the vehicle. Thus, this new system is designed to solve the problem where drivers may not be able to brake manually exactly at the required time, but the vehicle can stop automatically by sensing the obstacles to avoid an accident.

In order to reduce the emission levels, more work is going on for the modification of engine work functions and all. There are several kinds of braking mechanism systems that would only can be applicable mechanically, to move the ideology more deep and brief the automatic braking system will be more sufficient and satisfactory in addition to mechanical braking system.

In present generation, numbers of vehicles are coming into existence with newer technologies for implementation of human comfort and other conditioning. To extend the ideology in more brief manner and to take the step in different way, may automatic braking system would fulfill the methods of extension of technical existences.

# DESIGN AND FABRICATION OF ELECTRO MAGNETIC BRAKING SYSTEM

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*Abstract:*    The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles.

In this thesis, a new mathematical model for electromagnetic brakes is proposed to describe their static characteristics (angular speed versus brake torque). The performance of the new mathematical model is better than the other three models available in the literature in a least-square sense. Compared with old models that treat reluctance as a constant, our model treats reluctance as a function of speed. In this way, the model represents more precisely the aggregate effect of all side effects such as degree of saturation of the iron in the magnet, demagnetizing effects, and air gap. The software program written in Mat lab can be used to code different brake characteristics (both static and dynamic) and evaluate their performance in different road scenarios.

*Index Terms* - **Automobile, braking system, electromagnets, heat transfer, ultrasonic.**
_____

## 1. INTRODUCTION

The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles.

In this paper, a new mathematical model for electromagnetic brakes is proposed to describe their static characteristics (angular speed versus brake torque). The performance of the new mathematical model is better than the other three models available in the literature in a least-square sense. Compared with old models that treat reluctance as a constant, our model treats reluctance as a function of speed. In this way, the model represents more precisely the aggregate effect of all side effects such as degree of saturation of the iron in the magnet, demagnetizing effects, and air gap. The software program written in Mat lab can be used to code different brake characteristics (both static and dynamic) and evaluate their performance in different road scenarios.