

MULTI-OBJECTIVE OPTIMIZATION OF END MILLING PROCESS PARAMETERS IN MACHINING OF EN 31 STEEL: APPLICATION OF AHP EMBEDDED WITH VIKOR AND WASPAS METHODS

By

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ABSTRACT

The objective of the current work is to optimize the end milling process machining parameters in end milling of EN 31 steel. Surface Roughness (SR), Dimensional Deviation (DD), and Material Removal Rate (MRR) are some of the crucial findings of this work. In this work, the weights are calculated by using numerical tool AHP (Analytic Hierarchy Process) method, and VIKOR (Vise Kriterijumska Optimizacija Kompromisno Resenje) and WASPAS (Weighted Aggregated Sum Product Assessment) methods are used in analyzing optimum machining parameters. These techniques are utilized for multi-objective optimization which minimizes SR, DD and maximizes the MRR. Results showed the effectiveness of VIKOR approach as well as WASPAS method, both methods are appropriate to any metal cutting operations on superior with multi-number of objectives concurrently.

Keywords: Surface Roughness, End Milling, Multi-Criteria Decision Making, VIKOR, WASPAS.

INTRODUCTION

A majority of metal cutting operations need the operator to select proper process parameters to minimize the cost of the machining. Many researches were carried out on the machinability, SR, cutting force, MRR, and tool wear during machining. Amongst metal cutting operation, end milling machining is most encountered for material removal. Many researchers focused on surface roughness in milling operations for evaluating the surface quality of machining. Various factors influence the surface roughness, such as cutting speed (CS), feed rate (FR), and depth of cut (DOC) in end milling process (Alauddin et al., 1995; Kadirgama et al., 2008; Yang & Chen, 2001; Zhang et al., 2007). Assessing the proper machining parameters in end milling, prediction of proper process parameters (Oktem et al., 2006), optimization of the rake angle of the cutter for minimizing the surface roughness (Zain et al., 2010), etc., have been studied. To make the machining process most successful, selection of proper process parameters by the

process engineer is important in such a way to reduce the machining cost of machining and quality of the machined product. If the same machining parameters are selected by a human operator, he needs to refer to a handbook or his own experience, based on the knowledge in the machining or manufacturing process and specifications of machine tools (Rao & Parnichkan, 2010). To overcome those problems, there is a need to develop effective optimization criteria which will find-out the optimum process parameters which will give the optimum result.

Multi-criteria decision making (MCDM) (Rao & Pawar, 2010) methods are most important in solving the problems related to selection, an occurrence of multiple and commonly conflicting criteria. MCDM (Rao, 2010) methods have been divided into two categories such as multi-objective decision making (MODM) and multi-attribute decision making (MADM). MODM methods induce decision flexible values that are ascertained in a perpetual or integer domain with either an infinitive or a large number

OPERATION SPECULATE ON EPOXY RESIN REINFORCEMENT OF ALUMINIUM OXIDE AND SILICON CARBIDE ON GLASS FIBER LAMINATE

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Abstract - Fiber reinforced polymer composite have been used as more number of components such as aircrafts, satellite structure, of fiber reinforced polymer, automobile components, wind turbine blades, sports goods. Many advantages such as relatively low production, ease to fabricate and high strengthability. Reinforcement polymer is either synthetic or natural. Synthetic fibre such as glass, carbon, Kevlar, have high specific strength but their fields of application are limited due to high production cost. In this paper, an investigation has been performed to make better utilization of Aluminium Oxide and Silicon Carbide for making value added products. The objective of the current work is to fabricate and study the mechanical behaviour of epoxy based hybrid composite with and without filler materials. Filler materials such as Aluminium Oxide and Silicon carbide which act as an epoxy modifier. Composites filled with 4%, 8%, 12% concentration of Al₂O₃ and SiC were fabricated by using hand layup techniques. The fabricated composites are cut into specimens according to the ASTM standards as well as superficial mechanical properties such as tensile strength, flexural strength, compression strength and hardness test of the specimens were found.

Key Words: Epoxy Resin Reinforcement, Aluminium Oxide, Silicon Carbide, Glass Fiber Laminate.

1. INTRODUCTION TO COMPOSITE MATERIALS

In recent years, the interest in composite materials is increasing due to its advantages as compared to monolithic metal alloys. Composites materials can be defined as engineered materials which exist as a combination of two or more materials that result in better properties than when the individual components are used alone. Composites consist of a discontinuous phase known as reinforcement and a continuous phase known as matrix. In practice, most composites consist of a bulk material (the „matrix“), and a reinforcement of some kind, added primarily to increase the strength and stiffness of the matrix.

Matrix Phase: The matrix phase generally comprises the bulk part of a composite. Materials in fibrous form are seen to be showing good strength property and for achieving this property the fibres should be bonded by a matrix. Matrix may consist of any of the three basic materials, i.e. mainly Polymer, ceramics or metals.

Reinforcement: The reinforcement is generally responsible for strengthening the composite and improves its mechanical properties. All of the different fibres used in composites have different properties and so affect the properties of the composite in different ways. It also provides stiffness to the composites.

2. FIBER REINFORCED COMPOSITES

The goals of the design of fiber-reinforced composites many times include high strength and stiffness on a weight basis. Specific strength and specific modulus are the terms that express these characteristics and correspond to the ratios of tensile strength to specific gravity and modulus of elasticity to specific gravity. For short fibers, fibers are too short to produce a significant improvement in strength. The characteristics of a fiber-reinforced composite depend not only on the properties of the fiber, but also on the degree to which an applied load is transmitted to the fibers by the matrix phase.

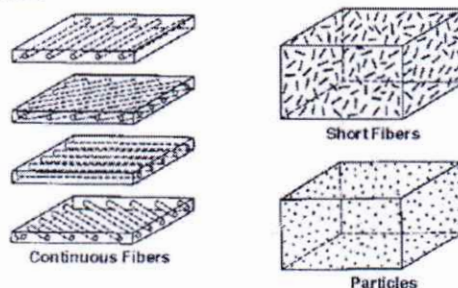


Fig 1.1: Types of fibers

The orientation of the fiber in the matrix is an indication of the strength of the composite and the strength is greatest along the longitudinal directional of fiber. This doesn't mean the longitudinal fibers can take the same quantum of load irrespective of the direction in

FABRICATION AND CHARACTERIZATION OF HYBRID METAL MATRIX COMPOSITES

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ABSTRACT

Materials are often selected for structural, aerospace and automotive applications because of better mechanical properties. In recent days development of Hybrid Metal Matrix Composites (HMMCs) has gained lot of interest in Materials Science field. In view of this, the present study focuses on the formation of Aluminum-SiC-Titanium dioxide HMMC. It was aimed to evaluate the mechanical and metallurgical properties of Al2014T6 alloy in the presence of silicon carbide, and Titanium dioxide its combinations. Various compositions are added and by using stir casting method HMMCs are fabricated. The properties like tensile strength, elongation, yield strength, hardness and micro structure were determined. In the presence of Silicon Carbide (SiC) and Titanium dioxide (TiO₂) [5%SiC + 5%TiO₂, 2.5%SiC+7.5% TiO₂ and 7.5% SiC+ 2.5% TiO₂] with Aluminum, composites were prepared. It was noticed that newly developed HMMCs exhibits better strength, hardness and elongation when compared with metal alloy.

Keywords: Aluminum, Titanium Dioxide, Silicon Carbide, HMMCs.

INTRODUCTION

Discontinuously reinforced Aluminum MMCs are competing with traditional metals and alloys as emerging engineering materials. There is an appreciable need for advanced materials with improved mechanical properties accompanied by cost reduction and feasibility of fabrication in the engineering world. They have high importance because of higher specific modulus, wear resistance and specific strength when compared with metal alloys.

Ravichandran and Dineshkumar (2014) carried out his research work on fabrication of aluminum metal matrix composites by powder metallurgy. In the addition of 5 weight percentage of TiO₂ to the pure aluminum improves the mechanical properties. Baradeswaran and Perumal (2013) in their experiments, chosen the commercial grade of Al-7075 alloy as the matrix phase, with B₂C particles as their reinforcement. The wear rate of composites is less when compared with pure matrix material. Varol, Canakci, and Ozsahin (2013) has used

ANN approach for identifying the effect of physical and mechanical properties of Al2024-B₂C composites fabricated by powder metallurgy. The reinforcement properties had considerable effects on the density, hardness and tensile strength, as well as the structural behavior of the composites. Harichandran and Selvakumar (2016) investigated the effect of the addition of micro and nano boron carbide particles to aluminum on the composite mechanical characteristics. By adding 8% B₂C wear resistance of the nano composites has increased. Bhushan, Kumar, and Das (2013) fabricated Al 7075 alloy with 10 to 15% weight of SiC particles by stir casting method and studied its behaviour. Microstructure of 7075 Al alloy, AA7075-SiC 10% weight particles (20-40 μm) and AA7075- SiC 15% weight particles composites are found. Ahamed and Senthilkumar (2011) has studied the compactness, micro structure and micro hardness of pre-mixed (elemental) Al6063, Al6063/1.5Al₂O₃, and Al6063/1.5Y₂O₃ and Al6063/0.75Al₂O₃/0.75Y₂O₃ powders and has reported that Al₂O₃, and Y₂O₃ particles were most influencing which improved sintering and micro hardness

Evaluation of Performance of Single Cylinder 4S- CI Engine Using a Neat Biodiesel Blend

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Abstract- The experimentation was carried out on a single cylinder, water cooled, direct injection diesel engine to operate on polanga oil methyl ester-diesel blend(PME20) for different injection timings such as 23^obTDC, 20^obTDC, 26^obTDC and 29^obTDC, at rated speed, under varying loads from no load to full load(0%-100%). The exhaustive tests were carried out to evaluate the performance and emission characteristics of diesel engine operated on PME20 (composition of 20% diesel and 80% neat PME fuel) to find optimum fuel injection timing(FIT) amongst selected FITs, in comparison with base line data of high speed diesel(HD) fuelled CI engine. PME20 has shown overall better performance, and emission characteristics, at 26^obTDC and at 80% of full load.

Keywords- PME20; FIT; HD; bTDC

1. INTRODUCTION

The global concern for air pollution and depletion of ozone layer has forced to re-evaluate the use of conventional fuels like gasoline, diesel and coal as well. In view of continues growth in demand of energy and rise of fossil fuels cost, it is emerged to investigate for most appropriate substitute for diesel fuel. Biodiesel refers to any diesel-equivalent bio-fuel made from renewable biological materials such as vegetable oils or animal fats. It is usually produced by trans-esterification and esterification reaction of vegetable oil with a low molecular weight alcohols such as ethanol and methanol. During this process triglyceride molecule from vegetable oil is removed in the form of glycerin (soap).Once the glycerin is removed from the oil, the remaining molecules are, to a diesel engine somewhat similar to those of petroleum diesel fuel. Biodiesels are essentially free of sulphur and aromatics. Biodiesel is a fuel naturally inbuilt with about 10% of oxygen. The concept of using vegetable oil as a fuel in 1895 when Dr. Rudolf Diesel developed the first diesel engine to run on vegetable oil.

In the present study polanga methyl ester -diesel blend (PME20) was selected as test fuel and investigation was carried out at four different injection timings.

2. LITERATURE REVIEW

Most of the researchers reported that the performance of biodiesel fuelled diesel engine is poor than petro-diesel operated engine. Interestingly, some of the researchers reported that thermal efficiency was higher with biodiesel than diesel fuel [1]. Some of the investigations showed that lower HC, CO and particulate matter emissions, but higher NOx emission

for biodiesel [16, 17]. The biodiesel operation reduces the harmful emissions viz., CO, HC and smoke but with little increment of NOx emissions relative to diesel fuel [2]. The biodiesel blends and neat biodiesel in diesel engine reduces carbon monoxides about 3-15% [3] unburnt hydrocarbons about 6-40% [4] and smoke density to 45% [5] compared to ULSD (ultra low sulfur diesel). However, the biodiesel blended fuels operation had shown NOx emissions up to 26% [6], BSFC increased by 6-15% [7] decreases in brake thermal efficiency up to 9% [8]. It was reported that the NOx reduced in descending order are: CME, PME, SME, WME, and RME; PM emissions reduction varies from 53%-69% [9]. 50% jatropha biodiesel blend showed maximum power with less smoke amongst all the biodiesels and their blends than diesel [10]. The rice bran biodiesel fuelled engines produced less CO, unburned HC, and PM emissions when compared to diesel fuel but higher NOx emissions [11]. The biodiesel blended fuels have strong beneficial impacts on HC, CO and PM emissions but adverse effects on NOx emissions [12-14]. Calophyllum Inophyllum (polanga) biodiesel and additives showed BTE increased and lower in BSFC than diesel [15]. There was an improvement in BTE, BSFC and substantial improvements in reduction of emissions for TRCC operated at higher injection pressure by improved combustion, due to better air motion inside the cylinder and high pressure injection increases the oxides of nitrogen (NOx) [18]. With four different fuel injection pressures (18, 20, 22, and 24 MPa) diesel engine operation showed that there was increase in BSFC, CO₂, NOx emissions, while HC and CO emissions were reduced at low injection pressures where as these values decrease with

Impact of Thermal in Stokes Second Problem for Unsteady Second Grade Fluid Flow

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Abstract- This paper tosses light on the impact of thermal in Stokes second problem for unsteady second grade liquid move through porous medium. The expressions for the temperature field and the velocity field are acquired scientifically. The impacts of different rising parameters on the velocity field and the temperature field are considered through graphs in detail.

Keywords: Unsteady Second grade fluid, Porous medium, Thermal.

1 INTRODUCTION

Recently, the study of non-Newtonian fluids drew considerable attention due to their pragmatic applications. As the non-Newtonian fluids and its applications are being vital in modern technology and industries, research on such fluids are imminent. A great number of technologically and industrially vital fluids such as polymers, molten plastics, fossil fuels, foods and, pulps which may douse in underground bedsteads, display non-Newtonian behavior. Many non-Newtonian fluid prototypes have been proposed, owing to density of fluids and their properties. Therefore this category of non-Newtonian fluids, second grade fluid is the modest subclass for an analytic solution can be practically possible to discover. If the non-Newtonian fluids correspond to physically realistic situations, meticulous analytic solutions for the flows of such fluids are most likely to find, as they serve a dual purpose. Firstly, they deliver a resolution to the flow that has technical bearing. Secondly, the solutions aforementioned can be used as authorizations against intricate arithmetical cods that have been brought up for much more complex flows. Non-Newtonian fluids were studied under different Physical aspects in the recent past by Hayat et al., [2], Fetecau and Fetecau[1], Chen et al., [3], Tan and Masuoka, [5], Fetecau and Fetecau, [4].

Chauhan and Olkha [6] ventured to study the impact of space temperature dependent heat source/sink when heat radiation over porous stretched sheet was present. Different models of the second grade liquid issue have been contemplated by Hayat et al. [8], Baris and Dokuz [7], Khan et al. [10],

Makanda et al. [12], Hameed et al. [9] and Akinbobola [11] are contemplated magnetic and heat transfer in a vertical tube on the peristaltic transport of a second grade liquid.

The impact of temperature subordinate viscosity on viscoelastic liquid, for example, second grade liquid causes changes in the properties of the liquid. For gases, the viscosity increments as temperature increments while for fluid it diminishes as temperature increments. Thus, a lot of research work has been committed to think about the impacts of many variable consistency models.

Massoudi and Phuoc [13] utilized Reynolds Viscosity model to research the impact of variable viscosity in a completely developed flow of non-Newtonian fluid down a heated inclined plane. A similar Reynolds law was utilized in summed up second grade fluid between two vertical parallel dividers by Massoudi et al. [14]. Ramya et al [15] Studied the impacts of temperature dependent viscosity on flow and heat transfer in a viscoelastic liquid in a permeable medium. They accepted that the viscosity shifts conversely as a component of temperature. Different unidirectional transient flows of a second grade liquid in a space with one limited measurement are considered by R Bandelli et al [16].

The development of a viscous liquid caused by the sinusoidal faltering of a level plate is named as Stokes' second issue by Schliching [17]. At first, both the plate and fluid are thought to be very still. At time $t = 0+$, the plate all of a sudden begins oscillating with the velocity $U_0 e^{i\omega t}$. The investigation of the flow of a viscous fluid over a swaying plate isn't just of principal hypothetical premium yet it likewise happens



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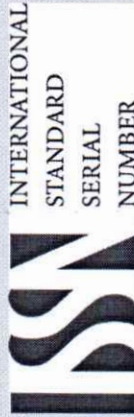
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DESIGN AND FABRICATION OF 180° WHEEL ROTATION VEHICLE

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ABSTRACT: The design and fabrication of 180 degree wheel rotation vehicle using DC motor and steering is done to reduce time to turn from one direction to other direction. This vehicle can move in all direction at a same position by used of steering, sprocket, DC motor, bearing and chain drive. Main function of this vehicle is easy to move from one direction to other direction. Modern development and economical progression of Indian society resulted in increase of people on railway platform, increase of vehicle on the road, due to space constraints, in hospital is major problem of the country. Present study aims for development of a system to reduce the turning radius of vehicle. In this system at first vehicle is stopped and wheels are then turned in the required direction with help of steering system and DC motor. It has turning radius nearly equal to negligible of length of the vehicle itself. This vehicle used to carry the goods in various areas such as, railway platform, hospital, industries and market.

Keywords: Bearing, Chain drive, DC motor, Sprocket, Steering and wheel.

INTRODUCTION:

Four wheel steering is a method developed in automobile industry for the effective turning of the vehicle and to increase the manoeuvrability. In a typical front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. In four wheels steering the rear wheels turn with the front wheels thus increasing the efficiency of the vehicle. The direction of steering the rear wheels relative to the front wheels depends on the operating conditions. At low speed wheel movement is pronounced, so that rear wheels are steered in the opposite direction to that of front wheels. At high speed, when steering adjustments are subtle, the front wheels and the rear wheels turn in the same direction.

Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear; the pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion). This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm. The rack and pinion design has the advantages of a large degree of feedback and direct steering "feel". A disadvantage is that it is not adjustable, so that when it does wear and develop lash, the only cure is replacement. A rack and pinion is commonly found in the steering mechanism of cars or other wheeled, steered vehicles. Rack and pinion provides a less efficient mechanical advantage than other mechanisms such as recirculating ball, but less backlash and greater feedback, or steering "feel". The mechanism may be power-assisted, usually by hydraulic or electrical means. A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.

OBJECTIVE:

Modern development and economical progression of Indian society resulted in increase of factories and industries. Due to space constraints material handling is the main problem is the major problem faced in most parts of the country. Present study aims for development of a system to reduce the turning radius of a vehicle. The indigenously developed system consists of Ackerman steering and various mechanism with arrangement of the various kinematics links. In this system at first vehicle is stopped and wheels are then turned in the required direction with the help of steering system. It has turning radius nearly equal to negligible of the length of car itself.

INVESTIGATION OF MECHANICAL & METALLURGICAL PROPERTIES OF HYBRID METAL MATRIX COMPOSITES

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ABSTRACT

The composite material expects a fundamental part in the aviation and vehicle applications in light of their remarkable structuring properties. Most of the experts have offered centrality to Aluminum Metal Matrix Composite (Al-MMC) in light of hardness and harsh nature of fortress segments like Nickel (Ni) and silicon carbide (SiC). In this paper an undertaking has been made to make and considers the mechanical properties of Al6061-SiC/Ni with different associations is made through mix tossing process. It is found that 10% of SiC and 5% of Ni strongholds in Aluminum compound has the best extraordinary quality among different pieces. The hardness of Al6061-SiC/Ni is lessened with extending the dimension of nickel.

KEYWORDS: Al-MMC, SiC, Ni, Stir Casting Process & Mechanical Properties

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INTRODUCTION

Aluminum is used for lightweight applications in view of its low thickness. Aluminum -based materials discover various applications in vehicle and avionics organizations. Among the diverse strongholds like SiC, Al₂O₃, AlN, B₄C, Ni, Graphite used as a piece of MMCs, SiC is one of the low thickness bolster open in broad sums. In later past, due to astounding, modulus, wear assurance and shortcoming insurance AMMCs with SiC strongholds have commonly found their applications in flight, military, normal, manufacturing ventures, etc starting late the particular amassing strategies are open for Al arrange composites, among them, blend tossing is a champion among the best process in light of its ease, versatility, low taking care of cost and high creation rate. Thusly, Al arranges composites are fabricated through mix tossing process in a manner of speaking. M. Vamsi Krishna et al., Investigated the Mechanical Properties of Al6061-SiC and Al6061-SiC/Graphite hybrid composites. These composites were prepared using blend tossing method in which the proportion of help is changed from 5-15% in endeavors of 5wt%.

The microphotographs of the composites uncovered extremely uniform spread of the particles in composites with a get-together at few spots. The test densities apparently were lower than theoretical densities in the majority of the composites. The dispersed Graphite and SiC in Al6061 compound contributed to improving the adaptability of the composites. The assessing electron micrographs of the precedents demonstrated uniform dissipating of the fortification particles in the framework with no voids. Baradeswaran has done experimentation on Effect of Graphite Content on Tribological direct of Aluminum mix Graphite Composite. He broke down the

Experimental Studies on Two Stroke SI Engine by Using Novel Piston and Gasoline Blends

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ABSTRACT

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Keywords:

performance parameters, un burnt hydro carbons emissions, CO emissions, ethanol, and methanol

It is well known fact that thermal efficiency of the two stroke engines on road usually ranges from nearly 35 % to 45 % and remaining energy is dissipated to the surrounding media. Therefore, it becomes the primary need to improve the engine performance. From the past decade and so on exhaustive research is carried by various researchers towards attaining higher level of the engine performance by doing certain modifications of the engine component family. Majority of researches focused on adding of coatings on pistons and by using the blends the performance characteristics are studied. The main aim of the present work is to develop a novel piston that reduces the percentage level of pollutants release to atmosphere and aid in improving the performance of the system. The work mainly focused on influence of novel piston and different blends in enhancing the engine performance and suppressing the level of emissions, thereby reducing the global working effects. The experiments are performed on single cylinder two stroke SI engine by using conventional piston, novel piston-1 (Bi metallic piston with copper piston crown), novel piston-2 (Bi metallic piston with Br piston) and different blends. It is noticed that the emission levels of pollutants got reduced by using novel piston-1 and E20 blend and performance wise also novel piston-1 and M20 blend gave the best results in overcoming the burning issues in two stroke SI engines.

1. INTRODUCTION

Two stroke SI engines take part in the field of transport and agriculture, but with the increasing demand of fossil fuels its limited reserves environmental pollution and lower thermal efficiency (around 30 % to 40 %) led to the development of alternative fuels and modifications in engine design. Several researches are carried in improving the engine performance by using various alternative fuels for controlling the emissions like CO and UBHC etc. in the field of two stroke engines.

The engine performance can be greatly enhanced by controlling the thermal energy dissipation from combustion chamber to surroundings. Many researchers have done their work on applying coatings in the combustion chamber.

Also the use of petroleum fuels release harmful emissions which causes global warming effects and health related problems. The disadvantages ultimately led to the path for development of alternate fuels keeping in mind of controlling emissions and supporting the demand for running automobiles by alternate fuels.

N.Nedunchezian et.al discussed about the plasma coating method coating on the cylinder head and piston. The selected catalyst is copper. The in cylinder coating of copper catalyst reduces the fuel consumption. There is 10 % improvement in fuel economy at 2.0 kW load condition achieved. The catalyst activity is higher at higher load conditions. The combustion rate is increased at all load conditions. The combustion parameters indicate a faster and cleaner combustion when engine is coated with the catalyst. The HC emissions are reduced at significant level [1].

Michel Anderson Marr et.al done his investigations on

metal and ceramic thermal barrier coatings for SI engines. It shows a reduction in peak heat flux with the thermal barrier coatings by 69 % and YSZ by 77 % relative to the conventional surface. Also from the experimental observation the metal TBC gave better performance when compared with the uncoated piston and YSZ coated piston [2].

Narasimha Kumar, S, et al. has discussed about the copper coat on piston crown of 300 microns of thickness by using ethanol as blend to petrol to find the engine performance characteristics. The performance parameters like volumetric efficiency, Thermal efficiency are increased by 3 % and 22 % respectively with gasoline and ethanol blend, with coated engine(copper) in contrast with pure gasoline operation and emission characteristics. The emissions like UBHC and carbon monoxide during exhaust of engine got decreased by 25 % and 30 % respectively in conventional engine with gasoline and ethanol blend when contrast to pure gasoline operation. The pollutants decreased by 20 % with

Catalytic coated engine when contrast to conventional engine for both the test fuels [3].

M. Dharani Kumar et.al discussed about the copper coated piston to lessen the exhaust emissions for the two stroke SI engines. The exhaust gases emissions namely CO, HC, O₂, CO₂ and have been reduced to 1.02 %, 582 ppm, 15.37 % and 1.42 % correspondingly by using Emission Gas Analyzer [4].

Sailesh Dhomne et al. done experimental investigations about the thermal barrier coatings on piston for two stroke engines to increase the engine performance parameters of specific fuel consumption is reduced by 9.73 %, and thermal efficiency increased by 12.73, Therefore Cr -Ni- Ce TBC is an efficient method to improve performance of two stroke SI

Thermodynamic Analysis of Solar Organic Rankine Cycle by using Working Fluid for Low Temperature Application

Lokanath M, Santhosh Kumar B, Kiran Avns, Saleemuddin S M

Abstract: The increasing energy need due to industrial expansion and population size led the human race for usage of major conventional energy sources like oil, coal, gas. But these resources trouble the environment leading to potential problems like pollution, global warming etc. Thus, in order to overcome the burning issues, many alternative energy sources are developed such as wind, hydro, solar, tidal, geothermal, biofuel, nuclear etc. are used for power generation. Among these the solar energy is plentifully available resource and can be employed to organic rankine cycle technology for power generation. The main aim of this research work is to develop a novel power generating system by using alternative energy resource i.e. solar energy. The work focussed on simulating the power generation of producing unit by employing solar organic rankine cycle and working fluids R-245fa, R-227ea & R-245fa/ R-227ea mixture. The Organic Rankine cycle efficiency mainly depend on the Selection of working liquid, working condition has extraordinary impact, and its vitality proficiency and effect on nature. The performance parameters like Solar Organic Efficiency, Solar Collector Area, second law efficiency, Turbine volume expansion ratio etc. are studied. It is noticed that organic efficiency of refrigerant mixture R245fa/R227ea is 4% more compared to pure fluid R227ea at turbine outlet temperature of 353K. The Volume expansion ratio of the turbine comparing to refrigerant mixture is reduced by 25.4% & 30% compared to pure refrigerant R227ea and R245fa.

Keywords: Organic Rankine Cycle, Working fluids, Waste heat Recovery, Low Temperature Application, Solar collectors.

I. INTRODUCTION

Organic Rankine Cycle (ORC) can convert low medium grade heat into electrical or mechanical power and has been widely recognized as the most promising heat-driven technologies. The ORC generate power from low-temperature heat, they can be implemented as power generation units for waste heat recovery systems, geothermal applications, and solar applications. The Organic Rankine Cycle's work on Rankine cycle instead of water it utilise Organic Working Fluid which have higher molecular mass and lower Boiling point that can produce power from Low temperatures heat sources.

1.1. PROBLEMS IN TRADITIONAL RANKINE CYCLE

In spite of the fact that Rankine Cycle is chosen as the power cycle however there are various issues which exist in traditional Rankine Cycle.

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- A Rankine cycle uses the water as working fluid and it doesn't allow productive recuperation of waste warmth beneath 370°C.
- One of the crucial issues of water is ought to be superheated in the Rankine Cycle. The superheating is imperative to ensure the idea of submerged water after the development in the turbine is dry.
- The nature of submerged water should not be underneath 0.88. Right when the quality is lower, dimension of vapor will be higher and deterioration in turbine front line will be at a higher rate.
- Due to low develop temperature, low weight, high unequivocal volume, tremendous turbine estimation required.
- High weight drops to transform into a high enthalpy drop thusly exorbitant multi sort out turbines required.

1.3. SOLAR ORGANIC RANKINE CYCLE

1. Organic Rankine cycle Uses Organic Working fluid instead of water. The Working fluid is pumped from low pressure to high pressure with help of a pump by isentropic compression process.

2. Thhigh-pressurere working fluid enters the Flat plate collector where it is changes it phase from liquid to vapor by absorption an external solar radiation at constant pressure process.

3. The super-heated vapor expand Isentropically through turbine which is coupled to generator to produce power output.

4. The vapor be admitted to condenser where it is change it phase to saturated liquid at constant pressure, this working liquid revert the pump and cycle replicates

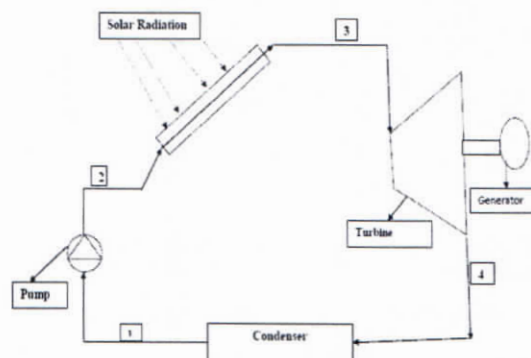


figure 1.1 Schematic of low emperature Solar organic Rankine cycle

Performance Analysis of Four Stroke CI Engine using Bio-Diesel

S. Nagendra, A.V.N.S. Kiran, B. Santosh Kumar, D. Swetha, S.M. Saleemuddin

Abstract: *With the decreasing trend of oil reserves and environmental changes due to burning of fossil fuels led to exploration of alternative energy sources for running vehicles. In regard to alternative energy, production of biodiesel will be the next choice for replacement of fossil fuels. It is well known fact that diesel engines when operated with biodiesels leads to lowering of global warming issues and emission levels. Second thing to note that biodiesel production should be cheap. In context to this edible and non edible oils combination for biodiesel production is a favorable choice. In the present work Biodiesel production using blends (coconut oil and cotton seed oil) is made from transesterification process and performance test is done on 4-stroke water-cooled diesel engine. It is noticed that coconut oil blend B10 is best alternative fuel and a replacement for diesel fuel in running 4-stroke water-cooled diesel engine.*

Index Terms: coconut oil, cotton seed oil, Diesel engine

I. INTRODUCTION

The achievement of every researcher is to reduce the exhaust emissions and increasing the performance and efficiency of an engine. The exhaust emissions are harmful to human life and nature. To overcome these problems the emission reduction techniques like alternative fuels, catalytic converters and by adding the chemicals to the fuels etc are implemented to the engines. Majorly the compression ignition engines are releasing the exhaust emissions like hydrocarbons (HC), carbon monoxide (CO), nitrous oxide (NO_x), to reduce the exhaust emissions by adding the alternative fuels with different proportions. Several researches has done there work on different alternative fuels and discussed. Yasutummi Yoshimot et.al (1999) took up the experimental work of operating a single cylinder diesel engine with emulsified frying oil.

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To reduce the viscosity, equal proportions of used frying oil and gas oil were mixed and emulsions of this blended fuel and water prepared. The BSFC of neat bio diesel was lower than with gas oil of high loads and retarded injection timings, while the smoke density was reduced at all operating conditions. It was concluded that using biodiesel emulsions at a rated output, the trade – off relation NO_x Vs bsfc and NO_x Vs smoke density have improved slightly over the gas oil emulsion. It was considered that reduction in smoke, emissions, air: fuel ratio is because of the oxygen included in the fuel [1]. Ramadhas A.S et. al (2005), has done experimental work on characterization and effect of using rubber seed oil as fuel in the C.I engines. Initially problems like high viscosity, poor atomization, carbon deposits were encountered. In order to overcome these problems rubber seed oil was blended with diesel in various proportions. It was concluded that acceptable brake thermal efficiency and specific fuel consumption were noticed with blends containing upto 80% rubber seed oil. It was considered that the carbon deposits in the combustion chamber of engine are higher in the case of rubber seed oil blends because of incomplete combustion of fuel [2]. Lucio postioti et. al (2003) have carried out experimental work on the injection strategies turning for the use of bio derived fuels in a common rail HSDI diesel engine. It was concluded that at full load and part load operations appreciable reductions in combustion noise, CO, HC emissions could be achieved with a proper choice of pilot injection duration without significant penalties in smoke, NO_x emission and brake specific fuel consumption. As far as the pilot injection timing is concerned, a significant sensitivity of CO, HC and combustion nose was observed, while FSN and NO_x were less markedly influenced by pilot injection timing [3]. Ralph McGill et .al (2003) have conducted an experimental work on emission performance of selected biodiesel fuels. In this work they used rape methyl ester in 30% and neat for the test. They have also used soy methyl ester in 30% blend and used vegetable oil methyl ester in 30% blend. They presented the results for regulated emissions as well as for aldehydes and composition of particulate matter, and polyaromatic hydrocarbons. During their works they saw the emissions such as NO_x, HC, CO and particulates are reduced [4]. Yu, C.W. et. al (2004) made investigations to determine engine performance and combustion analysis for waste cooking oil and diesel. It was observed that due to shorter ignition delay the premixed combustion phase of waste cooking oil was less intense than that of diesel. For waste cooking oil the peak pressures were 1.5 bar higher and occurred 1.1-3.8o earlier than diesel. He concluded that the energy released at the late combustion phase is higher due to heavier molecular weight material present in waste cooking oil.

FLEXURAL ANALYSIS OF SMART STRUCTURAL COMPOSITE

LAMINATES BY USING A NEW HIGHER ORDER THEORY

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ABSTRACT

The present article involved the enrichment of a higher order shear deformation theory especially for composite laminates embedded with piezoelectric materials under electro-mechanical loading. The main aim of the present investigation is to propose the analytical formulations and solutions to examine the flexural behavior of the laminated composite plates embedded with piezoelectric fiber reinforced composite by using a higher order theory. The assumed two models M1 & M2 are developed separately with individual higher order theories. The principle of virtual work is used in order to obtain the boundary conditions and the governing equations of equilibrium. The Navier's technique is involved in order to obtain the solutions. The results are tabulated and analyzed for different aspect ratios, voltages for the study of variation of in plane and transverse displacements and also the normal stresses and transverse shear stresses.

KEYWORDS: Smart Materials, Higher Order Shear Deformation Theory, Principle of Virtual Work & Navier's Technique

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1. INTRODUCTION

The conventional structures have no control over the induced deformation where as in smart structures the state of deformation is continuously monitored and has good control over its configuration of deformation. The latest development in the composite science is the piezoelectric materials are embedded to them in form of distributed sensors or actuators. It is really a good focus on the development of innovative materials in the field of material science engineering. Combining the properties of conventional composites with the intelligent materials like piezoelectric materials, bimetal alloys etc. results the generations of smart composite materials. The advanced engineering applications like air craft, aerospace, naval structures, rocket and missile technology, defense and war appliances etc. are always needed the smart or intelligent structural materials in their fabrication.

Laminated composite structures, with embedded piezoelectric actuators and sensors combines some of the superior mechanical properties of composites with the additional capabilities to sense deformations and stress states and to adapt their response accordingly. Piezo-laminates as smart-intelligent composites offer great potential for active control of advanced aerospace, nuclear, and automotive structural applications. Kant and Swaminathan [2002] are presented analytical solutions for the static analysis of laminated composite and sandwich plates based on a higher order refined theory. Shiyekar S. M., Tarun Kant [2011] are considered the higher order shear deformation effects on analysis of laminates with piezoelectric fiber reinforced composite actuators. P. Hemavathi, P. Veera Sanjeeva Kumar [2017] has investigated the Bending Analysis of Smart Composite Laminated Plates Subjected To Electro-Mechanical Loading Using HOSDT". Raju P.R., J. Suresh Kumar [2014] are presented a

Experimental Research on Improvement of Battery Reliability

G.V. Subbaiah, P.V.Sanjeeva Kumar, P.Hemavathi, Y.Suresh Reddy

Abstract: The heat control and maintenance of batteries is essential for effective operation of UPS in harsh environmental condition since battery working reliability, performance, durability and its economy is directly related to the environmental temperature and air flow around batteries. Therefore, ideally, batteries should be use within its comfortable temperature range to get its optimum performance. Compact design of Batteries in enclosed environments necessitates thermal management of the battery system for optimum life and performance. This invention proposes an efficient vapour compression refrigeration system to effectively cool the batteries and maintain optimum battery surface temperature of 25 °C for better performance and extended battery life at 40°C external ambient temperature. Moreover Silica gel based Solid desiccant wheel is used to absorb moisture from air so that condensation in the battery cabinet can be minimized. Computational fluid dynamics and heat transfer simulation was performed to devise a initial concept. Experimental validation of the prototype was made to verify simulation results and actual temperature distribution.

Index Terms: : UPS, Battery, Vapour Compression Refrigeration, RBC (Replicable Battery Cartridge).

I. INTRODUCTION

Competitive environment necessitates modular design for power circuit and battery. This provides a greater flexibility for user to upgrade the UPS system during its life time. Depending on the user requirement several battery modules are assembled within the metallic enclosure. This results in modules operating at different temperatures during charging/Discharging cycles. The change in Temperature from one module to other in a battery pack causes to changes in charge or discharge behaviour in respective module and which in turn to electric unbalancement of modules or packs, finally decreases the pack performance. The object of temperature management in the battery cabinet is to ensure a battery pack maintained at optimum average temperature (25°C) provided uniform temperature distribution. This helps increasing battery life and reliability of the charging and discharging operations. To evaluate the battery pack design heat transfer, fluid flow is used. The simulated CFD analysis results are validated through real time testing. Originally there was an assumption that the UPS is being operated in controlled environment. In developing economy, the situation is totally different. UPS is being operated in harsh environment and this resulted in more failures. Also within warranty, the batteries were getting replaced multiple times. This had incurred huge cost impact and predicted failure rate is currently greater than 100%.

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Ben Ye ,Md Rashedul H R et.al are investigated the temperature control and optimization of cooling plates for battery module for electrically operated vehicles [1]. The performance analyses of Li-Ion batteries are investigated under various thermal loads [2-4]. The situ method has used in order to analyze the performance characteristics batteries [5]. The latest progress and accurate state of charge conditions of Li -Ion batteries [6-7] are really helped to improve the reliability of battery in the present work. The technique of halogen conversion- interaction chemistry in graphite, Scalable Synthesis of Dual-Carbon and experimental examination of large capacity gives the good idea in order to improve the reliability of batteries [8-12].

1.1 Conceptual design

To evaluate the battery pack design and provide solution for battery thermal issues for harsh working environment, we have used heat transfer, fluid flow principles, CFD analysis and experimental thermal validation. Fig-1 shows integration of a Battery cabinet with cooler.

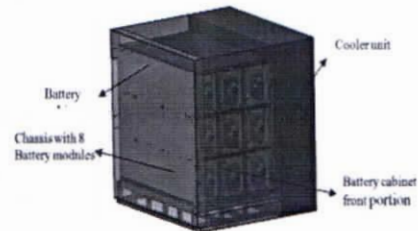


Fig -1: Integration of cooler with battery cabinet

1.2 Cooling Architecture

Vapour compression refrigeration system is attached to the side of the battery cabinet along with the desiccant dehumidification as shown in the Fig-2.

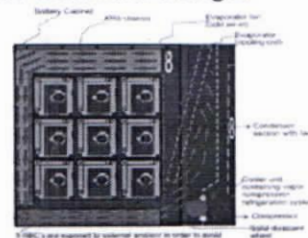


Fig -2: Battery cooler architecture concept

OPTIMISATION OF PROCESS PARAMETERS FOR MULTI-RESPONSE CHARACTERISTICS IN EDM OF H-11 ALLOY USING ANOVA AND TOPSIS

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ABSTRACT: In today's world manufactured product not only requires high precision and quality but also the same should be achieved in minimum time. EDM is recognised as most popular non-conventional machining process. EDM is used to machine tough materials which can't be machined using simple conventional machining process. The current work deals with the effect of material removal rate (MRR) and surface roughness with different input variables gap current, pulse on time, pulse of time during EDM of H-11 alloy using electrolyte copper were investigated. Experimental work is carried out with different combinations of process parameters. ANOVA and TOPSIS are used for correlating the process parameter with the responses and to analyse the significant of the desired model.

KEYWORDS: EDM, Material Removal Rate (MRR), Surface Roughness, ANOVA, TAGUCHI and TOPSIS.

I. INTRODUCTION

EDM is basically a non-conventional (or) non-traditional machining process. Non-traditional manufacturing processes is defined as a group of processes that remove excess material by various techniques involving mechanical, thermal, electrical or chemical energy or combinations of these energies but do not use a sharp cutting tools as it needs to be used for traditional manufacturing processes. Extremely hard and brittle materials are difficult to machine by traditional machining processes such as turning, drilling, shaping and milling. Non-traditional machining processes, also called advanced manufacturing processes.

In this electric discharge machining, the material removal happens due to thermal evaporation. EDM is used to machine very hard materials and prepare difficult shapes. Electric energy is used to propagate electric spark to remove the excess material. EDM depends on the potential difference and gap between tool and work piece and the spark is developed. Tool is connected to the negative (-ve) terminals of the generator, and the work piece is connected to the positive (+ve) terminals of the generator. Dielectric fluid plays the major role in the electrical discharge machining. Kerosene is generally used as dielectric medium and for this experimentation, kerosene is taken as dielectric fluid. This Dielectric fluid contains oxygen free machining and provides low tool wear, high accuracy and better surface quality.

EDM process involves in various applications like extrusion and forging of dies, high stressed steel parts like helicopter rotor blades, arresting hooks etc.

Input parameters were current, pulse on time and pulse off time shows a greater influence on MRR and Surface Roughness. In which current has more influence on MRR by increasing the current increases the MRR also increases the surface roughness, pulse on time is directly proportional to material removal rate or vice versa the greater the pulse on time increases the material removal rate and the pulse off time states cycle is completed when sufficient pulse off time is allows before the start of next cycle. Pulse off time will affect speed and the stability of the cut. In theory, the shorter the off time the faster the machining operations, if the off time is too short, discharged work piece material is not swept away by flow of dielectric.

II. LITERATURE REVIEW

Aditya Kumar [2015] achieved the parametric analysis of EDM. A mathematical model was developed for expected optimization by genetic algorithm. In which the optimum conditions of the process parameters, the pulse off time is more effected parameter on MRR with help of genetic algorithm. Kodlinge and Khire [2014] had presented in detailed investigation in MRR of Tungsten Carbide for EDM operation using Kerosene as dielectric medium. ric analysis of EDM. A mathematical model was developed for expected optimization by genetic algorithm. Mikhail Kliuev and Konrad Wegener [2019] was studied Influence of energy fraction in EDM drilling of Inconel 718 by

MECHANICAL PROPERTIES AND MORPHOLOGY OF POLY (LACTIC ACID) (PLA) WITH DIFFERENT FLEXIBLE COPOLYMERS

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ABSTRACT

Poly (lactic acid) (PLA) blended with acrylonitrile-butadiene styrene (ABS) and natural biodegradable tapioca cassava starch powder (NBTCSP) the weight ratios on the properties of blends, the blends films were prepared by using a twin-screw extruder and semi-automatic compression molding machine. The mechanical and morphological properties of samples were investigated by tensile test, flexural, compressive, impact test and scanning electron microscope (SEM), respectively. It was found that the tensile strength of PLA/ABS (45/45/ wt %) blend composite was about 31.50 MPa in the absence of natural biodegradable tapioca cassava starch (NBTCSP), and it increased to 28.66–32.90 MPa in presence of natural biodegradable tapioca cassava starch powder (NBTCSP) at 10 wt%. The flexural value of PLA/ABS (45/45/ wt %) blend composite was about 31.50 MPa in the absence of natural biodegradable tapioca cassava starch powder (NBTCSP), and it increased to 28.66–32.90 MPa in presence of natural biodegradable tapioca cassava starch powder (NBTCSP) at 10 wt%. The SEM images showed good interface and distribution for PLA containing 47.5 wt% ABS, 5 wt% (NBTCSP) and 45 wt% ABS 10 wt% (NBTCSP)

KEY WORDS: Poly (lactic acid) (PLA) blended with acrylonitrile-butadiene styrene (ABS) and natural biodegradable tapioca cassava starch powder (NBTCSP) and SEM analysis.

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<http://www.iaeme.com/IJMET/issues.asp?JType=IJMET&VType=10&IType=01>

Design and Fabrication of Motorised Stair Case Climbing Trolley

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Abstract

Despite rapid changes in the way the things are being manufactured, we are still used to the age of techniques of manufacturing. The reasons are multifold ranging from inertia, rejection of the new technologies, lack of engineering aptitude, lack of skill & technical know-how and most importantly fear of losing employment opportunities. This project aims at developing a mechanism for easy transportation of heavy loads over stairs. The need for such a system arises from day-to-day requirements in our society. Devices such as hand trolleys are used to relieve the stress of lifting while on flat ground. However, these devices usually fail when it comes to carrying the load over short fleet of stairs. In the light of this, the project attempts to design a stair climbing hand cart which can carry heavy objects up the stairs with less effort compared to carrying them manually. In present project, the trolley is equipped with Tri-Star wheels which enable us to carry load up and down the stairs and also eases the movement of trolley in irregular surfaces like holes and bumps.

Keywords: Tri-Star wheel, Wheel frame, Hybrid stepped motor, Step angle, Step length.

INTRODUCTION

Stair Climbing is a key functionality desired for robots deployed in Urban Search and Rescue (USAR) scenarios. A novel compliant modular robot was proposed earlier to climb steep and big obstacles. This work extends the functionality of this robot to ascend and descend stairs of dimensions that are also typical of an urban setting. Stair Climbing is realized by equipping the robot's link joints with optimally designed passive spring pairs that resist clockwise and counter clockwise moments generated by the ground during the climbing motion.] Sonukumar Krishnaprasad Singh et.al[2017] are presented a paper on Design & Fabrication of semi-automatic stair climbing trolley. P.JayPraveenraj et.al.[2016] are given the modifications in the trolley design of their paper on Design and Fabrication of stair climbing trolley. M.M.Mogaddam and M.M.Dalvand [2005] have submitted a paper on Stair climbing mechanism for Mobile Robots. A.S.Shriwaskar and S.K.Choudary[2013] are presented an article on Synthesis, Modeling, Analysis and Simulation of stair climbing mechanism. M.-S. Wang and Y.-M. Tu, [2008] are presented a paper on the Design and implementation of a stair-climbing robot. Q. Zhang, S. S. Ge, and P. Y. Tao [2011] are considered Autonomous stair climbing for mobile tracked robot in their project to develop the robotics . Murray J. Lawn [2003] has investigated the Modeling of a stair-climbing wheelchair mechanism with high

single-step capability. Luc Jaulin [2007] are presented a paper on the Control of a wheeled stair-climbing robot using linear programming. Sri Harsha Turlapati [2015] are submitted an article on Stair Climbing Using a Compliant Modular Robot. Md. Farhad Ismail [2012] are proposed the Fabrication of a Stair Climbing Vehicle for Industrial and Rescue application Using Appropriate Technology in their article. Jinguo Liu [2005] are presented a paper in proceedings on Analysis of Stairs-Climbing Ability for a Tracked Reconfigurable Modular Robot.

THEORY & COMPONENTS

In day-to-day life we need to carry some goods and objects through stairs especially in offices, schools, colleges, hotels, industries, apartments etc. where the lifts may not be available, may be crowded with people or under repair .It is difficult to carry various objects through stairs manually for higher floors. A stair climber is a type of trolley fitted with rotating wheels or tracks so that it can be pushed or pulled up or down steps or a stairway. Stair climbers can be manual or battery-powered, and are commonly found in wheel, track, and push arm or walker variants.

Tri-Star Wheel

The Tri-Star wheel was designed in 1967 by Robert and John Forsyth of the Lockheed Aircraft Corporation. They were first developed as a module of the Lockheed Terrastar, a commercially unsuccessful amphibious military vehicle. A Tri-Star wheel functions as an ordinary wheel on flat ground, but has the ability to climb automatically when an impediment to rolling is encountered. This wheel design consists of three tires, each mounted to a separate shaft. These shafts are located at the vertices of an equilateral triangle. The three shafts are geared to a fourth, central shaft (to which a motor may be attached). When geared in this quasi-planetary fashion, these triangular sets of wheels can negotiate many types of terrain, including sand and mud; they can also allow a vehicle to climb over small obstructions such as rocks, holes, and stairs. The wheel assembly may be gear-driven, with two wheels in rolling contact with the ground. The third wheel idles at the top until the lower front wheel hits an obstruction. The obstruction prevents the lower front wheel from moving forward but does not affect the motion of the driving axle. This causes the top wheel to roll forward into position as the new front wheel. This wheel usually lands on top of the obstruction and allows the rest of the assembly to vault over the obstruction. Tri-Star wheel in motion is shown in figure2.1.