International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

DESIGN AND FABRICATION OF SOLAR POWER TRICYCLE WITH ADJUSTABLE SEAT

Ranjeet Kumar[1], Md. Sharafat[2], Pankaj Sah[2], Surya Mohan Sharma[2], Pappu Chaudhary[2], Dr. V.VijendraKumar[3], Dr. K.S Badrinarayan[4]

[1]Research Scholar, Department of Mechanical Engineering, M S Engineering College, ranjejas@gmail.com

[2]UG Scholar, Department of Mechanical Engineering, M S Engineering College, ppankaj179@gmail.com

[3]Professor and H.O. D Department of Mechanical Engineering, M S Engineering College, vijendravk@gmail.com

[4]Professor and Principal, M S Engineering College, Principal@msec.ac.in

ABSTRACT

The main goal of the project is to bring increased mobility to handicapped people. Tricycle is a very economic means of short distance travelling both in city and village. Solar plays a vital role in our day to day life. We have developed the solar tricycle for handicapped person can't sit on the seat by their own effort. Solar tricycle will help to reduce the effort of handicapped person. All the designs specification considered after analysing the problems from the handicapped person. Comfort of the person in the tricycle is an important and we have given importance to it. The main content of the tricycle is Solar PV panel, Brushless DC motor with 250 W, 12 V, Charge controller, battery, braking, steering system and the entire component through the reduced human effort.

1. INTRODUCTION

The solar power operated tricycle is used to mobility from one place to another place and mostly handicap person are using tricycle. Handicapped people depend on only tricycle to travel a long distance in daily basis.

There are three types of tricycle - paddle tricycle, motorized tricycle, and electric tricycle. First, paddle tricycle needs a lot of energy to paddle the tricycle. The user will be tired after used the tricycle. Second, motorize tricycle; fuel is used to run the engine that is costly and not eco-friendly.

Third one Solar powered vehicle use photovoltaic cell to convert solar rays into electrical energy. The electricity goes either directly to an electric motor powering the vehicle, or to a special storage battery. PV cells produce electricity only when the sun is shining. Without sunlight, a solar powered tricycle depends on electricity stored in its batteries.

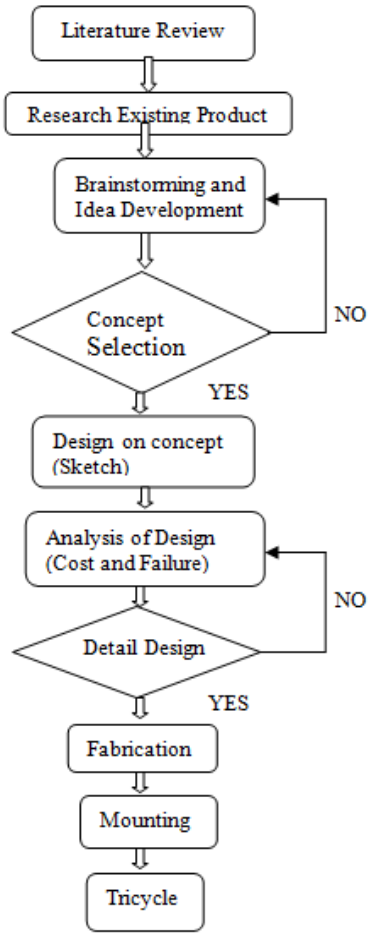
This project work is designed for those handicapped people who can't sit on the seat by own effort. Adjustable seat is provided to sit on seat by own effort and able to drive the tricycle. After driving the tricycle, handicapped person comes down to ground level and easily can get down from tricycle without taking any help from others.

2. OBJECTIVE

To solve the handicapped problem like moving one place to destination place, we have developed better technology. To make it success, there are many thing that we need to know how to run prime mover, how to fit adjustable seat, how to store electricity and give more output in new vehicle. In that case, these are the list of the objective to be conduct before continue to proceed on this study:

- To develop a tricycle with adjustable seat,
- To develop a tricycle that use renewable energy, environmentally friendly and cheap.
- To develop an electrical tricycle that can charge the battery when it is not in used.
- To develop low speed tricycle, but for a longer distance.
- Cost of tricycle does not exist to Rs 20000.

3. METHODOLOGY



4. DESIGN CALCULATIONS

4.1 MOTOR

The total weight of the tricycle is 150 kg (including person).

Power (watts) =Total weight x g speed x gradient

Where,

Total weight = 150 kg

Speed = 10 kmph = 10x5/18 m/s

Gradient = slope (assume 3%)

Power = 150 x9.81 x10x5/18x0.03

=122.62 watt

Therefore power required approximately is 125 watt.

Thus a 12 Volt, 125 W motor will be run the tricycle.

4.2 Battery

System voltage = 12 Volt,

Load current = 125W/12V = 10.41A

Estimate 2 Hours of tricycle running per day

Load current = 2 x 10.4 x 1.2 = 25 Ah/day

Assume 20% overall losses,

Size of the battery = 25 x 1.2 = 30Ah/day,

Energy required for 125 W motor = 30 Ah x 12 V

= 360 Wh/day.

Therefore 30 Ah/day, 12 Volt power is required for the system which can be supplied with the help of 12 Volt battery of 30 Ah/day.

Charging time: To calculate charging time needed to charge the battery of 35 Watt, 12 Volt solar chargers,

Ampere per hour = 35 W/12 V

of the charger = 2.9 amp

Therefore = 7 amp hour/2.9 amp

= 2.4 hours of direct sunlight.

4.3 Solar panel

Commercially available single solar cells normally have the dimensions of (3" x 6"), (10cm x 10cm) solar etc. A (10cm x 10cm) solar cells electricity output is likely rated at 0.50 to 0.55 volts with 3 to 3.3 amps. Here, in the module, 36 cells are connected (in series) together so that in all operating conditions a PV module gives well above 12 volts, which is the required to charge a 12 Volts battery.

Design of solar beam radiation:

A solar tricycle which is placed on Wardha made of angle beam radiation on may 1 at 9.00am (local apparent time) the solar panel is located in Wardha (28 degree 35'N 12E). It is tilt an angle of 36 degree with horizontal and is pointing done in south for this h=0.

Where, h= the surface incident angle on may 1, n=121.

= 23.45 sin [360/360 x (284 +121)

= 16.50 degree

At 9.00am (local apparent time)

W= 45 degree substitute in equation of inclination surface facing due south h=0 degree

Cos Q = Sin14.90deg sin(28.58deg-36deg) + (cos14.90deg x cos45deg x Cos(28.58 deg-36deg)

CosQ=0.644

Q=48.90degree

4.4 Design of shaft

An electric power shaft transmits to 125 Watt power at 55rpm to find out design of shaft with assuming suitable material.

Power=125 Watt, N=55rpm

Torque = pi/16 x t d^3

P=2PiNT/60

0.125=2 x Pi x 55 x T/60000

T=21.7 Nm

T=21.7x1000Nmm

For solid shaft

Assuming material of shaft-

SAE = 1023

Sut = 527, Syt = 296

Tmax<0.3syt

=0.3x296

=88.8Mpa

Or

Tmax<0.18

=0.18x527

=94.86

Taking Tmax = 88.8N/mm^2 (without keyway)

Tmax = 88.8 x0.75

=66.6 N/mm^2

Diameter of shaft:

Torque = Pi/16xTxd^3

21.73x1000=Pi/16x66.6xd^3

D=12.23mm

Considering bending stress develop on a shaft therefore diameter of shaft will be increased by 50%

d=12.23+1.5

d=17.23mm

d=18mm(standard diameter for shaft)

4.4 design of break poer

The torque is measured by the tachometer device is 7.65N/mm

BP = 2 Pi N T/60

BP=2xPix55x21.73/60

BP = 125W

5. DESIGNED AND FABRICATED PART:

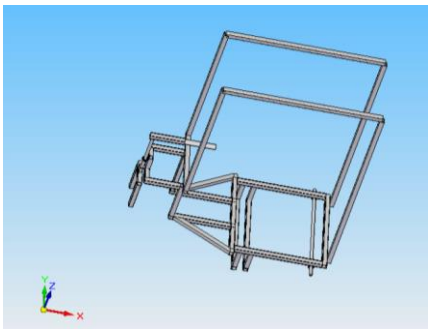


Figure-1 3 D Modeling of Tricycle

Figure-2. Fabricated Handicapped Tricycle

5. RESULT

Speed measurement

We have used the android application to measurement the speed of the solar tricycle. Maximum speed, minimum speed, and average speed are measured by this application. We have considered two places in different trial runs.

Results of the trail run

Sl. No.	Trip	Distance	Time Taken	Average Speed	Maximum Speed
1.		1.7km	3.40 min	12.81 kmph	20 kmph
2.		6.5km	40.12 min	11.35k mph	20 kmph

The total charging time with electrical source 2.4 hrs

6. CONCLUSION

This solar tricycle successfully developed as per the design for disabled community. The max load that it can easily sustain is 100 kg of weight. It consumes 0.5 Kw / Km. This tricycle is cheaper, simpler in construction & can be widely used for

short distance travelling. It is very much suitable for young, aged, handicap people and caters the need of economically poor class of society. It can be operated throughout the year free of cost. It is eco-friendly & pollution free, as it does not have any emissions. Moreover it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather. This solar power assisted tricycle is working with a reasonable speed with less fatigue to the rider. The solar panel mounted above provides shade as well as power. The parking place for solar powered vehicle does not require a shed.

The battery can be charged even during riding the tricycle. This ensures continuous energy input to the tricycle without any additional cost.

The average and maximum speed was obtained as 12.8 kmph and 20 kmph respectively. Various vehicles of same category available in India was compared for different Parameter and it was concluded that solar tricycle proved to a complete blessing to the disable community compared to other vehicle using various sources of energy.

REFRENCES

[1]. Prof. Palak Desai*, Prof. Darshan Kapadia*, Tank Nikunj, "DESIGN AND FABRICATION OF SOLAR TRI CYCLE", IJESR , ISSN: 2277-9655, June, 2016

[2]. S. Devaneyan," Solar Powered Electric tricycle for Physically Challenged Person",International Journal of Science, Engineering and Technology Research (IJSETR) Volume 5, Issue 12, December 2016

[3]. Snehal G. Bali, " Fabrication of Solar Powered Tricycle for Handicapped Person "IJIRST, March 2015, ISSN (online): 2349-6010

[4]. Abhishek K, Pratik Dhote "Literature Review on Solar Powered Tricycle for Handicapped Person" IJIRST –International Journal for Innovative Research in Science & Technology| Volume 1 | Issue 10 | March 2015 ISSN (online): 2349-6010

[5]. Rajendra Beedu," DESIGN, DEVELOPMENT AND PERFORMANCE EVALUATION OF SOLAR POWER ASSISTED TRICYCLE" IJRET, Volume: 04 Issue: 07 | July-2015.

[6]. Fiyanshu Karla, Aniket Jana, Saibby Singh, S.Shakthivel," Design and Development of Solar Assisted Hybrid Tricycle",JCHPS- ISSN: 0974-2115

Ranjeet Kumar *is working as an Assistant Prof. in Mechanical Engineering Department of MS Engineering* College *Bangalore. He has guided many UG Projects. His area of interest is CAD/CAM, FEA & Composite Materials.*

Md.Sharafat is pursuing the BE in Mechanical Engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest ***on Solar Power Tricycle with Adjustable Seat.***

Pankaj Sah is pursuing the BE in Mechanical Engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on ***Solar Power Tricycle with Adjustable Seat.***

Pappu Chaudhary *is pursuing the BE in Mechanical Engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on* ***Solar Power Tricycle with Adjustable Seat.***

Surya Mohan Sharma is pursuing the BE in Mechanical Engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on ***Solar Power Tricycle with Adjustable Seat.***

Dr. Vijendra Kumar, *Professor and Head, Department of Mechanical* Engineering, MSEC, Bangalore, India *Experience: 23Years Specialization: Design and CFD*

Dr.K.S.Badarinarayan is principal of M S Engineering College, Bangalore. He is having 28 years of academics and industrial experience including 6 years of research experience. He has presented many journal papers in international and national conferences. His area of interest is Flexible manufacturing system scheduling.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

SOLAR POWER LED STREET LIGHT WITH AUTO INTENSITY CONTROL

Kushal Kumar G[1], Himanshu Kumar Shukla[2], Rajeev Kumar[3]r, Hemanth Kumar B[4], Dheeraj Kumar[5], Dr V.VijendraKumar[6], Dr. K.S Badrinarayan[7]

[1] Assistant Professor, Department of mechanical engineering, M S Engineering College, kushala77@gmail.com

[2]U G Students , Department of mechanical engineering, M S Engineering College, shukla.himanshu38@gmail.com

[3]U G Students , Department of mechanical engineering, M S Engineering College, rajeevranjan5121993@gmail.com

[4]U G Students , Department of mechanical engineering, M S Engineering College, hemanthkb271094@gmail.com

[5]U G Students , Department of mechanical engineering, M S Engineering College, dheerajkant95@gmail.com

[6]Professor and H.O. D, Department of mechanical engineering, M S Engineering College,vijendravk@gmail.com

[7]Professor and Principal, M S Engineering College, principal@msec.ac.in

ABSTRACT

Due to rapid increase in urban sector in India large volume of energy is required. And also we know that the crisis of water resources is rapidly increasing at a very high rate, due to less rain than expected. Fossil fuels are also decreasing due to extinction. So to fullfilenergy requirement, Renewal Energy in the form of Solar Energy which is presently used in urban sector of India. To provide street light system is one of the responsibilities of a country. This Project paper gives the basic ideas about the control the intensity of street light by the programmable micro controller to reducing the intensity as well as save the energy, as a result the programmable micro controller was engaged to provide different intensity at different condition.

A charge controller circuit is used to control the charging of the Li-ion battery, and an LDR(Light Dependent Resistance) is used to sense the ambient light on day time.LED (light emitting diode) are switched ON in dusk and OFF at dawn of the night automatically using D2D (Dusk to dawn) switch. Now days LED is replacing HID so the intensity can be control by Pulse with modulation. A PIR (Passive infrared detector) Sensor is used to sense the moment as well as the heat of living thing passing near it.This Project paper gives the basic ideas about the control the intensity of street light by the programmable micro controller to reducing the intensity as well as save the energy, as a result the programmable micro controller was engaged to provide different intensity at different condition.

1. INTRODUCTION

The project is designed for LED based street lights with auto intensity control using solar power from photovoltaic cells. As awareness for solar energy is increasing, more and more individuals and institutions are opting for solar energy. Photovoltaic panels are used for charging batteries by converting the sunlight into electricity. A charge controller circuit is used to control the charging and prevent the battery to overcharging from the solar panel.

Battery charger should have over voltage protection, short circuit protection and reversed polarity protection. Intensity of street lights is required to be kept high during the peak hours. At late night intensity of light should be max after some time the intensity can be reduced progressively till morning to save energy. Thus finally it completely shuts down at morning 6, and again resumes at 6 pm in the evening. The process repeats every day.

The microcontroller contains programmable instructions which controls the intensity of street lights based on the PWM (Pulse width modulation) signals generated. To generate PWM signal at different time we used RTC.

Real-time clock (RTC) counts seconds, minutes, hours, date of the month, month, day of the week, and year with leap-year. RTC will consume power from microcontroller.

From the dusk with full intensity till 12pm and after that intensity will reduced to 50% till 6pm and and finally OFF at the dawn. We are using PIR sensor which detect the heat and movement nearby light. When anything passes under the street light again its glow at full intensity. After 50 second its intensity again drop down to 50%.

LED lights are the future of lighting, because of their low energy consumption and long life they are fast replacing conventional lights world over. Hence we used LEDs to control the intensity of light.

2. OBJECTIVE

The aim of the project is to save the energy or power, used in places like street where lighting is very important for the people who travels. So, the street will be well illuminated with many street light.

At the same time when people are not present at a particular place the lighting can be made dim at 50% by using Dimmer and when people come to that area, according to the PIR lighting can be made sufficiently brighter.

To provide a better solution to minimize the electrical energy wastage in operating street lights.

The major objectives of this solar street light have promoted the reducing the use of electricity as street light and increase the using of new technology of renewable energy sources.

3. METHODOLOGY

This circuit consists of a Solar Panel, charge controller circuit, LED lights, PIR sensor and Li-ion battery which is charged by the solar panel.

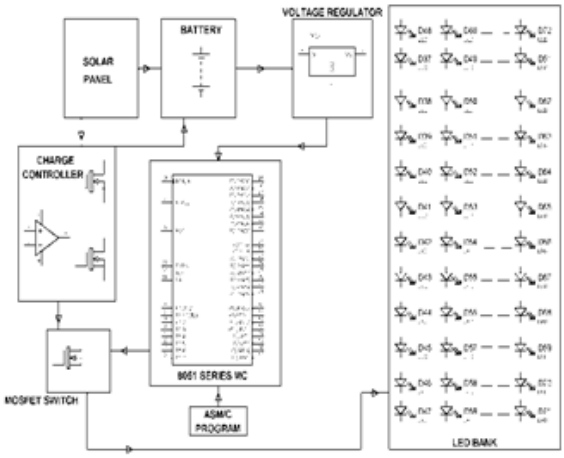
A PIR (Passive infrared) sensor works on the principle, when any living moving object passes through it, it detect the body temperature. An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor.

During Day time battery charge through the solar panel (Photovoltaic cell). When ambient light is not enough, LED's will switch on automatically.

During deep night, If there is any motion near to the street light as detected by PIR sensor all LED's will glows with 100% brightness.

If there is no motion near to the light for more than 30 Second then LED's will reduce brightness to 50%, resulting long life battery.

4. BLOCKDIAGRAM



5. EXPLANATION OF EACH BLOCK

Solar Panel: A solar panel is a collection of solar cells. The solar panel converts the solar energy into electrical energy. Output of the solar panel is its power which is measured in terms of Watts or Kilo watts. Solar power uses multiple reflectors to collect more sun's thermal energy. Thermal energy collected through the day to perform different operations. Performance of the solar panel depends

on a number of factors like climate, conditions of the sky, orientation of the panel, intensity and duration of sunlight and its wiring connections. Charge controller circuit: If the battery voltage is below 12V, then the current from LM317 IC flows to the battery. The current flow to the battery stops when the battery voltage rises to 13.5V. Hence charge controller circuit will prevent the battery to flow high current through it.

Rechargeable Battery: A rechargeable battery, storage, secondary battery or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. Several different combinations of electrode materials and electrolytes are used, including lead–acid, nickel cadmium (NiCd), nickel metal hydride (Ni-MH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer)..

Voltage Divider circuit: A voltage divider is a simple circuit which turns a large voltage into a smaller one. Using just two series resistors and an input voltage, we can create an output voltage that is a fraction of the input.

ASM/C Program: Micro-controller will control the intensity of light at different time slots. Micro controller circuit will generate PWM waves at a particular time using RTC (Real Time Clock) these system provide sets of digital and analog Input and Output pins that can be interfaced to the street light circuit. Operating voltage of program is 5v.

6. WORKING

This automatic battery charger circuit design mainly involves two sections – power supply section and load comparison section.

If the battery voltage is below 12V, then the current from LM317 IC flows through the resistor and diode to the battery. At this time zener diode will not conduct because battery takes all the current for charging.

When the battery voltage rises to 13.5V, the current flow to the battery stops and zener diode gets the sufficient breakdown voltage and it allows the current through it. Now the base of the transistor gets the sufficient current to turn on so that the output current from voltage regulator is grounded through the transistor. As a result Red LED indicates the full of charge.

7. MODLING AND FABRICATION

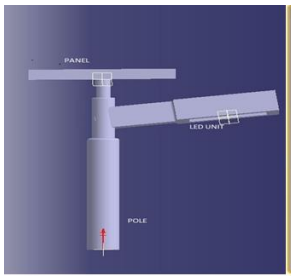


Figure-1 3D Modelling solar street light

Figure-2 Fabricated solar street light

8. POWER CONSUMPTION

If we are using 200W HID, 12hrs per day for street light.

Power consumption:

Watt per day

200×12 = 2400W-h/day

2400/1000 = 2.4Units/day

Consumption per month

2.4 Units ×30=72 Units / month

Consumption per year

2.4Units×365=876kW/year

COST

Commercially Rs. 4.60/unit (According 2016-2017 commercial tariff) :

Amount per day, Rs. 2.4×4.60=11.04

Amount per month, Rs. 72×4.60=331.2

Amount per year, Rs. 876×4.60=4029.60

If we are using 75W CFL×12hrs per day for street light.

Power consumption:

Watt per day 75W×12=900W-h/d

900/1000= 0.9 Units /day

Consumption per month 0.9 Units ×30=27 Units /month

Consumption per year 0.9 Units ×365=328.5 Units /year

COST

Commercially Rs. 4.60/unit (According 2016-2017 commercial tariff):

Amount per day, Rs. 0.9×4.60=4.14

Amount per month, Rs. 27×4.60=124.2

Amount per year, Rs. 328.5×4.60=1511.10

Power consumption of Solar street light

In conventional solar street light for 6W×12hrs. :

Consumption per day 6W×12=72W-h/day

72/1000= 0.072Units/day

Consumption per month 0.072×30=2.16 Units /month

Consumption per year 0.072×365=26.28Units/year

But if we are using LED street light with auto intensity control system

From 6 O'clock to 12 o'clock at night light will be on full intensity

Power consumption 6×6 = 36W-h

Between 12 o'clock to 6 o'clock at morning maximum 1 hour light will be on full intensity and remaining period will be on 50%. Then

Total power consumption 36+6+ (5×3) = 57W-h/day

57/1000 = 0.057Units/day

Consumption per month 0.057×30=1.71Units/month

Consumption per year 0.057×365=20.8kWh/year

COST

Cost of power consumption in LED Street light with Auto intensity control:

Amount per day, Rs. 0.057×4.60=0.31

Amount per month, Rs. 1.71×4.60=7.86

Amount per year, Rs. 20.8×4.60=95.70

As we can observed, we are saving Rs. 3933.9 per year from HID lamp And Rs. 1415.41 per year than CFL street light.

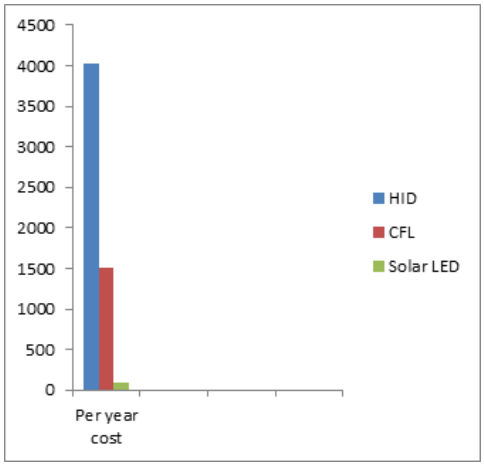


Figure-3 Graph of consumption cost per year

RESULT

Hence it's completely automatically and no one need to operate the street light like switch ON and OFF. By this system we can save more electrical energy which is using as HID street lights now days. By using of Li-ion battery, High life span of battery and free from maintenance.

CONCLUSION

Solar energy is best renewable energy available in the nature which is available freely and in infinite amount. It is also very environment friendly and emits zero pollution.

Where conventional street light consume high amount of electrical energy and these are not environment friendly, because they emits hazardous gases to the atmosphere. Its initial installation cost is bit high then other conventional street lights but saving of energy and energy cost is very high.

REFRENCES

[1]. Performance Improvement of Solar PV Panel Using Reflectors and Bi-Axial Tilting Mechanism, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 27-31

[2]. Photovoltaic and Solar Energy, Vol. 2, Authors: Derek Nalley and Scott Pinegar, Owner: National Renewable Energy Laboratory.

[3]. Smart Streetlight Using IR Sensors, IOSR Journal of Mobile Computing & Application (IOSR-JMCA), Volume 3, Issue 2. (Mar. - Apr. 2016)

[4]. Design and Implementation of Automatic Street Light System using Light Dependent Resistor, International Journal of Engineering Trends and Technology (IJETT) – Volume 35 Number 10 - May 2016

[5]. Solar Powered LED Street Lighting with Auto Intensity Control, International Journal of Scientific & Engineering Research, Volume 7, Issue 7, July-2016 34 ISSN 2229-5518

[6]. Automated Light Control System For Offices, International Journal of Engineering Sciences & Emerging Technologies, Jan. 2015. ISSN: 22316604 Volumes 7, Issue 4.

[7]. An Intelligent Automation Control on Electrical Equipments Using Internet of Things, Sixth International Conference on Emerging trends in Engineering and Technology (ICETET'16) www.ijera.com ISSN: 2248-9622, pp.35-38

[8]. A Noval Approach In Smart Street Lighting Control System, Pak. J. Biotechnol. Vol. 13 (Special Issue On Innovations In Information Embedded And Communication Systems), Pp. 469- 473 (2016).

[9]. Solar photovoltaic electricity: Current status and future prospects, T.M. Razykov, C.S. Ferekides, D. Morel, E. Stefanakos, H.S. Ullal, H.M. Upadhyaya, ScinceDirect, Solar Energy 85 (2011) 1580–1608, 3 January 2011.

[10]. Advancements in Solar based LED Street light, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 5, May 2013.

[11]. Survey on Street Lighting System Based On Vehicle Movements, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization), Vol. 3, Issue 2, February 2014.

[12]. A Study Of Solar Street Light And Optimization For Spacing In Poles And Cost, Abhinandan Sharma, Prof. (Dr.) B. K. Sharma, 3hari Singh, Bhanu Pratap Singh, ISSN: 2348-4098, Volume 2 Issue 7 Sep-Oct 2014.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

OPTIMIZATION OF PROCESS PARAMETER FOR AUSTENITIC STAINLESS STEELS USING CONVENTIONAL METHOD

Guruprasad H M [1], Chandra Prakash Yadav G N [2], Mahanth L [3], Harshith V [4], Rajiv Ranjan[5], Prakash A M[6], Dr. V. Vijendra Kumar[7], Dr.K S Badarinarayan[8]

[1]Student, Mechanical engineering Department, MSEC,Bengaluru, India,gurugp08@gmail.com
[2]Student, Mechanical engineering Department, MSEC,Bengaluru, India,Chandraprakashyadv93@gmail.com
[3]Student, Mechanical engineering Department, MSEC,Bengaluru, India,mahanthreddy4@gmail.com
[4]Student, Mechanical engineering Department, MSEC,Bengaluru, India,harshithamay@gmail.com
[5]Assistant Manager, DMRC department, BEML, Bangalore, India, rajiv.ranjan1109@gmail.com
[6]Assistant Professor, Mechanical engineering Department, MSEC, Bengaluru,India, Prakash.smr@gmail.com
[7]Professor& HOD, Mechanical engineering epartment,MSEC,Bengaluru,India,vijendravk@gmail.com

ABSTRACT

Resistance Spot welding (RSW) is a major welding process widely used in automobile manufacturing industries.RSW is a process of joining metal sheets by the application of heat and force. This paper emphasizes on parameters affecting RSW joint of 3 sheets. As we chosen AF grade material for welding, it leads to challenges regarding aesthetic look, providing required tensile shear strength and nugget diameter unlike in A grade welding. The process is further complicated by the introduction of three sheet lap joint weld for the high strength. We followedconventional trial and error method to select process parameter for welding. Used flat tip to give the weld aesthetic look. And the welded samples are tested for macro section test and tensile shear strength.

I. INTRODUCTION

Resistance spot welding is a process in which contacting metal surfaces are joined by the heat obtained from resistance to electric current. Many process parameters like current, pressure and weld time play a very important role in spot welding. Spot welding of 3 sheets (Austenitic stainless steel) has to overcome many challenges compared to 2 sheets as to obtain required nugget diameter and tensile strength. The current flows through the sheets from one electrode to the other, and the resistance to this flowing current generates heat. A temperature is reached where the metal sheets fuse at the faying surfaces and a molten region is generated at the centre. As the current shuts off, the melt rapidly solidifies by supplying coolant, forming a solid nugget. Section test and tensile shear test have to be conducted to check the strength and quality of the weld.

Austenitic stainless steels are the most specified grades produced because of their excellent formability and corrosion resistance. All 200 and 300 series steels are austenitic and contain15% to 30% chromium and 2% to 20% nickel for enhanced surface quality, formability and increased corrosion and wear resistance. They are non-magnetic in the annealed condition and depending on the composition, primarily the nickel content, they become slightly magnetic when cold worked. Selecting the right stainless steel grade for a specific

RSW process is vitally important in order to achieve a sustainable solution.

II. PROCEDURE: In this RSW process, the current flows through two electrodes, one of them is flat electrode to get aesthetic look. Three sheets of austenitic stainless steel are held together and placed between the two electrodes. As the current flows through the electrodes to the material, molten metal is formed at the center of joint by the application of resistance. The coolant is passed through the electrode to solidify the molten metal. Thus proper nugget is formed and joint is created between the three sheets.

Conventional trial and error method is employed to select the important process parameter such as current, pressure and weld time.

III. PROCESS

A. Preparation of test specimen

1) *Laser Cutting:*Initially 3mm Austenitic stainless steel metal sheet is cut to small pieces.

Required dimensions are

- Length=140mm
- Breadth=40mm

B. Macro test for spot weld joint:

Scope: The method of macro test for spot welded joint of metallic materials not more than 5mm in plate thickness.

Joint Type: Lap joint of 3 Test pieces. The shape of test piece shall confirm to table 1 and figure 1.

*Macro test method:*Test should be done on the section vertical to the surface of the plate. Cut off the section passing through 60% of nugget diameter length of spot weld by suitable means e.g. using cutting machine, followed by polishing & etching. After this the etched sample is taken for drying and then to microscope for further inspection like nugget diameter, penetration and defects if any like blowhole, internal weld crack etc.

Explanation:

Abrasive cutting: First the specimen is marked on the welded spot. Marking should be done in such a way that it should be the nearest chord to the diameter around 60% of nugget diameter. So when we cut the test specimen we should get the diameter of weldment.

Table 1

Nominal thickness of plate (?)(mm)	W (mm)	L (mm)
Under 0.8	20	75
0.8 to 1.3	30	100
1.3to 2.5	40	125
2.5to3.5	40	140
3.5to 4.4	50	150

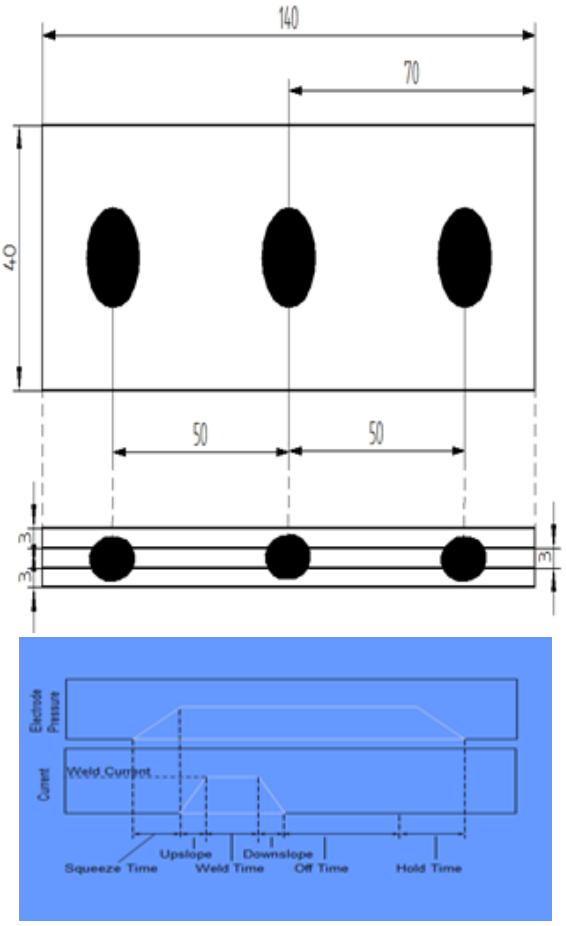


Figure 1

Cutting Wheel Specification:

250×1.5×31.75

A60 P6 PA

Bond - A

Grit/grain size - 60 µm

Coolant - P6

Outer diameter -250 mm

Bore diameter - 31.75 mm

Thickness - 1.5 mm

Speed - 2500 rpm

Material - carborundum (silicon aluminium oxide)

IV. OPTIMIZATION

Effect of welding current

The current has more influence on the amount of heat generated. Tensile shear strength increases rapidly with increasing current density. Excessive current density will cause molten metal expulsion, weld cracking, and lower mechanical strength properties. In case of spot welding, Excessive current will overheat the base metal and result in deep indentations.

Effect of weld time :The total heat developed is proportional to weld time. During a spot welding operation, minimum time is required to reach melting temperature at some suitable current density. Excessively long weld time will have the same effect as excessive amperage on the base metal and electrodes.

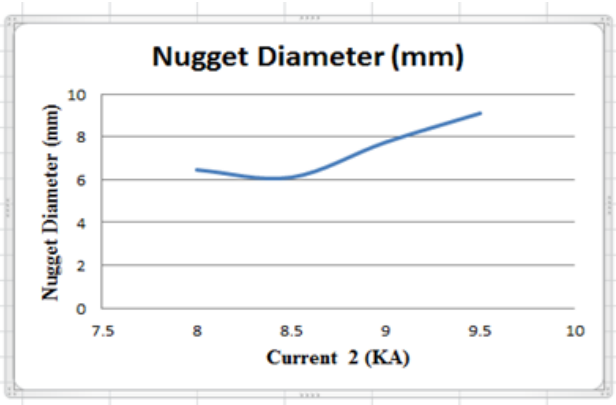
Effect of welding pressure :As the pressure is increased, the contact resistance and the heat generated at the interface will decrease. To increase the heat to the previous level, amperage or weld time must be increased to compensate for the reduced resistance. Contact resistance will be high. As the pressure is increased, the high spots are depressed and the actual metal-to-metal contact area is increased, thus decreasing the contact resistance.

V. RESULTS:

Variation in Current 2:

Sample No	Welding Force [kgf]	Squeeze time [Cycles]	Up-slope [Cycles]	Weld time 1 [Cycles]	Current 1 [KA]	Weld time 2 [Cycles]	Current 2 [KA]	Cool time 1 [Cycles]	Cool time 2 [Cycles]	Hold time [Cycles]	Off time [Cycles]
1	800	50	3	40	6	40	8	30	90	60	90
2	800	50	3	40	6	40	8.5	30	90	60	90
3	800	50	3	40	6	40	9	30	90	60	90
4	800	50	3	40	6	40	9.5	30	90	60	90

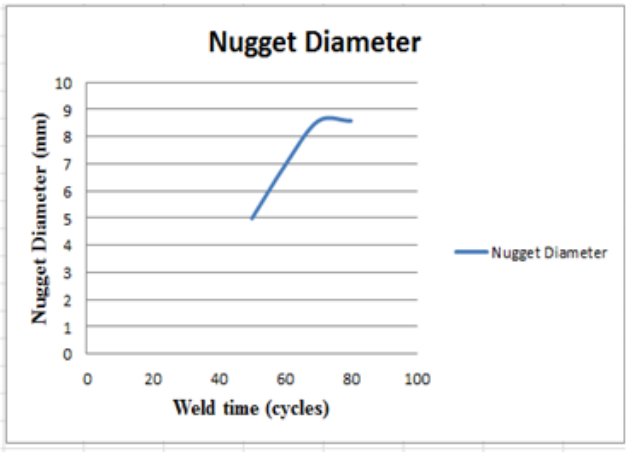
Serial No	Sample No	Nugget Diameter (mm)
1	1	6.46
2	2	6.11
3	3	7.75
4	4	9.1



2. Variation In Weld time 2:

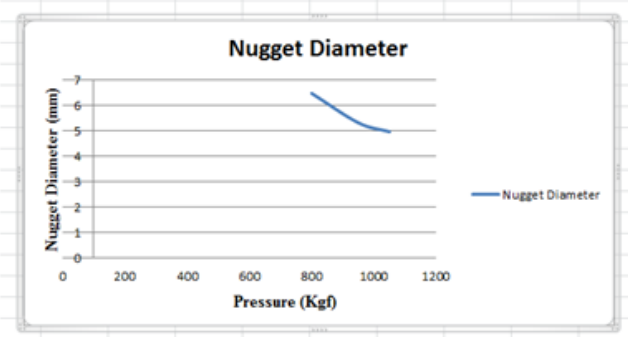
Sample No	Welding Force [kgf]	Squeeze time [Cycles]	Up-slope [Cycles]	Weld time 1 [Cycles]	Current 1 [KA]	Weld time 2 [Cycles]	Current 2 [KA]	Cool time 1 [Cycles]	Cool time 2 [Cycles]	Hold time [Cycles]	Off time [Cycles]
5	800	50	3	40	6	50	8	30	90	60	90
6	800	50	3	40	6	60	8	30	90	60	90
7	800	50	3	40	6	70	8	50	90	60	90
8	800	50	3	40	6	80	8	60	90	60	90

Serial No	Sample No	Nugget Diameter (mm)
1	5	4.99
2	6	6.94
3	7	8.57
4	8	8.58



Sample No	Welding Force [kgf]	Squeeze time [Cycles]	Up-slope [Cycles]	Weld time 1 [Cycles]	Current 1 [KA]	Weld time 2 [Cycles]	Current 2 [KA]	Cool time 1 [Cycles]	Cool time 2 [Cycles]	Hold time [Cycles]	Off time [Cycles]
1	800	50	3	40	6	40	8	30	90	60	90
9	950	70	3	40	6	40	8	30	90	60	90
15	1050	50	3	40	6	40	8	30	90	60	90

Serial No	Sample No	Nugget Diameter (mm)
1	1	6.46
2	9	5.30
3	15	4.95



VI. CONCLUSION AND DISCUSSION

From the literature it is found there are remarkable works carried out in the field of process parameter optimization for the material like stainless steel and aluminum. But that work carryout only for limited materials not for other material. The literature above reveals that the lot of efforts was taken in order to rationalize the RSW process. RSW process experimental work has been carried out by researchers for process been done for product parameters like penetration, heat parameters like welding current, welding time and squeezes time and hold time, Electrode Pressing force, electrode geometry, the choice of electrode material. Also research has affected zone, sheet thickness, overlapping length, strength of weld and distortion stresses.

VII. REFERENCES

1. Outokumpu Handbook of Stainless Steel.
2. D.S. Sahota, Ramandeep Singh, Rajesh Sharma, Harpreet Singh, "Study of effect of parameters on resistance spot weld of ass316 material".ISSR Journal 2320-2491, Vol. 2, No. 2, February-March 2013.
3. B. S. Gawai, Dr. C. M. Sedani, "Optimization of Process Parameters for Resistance Spot Welding Process of HR E-34 Using Response Surface Method – A Review", IJSR Journal2319-7064, Vol. 5, Issue 3, March 2016.
4. C. V. Nielsen, K. S. Friis, W. Zhang, N. Bay, "Three-sheet spot welding of advanced high-strength steels", AWS Journals, vol. 90 Feb 2011.

5. Y. Cho and S. Rhee, "Experimental Study of Nugget Formation in Resistance Spot Welding", AWS Journals, 195-s – 201-s, Aug 2003.
6. H. Thornton, A. R. Krause and R. G. Davies, "Contact Resistances in Spot Welding", AWS Journals, 402-s –421-s, Dec 1996.
7. Z. Han, J. Orozco, J. E. Indacochea, C. H. Chen, "Resistance spot welding: A heat transfer study", Welding Research Supplement, 363-s – 371-s, Sep 1989.
8. Y. Y. Zhao, Y. S. Zhang, and Pei-chung Wang, "Weld Formation Characteristics in Resistance Spot Welding of Ultra-Thin Steel", AWS Journals, 71-s – 82-s, Vol. 96, FEBRUARY 2017.
9. T. D. Anderson, M. J. Perricone, J. N. Dupont, A. R. Marder, "The Influence of Molybdenum on Stainless Steel Weld Microstructures", AWS Journals, 281-s – 292, Vol. 86, Sep 2007.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

PROTOTYPE OF AUTOMATIC WALL PAINTING MACHINE

DEEKSHITH P[1], JOYEL JAHN[1], GODWIN DOMONIC[1], JESWIN JOSEPH[1], DEEPAK KUMAR SHETTY[2]

[1]B.E Student, Department of Mechanical Engineering
Vivekananda College of Engineering and Technology, Puttur, Karnataka, India
[2]Asst. Professor, Department of Mechanical Engineering, Vivekananda College of Engineering and Technology, Puttur, Karnataka ,India

ABSTRACT

Painting is a process of applying paint on surface of any object or wall. But wall painting is time and effort consuming process. It is also hazardous, boring and exhausting technique which makes it an excellent case for automation. Painting had been automated in most of automotive industry but not yet for the construction industry and also for the house wall painting. There is a strong need for a movable robot that can move to paint interior walls of household buildings. In this paper, the conceptual design of remote operated wall painting robot is described consisting of an electric spray gun that paint the walls vertically and is fitted on a movable robot base to give the linear feed motion to cover the painting surface. The design objective is to fulfill the foundation of simplicity, easy handling, low cost, reducing human effort and constant painting. IR sensors are fitted to adjust the distance limits and maneuver in the room area. A remote operated system is designed to guide the vertical motion of electric spray gun with the help of lead screw and electric motor. Also plan to move the base in horizontal direction

INTRODUCTION

Despite the advances in the robotics and its wide spreading applications, painting is also considered to be the difficult process as it also has to paint the whole building. To make this work simple and safe and to minimize the number of labour automation in painting was introduced. The painting automation for the exterior wall in buildings has been proposed. All these predominate the interior wall painting has shared little in research activities. The chemicals in painting can cause hazards to the painters such as eye and respiratory system problems. Also overall nature of the painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. These factors motivate the development of an automated painting system. When construction workers and robots are properly work together in building tasks, the entire construction process can be better managed and savings in human labour and timing are obtained as a consequence. In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous and harmful environments, which helps to solve most of the problems related with safety when multiple activities carried at the same time as well.

PROCEDURE

In the 2-Axis Spray Painting Machine, to start the system switch ON the power supply with the help of 12v battery which connected to the DC motor. When the Machine is started, system gets initialize. Now the system can move in x-axis with the help of basement wheel mechanism system. After performing this operation, spray gun can move in y-axis easily with the help of Sprocket and Chain arrangement .One best feature is that an IR sensor, it will detect the perfect position of wall where machine can paint. The whole operation can perform easily and safely.

COMPONENTS USED

The construction of the automatic wall painting robot consists of two main parts. They are

1. Mobile Platform
- Frame Stand
- Stepper Motor
- Spur Gears
- Control Unit

2. Spray gun mount
- IR sensor
- Flow control valve
- Spray gun

I. FRAME STAND: The frame stand is the steel welded in such a way that it can carry the whole equipment. The steels are welded strongly in welding laboratory with an idea to carry the entire robot with the control unit, Stepper motor in the mobile platform and the IR sensor, solenoid valve and spray gun in the roller shaft. Limit switches are attached to the frame stand in order to move the robot in the direction specified. The Spur gears are controlled by the Stepper motor rotation which is controlled by the ARM microcontroller.

II. STEPPER MOTOR: A stepper motor (or step motor) is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application. It is an electromechanical device which converts electrical pulses into discrete mechanical movements.

III. SPUR GEAR MECHANISM: Spur gears are the most common type of gears. They have straight teeth, and are mounted on parallel shafts. Spur gears have high power transmission efficiency, compact and easy to install, offer constant velocity ratio, highly reliable, can be used to transmit large amount of power (of the order of 50,000 kW). Spur gears have a wide range of applications. They are used in Metal cutting machines, Power plant, Marine engines, Mechanical clocks and watches, Fuel pumps, Washing Machines, etc.

IV. CONTROL UNIT; The microcontroller used in the controller unit is LPC2148 ARM microcontroller. The microcontroller unit is used to control the stepper motors and the movement of spray gun fitted on the conveyor belt. Microcontroller unit is provided with the 5V signal and as soon as the supply is ON, LCD gets initialized. The controller sets to setting mode and the moving and painting distance are given as input to the microcontroller. The microcontroller controls the rotation of DC motor based on the distances given in order to control conveyor belt movement. When IR receiver receives the signal, the conveyor belt moves and the spray gun goes to ON condition and if the conveyor belt stops, the spray gun goes to OFF condition. It contains relays for the control of forward and backward movement of the stepper motors. When the microcontroller receives the signals from IR sensor, it will be taking a decision to operate the machine. This pulse signal received from IR sensor circuit when there is any object.

V. LIQUID CRYSTAL DISPLAY: A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. They are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image burn-in. LCDs are, however, susceptible to persistence. A 16x2 LCD is connected to the microcontroller.

VI. IR SENSOR: IR sensor is used for this project. IR (Infrared) is the typical light source being used in the sensor for robot to detect opaque object. IR Sensor (IR Receiver and IR Emitter) the basic principle of IR sensor is based on an IR emitter and an IR receiver. IR emitter will emit infrared continuously when power is supplied to it. On the other hand, the IR receiver will

be connected and perform the task of a voltage divider. IR receiver can be imagined as a transistor with its base current determined by the intensity of IR light received.

LITERATURE REVIEW

Paper 1: Design of an Autonomous Wall Painting Robot

In this paper author describe the design and working of an autonomous wall painting robot. The conceptual design of a movable painting robot to be used for painting interior walls of residential building had been described. The robot uses roller fed with liquid paint and keeps contact with the wall surface. The robot enables the roller to scan vertically as well as horizontally to the painted walls. The robot can maneuver to adjust itself in front of the wall.

Paper 2: A Review on Design and Development of Semi Automatic Painting Machine

This paper gives basic information about small and medium scale industries manufacturing components have to paint for protecting from rusting so the spray application consumes maximum time and paint which required the skilled worker emerged with the application. They cannot manage robotic arrangement for higher efficiency so the rise of the such process have to be made which is affordable, gives better accuracy, consumes minimum time for coating.which is suitable for our requirement and which can be valuable for small and medium scale industries.

Paper 3: Automatic Wall Painting Robot

Here they studied that automatically paint the wall surface of given dimension has been designed and implemented in effective manner. The approach uses Infrared transmitter and Infrared receiver to identify the appearance of wall. The microcontroller unit to regulate the movement of the DC motor. The robot wipe out the hazards caused due to the painting chemicals to the human painters and also the nature of painting techniques that require imitated work and hand rising makes it dull, time consuming. The robot is cost effective, reduces work force for labours, reduces time consumption. The drawback of the project is that the robot continues painting later the end of the wall so it can be eliminated by adding some indicating objects such as alarms.

Paper 4: Set up of an Automated Multicolour System for Interior Wall Painting

In this paper, they shown that automated painting can be not only aimed at correcting productivity, but also quality checking. A robot arm with high precision is required. An automated system to convert the normalized coordinates of the liquid colours to be reproduced into the movement speed of the robot end tool and valve opening end of the mixing board. Most of the work will be probably necessary to achieve high resolution. Because of the shape of full scale robots, probably also the resolution of the human scale robot will be lower. Another particularity of the small scale arrangement is of course the ability to access some hard places of buildings under construction, where human range robots could not be allowed.

Paper 5: Development of Wall Painting Robot

They have shared that construction of Wall-Surface Operation Robot plan to automate and increase the efficiency a series of restoration works by adding, changing of an attachment, new task for cleaning. Tile separation sensing and repair work to the initial functions of picture painting in a single and multiple colors is also done. The analysis of this example was introduced as a periodic inspection of the 10th year for the office building concerned. And, high profitability is expected because of presence of many similar structures.

DESIGN CALCULTION

PARTS	PARTICULARS	CALCULATED VALUE	QUANTITY
Bearing	Mean dia	31.5mm	4
Solenoid Valve	Type Max pressure Frequency	3/2 0.1-1Mpa 50Hz	1
Drive Gear	No. of teeth Power Material	30 3.02KW CI	1
Driven Gear	No. of Teeth Power	56 3.8KW	1

	Material	CI	
Sprocket	No. of teeth Speed Torque Power	44 30rpm 2.371KN-m 0.745KW	2
Chain	Sprocket Dp Chain Lp Chain length	14.33mm 258.46pitch 3.705m	1
DC motor	Power Voltage Speed	17Watt 12Volt 1500rpm	2

ADVANTAGES

1. It consume less time and electricity.
2. Installation cost is moderate.
3. Weight of the design is not more than 19 kg. So It can be portable from one place to another.
4. Due to the use of wheel and motor it can be move in horizontal and vertical direction. It minimizes the wastage of color.

LIMITATIONS

1. Unable to paint curved surface.
2. This method is costlier.

APPLICATION

1. Easy painting of flat surfaces
2. Detects hollow surfaces
3. Continuous precise operation

CONCLUSION

Automatically paint the wall of given dimension has been designed and implemented. The approach uses IR transmitter and IR receiver to detect the presence of wall. The microcontroller unit to control the movement of the DC motor. The robot eliminates the hazards caused due to the painting chemicals to the human painters such as eye and respiratory system problems and also the nature of painting procedure that requires repeated work and hand rising makes it boring, time and effort consuming. The robot is cost effective, reduces work force for human workers, reduces time consumption. The pitfall of the project is that the robot continues painting even after the end of the wall hence it can be overcomed by adding some indicating objects such as buzzers. In the future the painting robot can be enhanced by using image processing in order to scan the objects and obstacles that are present in the wall so that those objects can be automatically omitted while painting.

REFERENCES

[1]. Mohamed Abdellatif "Design of An Autonomous Wall Painting Robot" Mechatronic and Robotic Dept. Egypt-Japan.

[2]. Dhaval Thakar, Chetan P. Vora "A Review on Design and Development of Semi-Automatic Painting Machine'' Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, Issue 4(Version 7), April 2014

[3]. P.Keerthanaa, K.Jeevitha, V.Navina, G.Indira4, S.Jayamani5 "Automatic Wall Painting Robot" International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 7, July 2013

[4]. Berardo Naticchia, Alberto Giretti and Alessandro Carbonari "Set Up of an Automated Multicolour System for Interior Wall Painting" International Journal of Advanced Robotic Systems, Vol. 4, No. 4 (2007) ISSN 1729-8806, pp. 407-416

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

DESIGN AND FABRICATION OF MAGLEV WINDMILL

Ranjeet Kumar[1], Mohan Gowda KS[2], Shreyas Raju KG[2], Pruthvi RajKumar[2], Hitesh A[2] Dr. V.Vijendra Kumar[3], Dr.K.S.Badrinarayan[4]

[1]*Research Scholar, Department of mechanical engineering, M S Engineering College, ranjejas@gmail.com*

[2]UG Scholar, Department of mechanical engineering, M *S Engineering College*, mohangowda7026@gmail.com

[3]*Professor and H.O. D, Department of mechanical engineering, M S Engineering College*, vijendravk@gmail.com.

[4]*Professor and Principal, Department of mechanical engineering, M S Engineering College*, Principal@msec.ac.in

ABSTRACT

"Electrical power has become prime necessity for any country for economic development. Due to exhaustion of conventional power generation methods and its adverse effects on the environment the focus on renewable energy resources has increased significantly in the recent years. Among various resources wind has proved to be cheaper alternative energy resource and hence extensive research efforts have been put to improve the technology of electricity generation through wind. This project introduces structure and principle of the proposed magnetic levitation wind turbine for better utilization of wind energy"

"Magnetic levitation, maglev, or magnetic suspension is defined by which an object is suspended with a support of magnetic fields. Maglev wind turbine have more advantages than the conventional wind turbine. The aim of this project is to design and implement a magnetically levitated vertical axis wind turbine system that has the ability to operate in both high and low wind speed conditions".

"Magnetic repulsion gives advantage of no use of ball bearings hence turbine is suspended in zero gravity & design of turbine gives universal rotation .Power is generated with use of permanent magnets and set of coils. Hence efficient use of green energy is possible using this model on higher scale

1. INTRODUCTION

"Renewable energy is generally electricity supplied from sources such as wind power, solar power, geothermal energy, Hydro power and various forms of biomass. The popularity of renewable energy has experienced a significant upsurge in recent times due to the exhaustion of conventional power generation methods and increasing realisation of its adverse effects on the environment. This project focuses on the utilisation of wind energy as a renewable source. Our choice for this model is to showcase its efficiency in varying wind conditions as compare to horizontal axis wind turbines. This contributes to its steady growing popularity for the purpose of mass utilization in the near future as a renewable source of power generation". "Wind is a form of solar energy. It is a natural power source that can be economically used to generate electricity. The way in which wind is created is from the atmosphere of the sun causing areas of uneven heating. In conjunction with the uneven heating of the sun, rotation of the earth and the rockiness of the earth's surface winds are formed. The terms wind energy or wind power describes the process by which the wind is used to generate mechanical power or electricity". "Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks

(such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity. The wind turbine is used for conversion of kinetic energy of wind into electrical energy. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity".

"The Maglev wind turbine design is a vast departure from con-ventional propeller designs. Its main advantages are that it uses frictionless bearings and a magnetic levitation design and it does not need to vast spaces required by more conventional wind turbines. It also requires little if any maintenance. The Maglev wind turbine was first unveiled at the Wind Power Asia exhibition in Beijing 2007. The unique operating principle behind this design is through magnetic levitation. Magnetic levitation is supposedly an extremely efficient system for wind energy. The vertically oriented blades of the wind turbine are suspended in the air replacing any need for ball bearings".

2. MAGNETIC LEVITATION

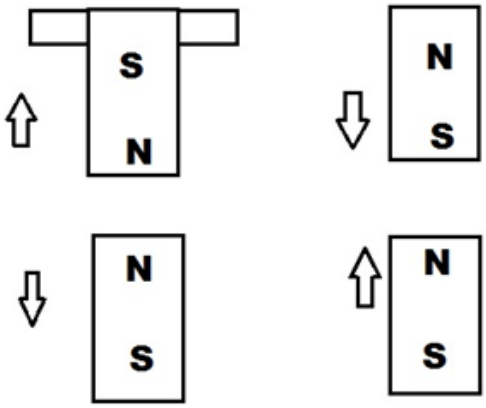
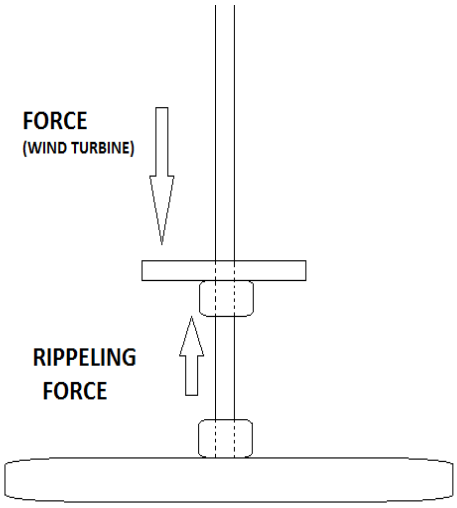


Fig. 1: A Simple Form of Magnetic Levitation efficient system for wind energy.

MAGNETIC LEVITATION: The method of suspending one object over the other without any support other than magnetic field.

2.1Magnetic Levitation Wind Mill

"In selecting the vertical axis concept for the wind turbine that is implemented as the power generation portion of this project, certain uniqueness corresponded to it that did not pertain to the other wind turbine designs. The characteristic that set this wind. "Generator apart from the others is that it is fully supported and rotates about a vertical axis. This axis is vertically oriented through the center of the wind sails, which allows for a different type of rotational support rather than the conventional ball bearing system found in horizontal wind turbines".



The basic way in which maglev wind mill is levitated.

3. OBJECTIVE

- "This is a reliable energy supply for the future".
- "The power source is non polluting & clean".
- "Magnetic levitation is an extremely efficient system for wind energy
- The benefit of not using bearings cuts down the friction that causes much inefficiency in traditional windmill
- Reduces the maintenance costs & increases the lifespan of generator
- The start rotating torque 28% of that of the preview same size unit of conventional windmill
- The rotating speed is increased by 10% under same wind speed
- The power output is raised evenly 20% under the same wind speed
- The power generation capacity is approx 20% above than the conventional windmills
- The operation costs are reduced to 50% of that of the conventional windmills"

4. METHODOLOGY

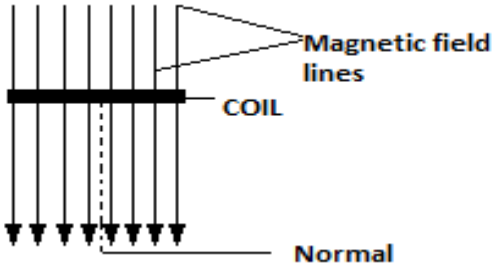
- Design and development of wind turbine frame
- Design and development of magnetic bearing
- Design and development of electric generator

4.1. Design and development of magnetic bearing: where

B is the magnitude of the magnetic field, Wb/m^2 (tesla)

S is the area of the surface, and

ϑ is the angle between the magnetic field lines and the normal (perpendicular) to S



4.2 Design and development of electric generator:

- "One of the basic principle for generation of electricity is electromagnetism".
- "Electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF) this phenomenon called electromagnetic induction"

e=Nd@/dt

where

e=induced voltage

N =number of turns of copper coil

@ = magnetic flux in webers

t = Time in seconds.

5. DESIGN CALCULATIONS:

Aspect ratio(α)=H/D=2 (assuming α=2)

By trial and error method assuming parameter, for expected power (P=20W)

Diameter=0.1

H=2D=0.2m

Swept area , A =H×D=0.1×0.2=0.02^2 sq.m

Power=0.5ρAV³Cp

=0.5*1.225*0.02*5.5³*0.593=1.208W

Similarly,

If D=0.2m, P=4.83W

D=0.4m, P=23.39W

Aspect ratio=2

Rotor diameter (D) =0.44m

Rotor height (H) =0.88m

Swept area(A)=0.3872sq.m

Power(theo)=23.39W

Diameter of end plate=1.1D

=1.1*0.44=0.484m

Diameter of blade(d)=D=2d-e`

0.44=2d-0.75d

d=0.2378

Assuming overlap ratio β=0.15 for better efficiency

β=(e-a)/d e`=e-a

e`=0.15d

*Drag force acting on maglev blade(Fd)

Fd=Cd*0.5* ρ*A*V^2

where, Cd for semi cylinder facing stream of fluid is 2.30

Fd=14N (after submitting values)

Maximum force for v=10m/s

Fd=2.30* ρ*A*V^2 (0.5)

Fd(max)=47N

*Bending moment acting on the shaft bearing placed from 10mm from lower of the turbine

Bending moment=Force*(0.44±0.01)

B.M =21.15N.m

<u>To find the diameter of axis:-</u>

Diameter of axis should be greater than

$$\sqrt[3]{\frac{32N}{\pi\rho}\sqrt[2]{\mu 2 + 0.75T2}}$$

From torsion equation (to find torque T)

$$\frac{I}{R} = \frac{T}{J}$$

Shear stress =F/A

=598422N/m.sq

$J=\frac{\pi}{32}*d^4$

J=9.817*10^-10 m4

T=I*J/R

T=9.79*10^-4 Nm

*Rotor torque velocity V=5.5 m/s

T(theo)=Fd*rotor radius

=14*0.22=3.08Nm

Co-efficient of torque Cp=T(theo)/T(act)

Eccentricity=β=$\frac{e-A}{d}$

(e-a)=0.15*0.2378=0.0556m

DESIGNED AND FABRICATED PART:

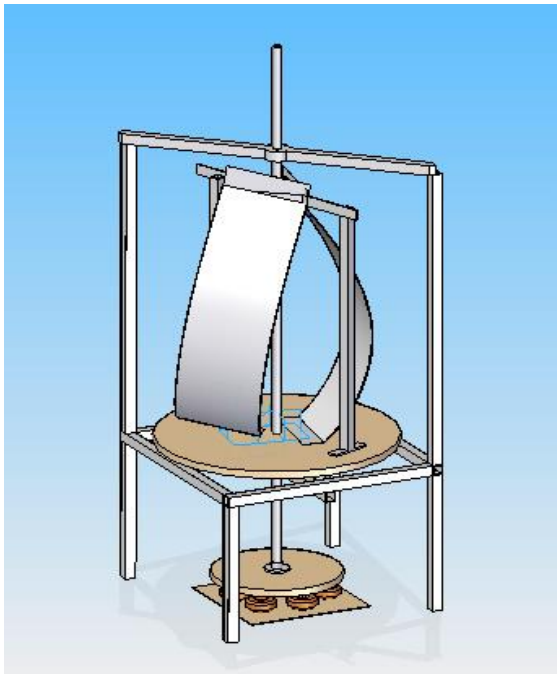


Figure-1 3D Modeling of Maglev wind mill

Figure-2. Fabricated Maglev windmill

6 RESULT

"Magnetic levitation possesses numerous applications in various fields of modern engineering designs and technologies. The focus of this article is primarily to demonstrate magnetic levitation phenomenon in a very simple way to enable science and engineering pedagogy to experimentally realize magnetic levitation and its potential applications. The paper also help the pedagogy to understand various principles and concepts of magnetism experimentally ,in addition to the realization of principles behind potential maglev applications such as maglev trains, flying cars, maglev wind turbines and magnetic bearings, thereby, this may hopefully actuate them to pursue research on maglev technologies to meet the magnetic demands of the society at present and also in the future .Estimated voltage will be approximately 12V ,frequency (24Hz).The rotation speed of turbine can be as fast as 320 rpm and current upto 1A" ..

7. CONCLUSION

"The important concept of magnetic levitation explained in this paper gives the frictional losses which can assume to be negligible .so this helps in achieving greater efficiency .as the number of turns of coils is increased the accordingly the magnets also increased the emf generated in the coil will be more".

"The turbine efficiency is improved by utilization of magnets helping to spin with fast speed with negligible friction as it cancels out the stress on the shaft of the turbine this modern design".

"To get more output another way is to reduce turbines own inertia by using lighter weight materials for turbine. So that for the same wind speed it will rotate faster, hence it will generate more power"

8. REFRENCES

[1]. Twidell J and Weir T, "Renewable Energy Resources", second edition, Taylor & Francis,270 Madison Ave, New York, NY 10016, USA, 2015

[2]. REN21. 2014. *Renewables 2014 Global Status Report* (Paris: REN21 Secretariat). ISBN978-3-9815934-2-6

[3]. Sidhu K. S., Director/ Research, Punjab State electricity board, Nonconventional Energy Resources- a Report.
[4]. Xiong L, Yan C, Zhiquan Y, "Optimization model for rotor blades of horizontal axis wind turbines", Front. Mech. Eng. China, 2(4): 483–488, 2012.
[5]. Grujicic M., Arakere G, Pandurangan B, Sellappan V, Vallejo A, and OzenM.,"Multidisciplinary Design Optimization for Glass-Fiber Epoxy-Matrix Composite 5MW Horizontal-Axis Wind-Turbine Blades", Journal of Materials Engineering and Performance,Vol. 19(8) November 2011.
[6]. Cheng Z, Nian R, Yang C, Ruihu W., "Criterion of aerodynamic performance of large-scale offshore horizontal axis wind turbines", Appl. Math. Mech. -Engl. Ed. 31(1), 13–20 (2010). DOI 10.1007/s10483-010-0102-2.
[7]. Liu S and Janajreh I., "Development and application of an improved blade element momentum method model on horizontal axis wind turbines", International Journal of Energy and Environmental Engineering, 2011.
[8]. Hong-che G, Tian-yu Q, and Jiu-chen J., "Design of Fuzzy Controller for Direct Drive Wind Turbines", J. Shanghai Jiaotong Univ. (Sci.), 17(2): 209-214, 2010.

Ranjeet Kumar *is working as an Assistant Prof. in Mechanical Engineering Department of MS Engineering* College *Bangalore. He has guided many UG Projects. His area of interest is CAD/CAM, FEA & Composite Materials.*

Shreyas raju kg is pursuing the BE in mechanical engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on maglev wind mill

Pankaj Sah is pursuing the BE in Mechanical Engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on ***Solar Power Tricycle with Adjustable Seat.***

Pruthvi Rajkumar is pursuing the BE in mechanical engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on maglev wind mill.

Mohan Gowda KS is pursuing the BE in mechanical engineering from M S ENGINEERING COLLEGE, Bangalore has worked on project with interest on maglev wind mill.

Hitesh A is pursuing the BE in mechanical engineering from MSENGINEERING COLLEGE, Bangalore has worked on project with interest on maglev wind mill.

Dr. Vijendra Kumar, *Professor and Head, Department of Mechanical* Engineering, MSEC, Bangalore, India *Experience: 23Years Specialization: Design and CFD*

Dr.K.S.Badarinarayan is principal of M S Engineering College, Bangalore. He is having 28 years of academics and industrial experience including 6 years of research experience. He has presented many journal papers in international and national conferences. His area of interest is Flexible manufacturing system scheduling.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

SOLAR POWERED MULTI AGRICULTURE MACHINE

Bhakta Vatsala H R[1], Pushpa S N[2], Hemanth Reddy P S[3], Pavan Kumar G M[4], Manoj Kumar K[5], Dr.V.Vijendra Kumar[6], Dr.K.S.Badarinarayan[7]

[1]Asst.Pofessor.deprtment of Mechanical Engineering, M S Engineering College, Bengaluru

[2,3,4,5]Student, Department of Mechanical Engineering, M S Engineering College Bengaluru,Pushpa.s.n.ngr@gmail.com,hemanth.007coolnike@gmail.com

[6] Prof .HOD. Dept. of Mechanical Engineering, M S Engineering College,Bengaluru,vijendravk@gmail.com

[7]Principal, M S Engineering college, Bengaluru, principal@msec.ac.in

ABSTRACT

This paper demonstrates the research and implementation of remote controller based Solar powered multiple agriculture machine. The Solar powered multiple agriculture machine is controlled by remote controller. The language input allows a user to interact with the Solar powered multiple agriculture machine which is familiar to most of the people. The advantages of this Solar powered multiple agriculture machine are hands-free and fast data input operations The complete system consists of five subsystems, the solar grass cutter, digging system, seed controlling system ,pesticide pump, sensor and solar power, section (on machine).

The main aim of our project has been to develop a solar operated digging machine, seed sowing, grass cutting & pesticide pump. In this the machine used a solar panel to capture and convert solar energy into electrical energy which in turn is used to charge four 12V batteries, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the rear wheel through belt drives. The speed control is done through a variable belt arrangement

Keywords—Micro controller,digging,seed sowing,grass cutting,DC Motor,

I. INTRODUCTION

The real power required for machine equipment depends on the resistance to the movement of it. Some of these resistances are the wind resistance, the rolling resistance and the gradient resistance.

Even now, in 98% of the contemporary machines that run, this power for movement is provided by the burning of fossil fuels in the IC engines or the external combustion engines. This, as evident, has led to widespread air, water and noise pollution and most importantly has led to a realistic energy crisis in the near future. The main aim for our project has been to develop a solar operated digging machine, which is solar powered. In this machine used a solar panel to capture and convert solar energy into electrical energy which in turn is used to charge four 12V batteries, which then gives the necessary power to a shunt wound DC motor. This power is then transmitted to the rear wheel through belt drives. The speed control is done through a variable belt arrangement.

Consequently, in this project an attempt is made to make the electric and mechanical systems share their powers in an efficient way.

Thus taking into consideration the ever increasing pollution levels and the stringent pollution norms (EURO-II and onwards) set up by the POLLUTION CONTROL BOARDS, and since the fossil fuels are depleting, probably may last within the decades to come or earlier, and to reduce the running cost of

the digging machine, we are in an attempt to incorporate the above mentioned features in our machine.

2. LITERATURE SURVEY

i. Mahesh R. Pundkar [1] stated that the seed sowing machine is a key component of agriculture field. High precision pneumatic planters have been developed for many varities of crops, for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path , in seed spacing.

ii. P.P. Shelke [3] concludes that bullock drawn planters are becoming necessity for sowing as the skilled workers for sowing are almost diminishing. Planting distance and plant population are crucial factors in maximizing the yields of crops.

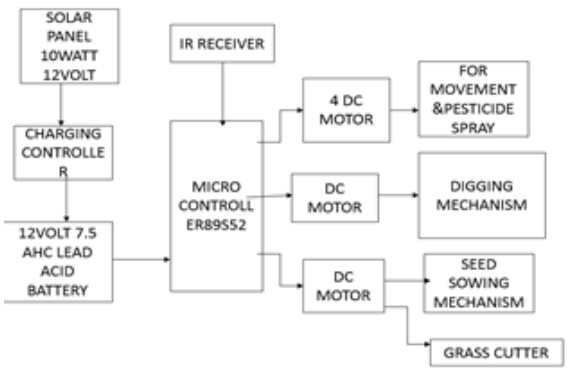
iii. Singh (1971)[4] revealed that by using a seed drill for wheat crop there was an increase in yield by 13.025 percent when compared with the conventional method, it also revealed that by using a seed drill for wheat crop, a saving of 69.96 per cent in man-hours and 55.17 percent in huliock hours was achieved when compared, with the conventional method.

iv. Umed Ali Soomro at al. [4] in Pakistan has evaluated three sowing methods and seed rate in a four replicated RCBD method and concluded that drilling method of sowing at seed rate 125 kg/ha is optimal for yield and quality of wheat grains, because the said sowing method and seed rate distribute seed uniformly and desired depth which provide appropriate depth for seed germination and crop establishment.

3. WORKNG PRINCIPLE: The basic aim of the project is to develop multipurpose machine, which is used for digging the soil, seed sowing, pesticide sprayer and grass cutter to produce at minimum cost and which runs on solar power and battery. In this machine a solar panel is used to capture solar energy and then it is converted into electrical energy which in turn is used to charge 12V battery, which then gives the necessary power to a shunt wound DC motor.This power is then transmitted to the rear wheel through chain drives. Consequently, in this project an attempt is made to make the electric and mechanical systems share their powers in an efficient way.The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement can vary from crop to crop and for different agro-climatic conditions to achieve optimum yields. Typical application of seed sowing of Cereal's including ground nut, all types of dal's, oil seed crop's etc.

A solar panel is a device that collects and converts solar energy into electricity or heat or mechanical work. Solar energy is first used to charge a storage battery. An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. The solar energy stored in the battery is utilized to operate DC motor. A DC motor is a device that converts direct current (electrical energy) into mechanical energy. By using the spur gear and Chain drive with sprockets power is transferred to the wheels for their movement. A 8051 Microcontroller is used to automatically control the machine. IR Sensors are fitted to the machine for automatic turning operation and to sense the obstacle in the moving path. An infrared sensor is an electronic instrument.

BLOCK DIAGRAM:



GEAR:

Spur gear: Spur gears are the most commonly used gear type. They are characterized by teeth, which are perpendicular to the face of the gear. Spur gears are by far the most commonly available, and are generally the least expensive. They are mounted on parallel shafts. Sometimes, many spur gears are used at once to create very large gear reductions. Spur gears are used in many devices that you can see all over like electric screw driver, oscillating sprinkler, windup alarm clock, washing machines, clothes dryers, etc,

DC Motor: An electric motor uses electrical Energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy, is accomplished by a generator or dynamo. Traction motors used on vehicles often perform both tasks. Many types of electric motors can be run as generators, and vice versa.

Lead Acid Battery: Battery is a connection of one or more electrolytic cells which provide regulated power. Batteries are devices in which reduction oxidation occurs at cathode and anode; they are separated by an ionic ally-conductive electrolyte.

Micro Controller:It is the heart of our system. It is the main control block and all other blocks are interfaced to the controller.. The completion and implementation of our system wholly depends on this logic and finally worked by the controller. We have selected 89S52 micro controller. Relay driver and display are interfaced to the various ports of 89S52.

Solar Cell: In our country there are so many types of power generator available i.e. Solar energy, hydro energy, wind energy, geo-thermal energy, tidal energy etc, are now considered the suitable successors to the fossil fuels in near future. Solar energy among these stands out as the ultimate unending source of energy coming from the sun to the earth's surface. The sun has produced energy for billions of years. Solar energy is the solar radiation that reaches the earth. Solar energy has been in continuous use for heating water for domestic use, space heating of buildings, drying agricultural products, and generating electrical energy.

SPECIFICATIONS:

DC MOTOR	
Capacity	17 Watts
Speed	100 RPm
Type of Motor	shunt Motor
Operating Volt	12 Volts
Power	1amps/ motor
LEAD ACID BATTERY	
Capacity	13.5 watt
Current	7.5ahc
lead acid battery	
SOLAR PANEL	
Capacity	12 volt
Power	5 watts
DC MOTOR WITH GEARED SYSTEM	
operate voltage	12 volt dcv
Speed	10rpm

FUTURE SCOPE

It is suitable for agriculture land for automatic digging and seed sowing by doing so we can reduce the manpower and economic we are trying to implement a prototype model of an automated solar digging and seed sowing machine within the limited available source and economy. The system can be subjected to further development using advanced techniques. It may become a success if our project can be implemented in the modern industries. However a machine is equivalent to 1000 humans input. The same works here.

CONCLUSION

The present situation in our country all the agricultural machine is working on manual operation otherwise by petrol engine or tractor .it expensive, farmer can't work for long time manually to avoid this problem, we need to have some kind of power source system to operate the digging machine.

- We are trying to implement a prototype model of drilling and seed sowing machine system within the limited available source and economy.

- The system can be subjected to further development using advanced techniques.
- It may become a success if our project can be implemented throughout our country.

REFERENCES

[1]. Gholap.D.D , More, V.M , Lokhande, M.S. and Joshi, S.G. Robotic Agriculture Machine. IJIRSET. 2014. 3 (Special Issue 4).

[2]. Shrinivas R.Z. and Kokate, R.D. Advanced Agriculture System. IJRA. 2012. 1(2) 107-112.

[3]. Chandika S. Automation and Emerging Technology Development of 2d Seed Sowing Robo. Journal of Agriculture Science. 2009. 1(1)

[4]. Ajit G.D. and Kulkarn V.A. Advanced Robotic Weeding System, ITSI-TEEE, 2013. 1(3).

[5]. Zoeb, K. Unique Solar Operated Spray Jet. IOSR-JMCE. 43-46.

[6]. Chengliang L, Mingjun, W. and Jun Zhou, 2008: Coordinating Control for an Agricultural Vehicle with Individual Wheel Speeds and Steering Angles.

[7]. Sunil K.A, Satyshree, G. and Patil, K.N. Solar Flat Plate Collector Analysis, IOSRJEN. 2012. 2(2) 207-213.

[8]. Ramesh M.V, Amarnath, J, Kamakshaiah, S. and Rao, G.S. Speed Control of Brushless DC Motor by using Fuzzy logic P I Controller. ARPN. 2011. 6(9).

[9]. Dong Y, Huanyong, C, Xijie, T, Qingping, Z. and Pengfei Xu. Research on Tooth Modification of Spur Bevel Gear. The Open Mechanical Engineering Journal. 2011. 5; 68-77. [10] Jeffrey W.W, 2004: An Inexpensive Alternative to Commercial Infrared Sensors. Unit of Psychology & Neuroscience Program, Albion College,Albion.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

AUTOMATED ROOF OF MINING TRUCK

Saish N. Rivankar[1], Dr. Akshay Nigalye[2],Prasanna C. Kattimani[3],Niraj G. Pai Bhale[4]

[1]Department of Mechanical Engineering, Agnel Institute of Technology & Design, Mapusa - Goa
snr@aitdgoa.edu.in

[2]Department of Mechanical Engineering, Goa College of Engineering, Farmagudi - Goa, India
agvn@gec.ac.in

[3]Department of Mechanical Engineering, Agnel Institute of Technology & Design,Mapusa - Goa, India
pk@aitdgoa.edu.in

[4]Department of Mechanical Engineering, Agnel Institute of Technology & Design, Mapusa - Goa
nirajbhale@gmail.com

ABSTRACT

The project is designing automated roof for tipper truck commonly used for transporting iron ore in mining industry. As a part of project, working prototype of tipper truck with mechanism is to be fabricated. The project aim is bi-focal and focuses on practical solution to issues which are related to company's productivity and issues which are socio-environmental.

The project needs the thorough study of these issues which are directly influenced by transportation of ore from mine site where iron ore is loaded on tipper truck to the unloading station (Harbour) where the ore is unloaded into barges.

At present state, a tarpaulin sheet is used to cover the hood of tipper truck which is done fully manually so in order complete the trips faster wrong methods are adopted by truck drivers resulting in partially open hood. Therefore, project focuses on developing a mechanism which is fast, easy to operate with least skill level.

The mechanism will be subjected to lot of wear and tear and hence while development of mechanism its durability will be considered. The weight analysis of the mechanism is important and efforts will be made to keep it to minimal. Finally, the mechanism has to be mounted on the hood of tipper truck so the feasibility and economics also will be considered.

The powering of mechanism will involve design of electrical circuit which in turn will involve positioning of actuators, electrical wires and switches to operate the mechanism and protection against the tough operating conditions.

The project demands key skills such as good knowledge of processes like sheet metal bending, drilling, grinding, welding, skills required to work on lathe machine, carpentry skills and good command on 3D modelling software like Solid Works.

Keywords: Ergonomic design, double pole double throw switch activation, sprocket chain power transmission, horizontal folding mechanism, tipper truck, rolling mechanism, collapsible mechanism.

INTRODUCTION

India, especially the Konkan coast of Goa and Karnataka has large deposits of mineral ore that is mined from the mines distributed across the states. Mining in Goa is done by open cast method which necessitates the removal of overburden overlying the iron ore formations. Goa is a major iron ore exporting state and over 60% of India's iron ore export is from Goa. In terms of foreign exchange earnings, it amounts to nearly Rs.1000 Crores per annum. The mining belt of Goa covers approximately 700 sq. km and is mostly

concentrated in four talukas namely, Bicholim in North Goa district and Salcete, Sanguem and Quepem in South Goa district. Panduronga Timblo Group is one of the leading players in the mining sector in Goa.

Mormugao Port Trust is the major port from Goa where all the export and import activities are carried out from Goa. The ore mined from the mines is transported to the port via trucks that unload the ore onto barges that carry it to the port via the inland waters.

Literature Study

- National Review: The mining industry in India is a major economic activity which contributes significantly to the economy of Goa as well as India. The GDP contribution of the mining industry varies from 2.2 - 2.5% only but going by GDP of the industrial sector, it contributes around 10-11%. Indian mining provides direct and indirect employment to seven lakh individuals. India is the largest producer of sheet mica, third largest producer of iron ore and fifth largest producer of bauxite.
- Company Profile: Panduronga Timblo Industries (PTI), a part of Panduronga Timblo Group, has been a paramount Goan mining Company was formed in 1961 during the Portuguese regime and was thereafter registered under Indian Partnership Act, 1932. The firm is one of the developing Iron Ore Producers and exporters in Goa. Over the years, it has powerfully anchored itself on the shores of Goa's sustained mining economy and today it is recognized amongst the premier companies that empower Goa, to grow eminently in mining sector. With over 50 years of mining experience, PTI has established 16 mine leases in the Southern as well as in Northern parts of Goa, covering a total area of 1114.82 Ha. Today, PTI has 4 fully operational mines. The head office is located at Subhash Timblo Bhavan, Margao, Goa. Maintaining a successful track record of timely & enhanced export every year of its processed ore, this year the company has achieved export of 1.6 million metric tons and is planning for higher target in future. Firm's core competency lies in mineral exploration & planning and is equipped with full-fledged exploration & planning division, with equally capable and experienced workforce delivering continually improved performance. Manned by skilled workers and engineers, company's fleet of sophisticated mining machinery includes:
  - **Washing plant:**125TPH
  - **Crushing plant:** BZR-HIS 1300
  - **Mobile crushing and screening plant:** 4242 SR, CAPACITY-150 TPH, Rubble Master RM 100 - 100 TPH.
  - **Mobile screening plant:** Chieftain 1400, Horizon 6203
  - **Ripper dozer:** D9H, CAT D9G
  - **Excavator:** TATA HITACHI Ex 200 LC, Ex 210 LC, Ex 350 & VOLVO EC 460BLC.
  - **Wheel loader:** VOLVO L 120F, CAT 950H, CAT 966C, HM 2021
  - **Motor grader:** VOLVO 930 C
  - **Heavy duty trucks:** MERCEDES BENZ ACTROS, HINOs.

Need For the Project

Once mining is carried out, iron ore needs to be transported from the mines to unloading sites where the ore is unloaded in the barges. This is accomplished by means of tipper truck. However, during the course of transport, it leads to pollution of air spillage of ore on roads. Polluted air creates problems to people residing in mining areas. Inhale of polluted air containing 'ore dust' is main reason for increase in population of people suffering from respiratory diseases in the mining locality. The respiratory diseases like Tuberculosis, Throat irritations etc. have become common. The dust flying from the partially covered truck creates discomfort to two-wheeler rider as the dust enters their eyes.

The spillage of ore makes roads slippery. Riding vehicles on slippery roads increases the chances of accidents. Many tipper trucks operate in mining areas therefore traffic is more and a small accident can put lives of commutators in danger. Also, the

spillage of ore during transportation means loss to the company and hence spillage is not desirable.

The project work will provide a feasible solution to all the problems discussed above.

Objective: Main objective of our project is to address the environmental concern in association with Panduronga Timblo Industry, Codlim office/mine, Goa. This can be achieved by designing a mechanism that will cover and uncover the carriage (hood) of the tipper truck automatically as desired by operator. Second objective is to fabricate a working model of tipper truck having automated roof.

Design and Analysis

Commencement of project began with a visit to the mining site at one of the PTI (Panduronga Timblo Industries) mines at Codlim. During this visit, we had a meeting with the PTI personnel, Shri. Shrikant Hegde. Requirements of the project were discussed. The main points covered during the discussion were

- Safety issue of driver during covering and uncovering of tipper truck.
- Effects of spillage of iron ore during transportation.
- Effects of fly dust from tipper truck.

During the discussion, it was decided to design a mechanism which will provide a solution to the issues addressed earlier. Requirement of model of a tipper truck along with working mechanism was made by PTI personnel. After the discussion, we had a visit to loading station of mine. Actual loading conditions were seen. The loading of ore into the tipper truck was done from sides using wheel loader from sides.

We were explained as to what improvements need to be made keeping in mind the constraints involved. This factor acts as a constraint for designing the roof cover. Date of submission of drawings of mechanism was decided.

After the visit, there was a discussion held between the group members and the guide. After lot of thought process and various alternatives for the mechanism were proposed.

The different mechanisms proposed were:

1. Rolling Mechanism
2. Collapsible Mechanism Rope Based
3. Collapsible Mechanism Chain Based

1. Rolling Mechanism:

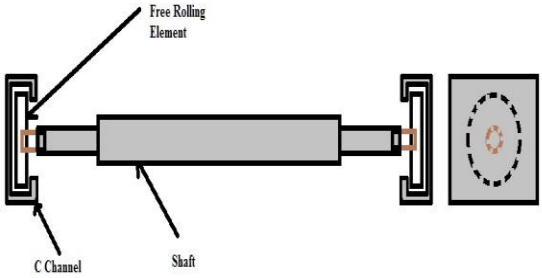


Figure 1: Rolling Mechanism

A rolling mechanism (Refer fig.1) consists of a cylindrical rod and a tarpaulin sheet was wound around the rod. Rolling elements were provided at both ends of the rod. This rolling elements roll in the C- channels provided on the vertical sided of the hood. As the rolling elements roll one direction the tarpaulin sheet unwinds to cover the hood and uncovers the hood if rolled in opposite direction. This mechanism was proposed because of its simplicity in design.

The advantages of the mechanism were analysed and were as follows.

- The mechanism involved only one rolling element (i.e. Main shaft) keeping wear to minimum
- The design was very simple and economical as total numbers of components were minimum.
- Two motors were required to drive the mechanism.

The main disadvantage of this mechanism was that the mechanism would fail to cover the hood because of the slipping of rolling element in C channel. Another disadvantage was that a slight misalignment leads to jamming of whole mechanism. The winding and unwinding of tarpaulin sheet would cause more wear of sheet.

2. Collapsible Mechanism Rope Based:

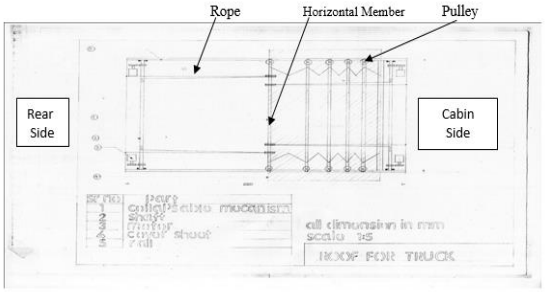


Figure 2: Rope based collapsible Mechanism

As seen from figure 2, the mechanism consists of number Horizontal links. It Horizontal links were connected to each other using cross links. Pulleys were attached to ends of each horizontal link using nut and bolt. The V- guide ways (5) were provided on inner sides of hood. Pulleys roll over these guide way to make closing and opening of mechanism. Two cylindrical shafts (2) free to rotate and were placed at both ends of the hood. Two ropes were connected to each shaft as shown in figure and other end of rope was connected to first horizontal link. The shafts were powered by four electric motors (3) and were placed as shown to balance pulling forces. As the motor rotates in one direction the ropes will wind on shaft placed at cabin end and unwind from shaft placed at rear end. This will cause horizontal links to accumulate at cabin end. The rotation of motor in opposite direction will cause winding of ropes on end shaft and unwinding of ropes from rod at cabin end. This causes the links to spread out. These two actions were used for opening and closing of the roof respectively.

The Advantages of the mechanism were as follows:

- Smooth opening and closing: The opening and closing of the roof will be smoother compared to rolling mechanism.
- Rigid: The frame ensures that the sheet (tarpaulin) is not suspended at any point in closed position. In a rolling mechanism, the sheet remains suspended from the front end to the rear end in closed position as there is no supporting frame.
- Durable: This mechanism ensures that there is less wear compared to rolling mechanism. The sheet is attached to the frames which in turn are attached to the horizontal links. The motion of the horizontal member results in closing and opening of the roof cover.

After analysing the mechanism, the following disadvantages were listed.

1. Complex structure: The number of mechanical linkages of this mechanism makes it a little complex compared to rolling mechanism.
2. Area: In open position a small part of carriage remains covered always. This reduces the area for filling of ore in the truck.
3. Ropes are inelastic and undergo elongation over period of time and this leads to reduction in tension in ropes. This is not a desirable.
4. It uses four motors which make it costlier and mounting of four motors at four different corners adds to infeasibility.

3. Collapsible Mechanism Chain Based:

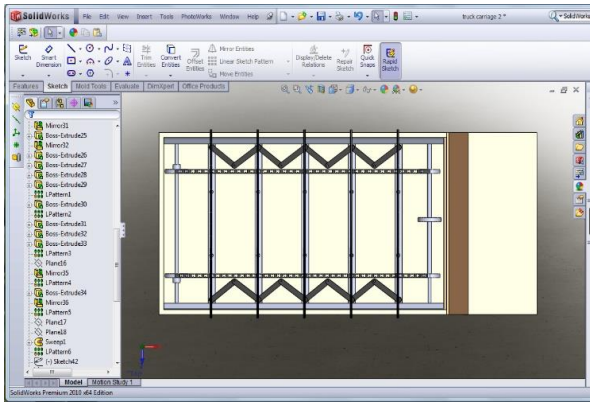


Figure 3: Chain based collapsible Mechanism

The construction and working principle is similar to rope based collapsible mechanism. (Figure 3) a long chain was provided instead of ropes. Chain drives the mechanism which in turn is driven by only one motor.

The mechanism was improvement over mechanism discussed in section 1 and gives added advantage one using only one motor. The detailed explanation of construction and working will be done in next chapter.

Based on the analysis of the pros and cons it was decided to go ahead with the collapsible

mechanism. Though it always has part of the carriage covered which reduces the carrying capacity of the truck, the rigidity and the smoothness involved with the mechanism it was decided to go ahead with the same.

4.1. Pre-Construction Phase

The initial requirement was to develop a prototype on which to implement the mechanism to be designed and fabricated.

- Engineering drawings of the prototype were made of scale 1:5 of actual tipper.
- Also, drawings of the mechanism were made.
- The drawings were analysed and an estimate of the materials required was drafted.

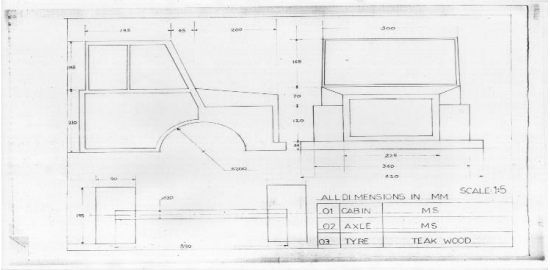
4.2. Initial Bill Of Materials

Name	Quantity	Dimensions	Cost
MS Sheet	1	8ftx4ft	1600/-
Steel Pipe	1	Length=1m Diameter=26mm	200/-
Wood	--	Standard Size	1500/-
Screws, Nails, Nut, Bolts, Washer	As Reqd.	As Reqd.	200/-
Single groove pulley	15	External Diameter=3.5cm Internal Diameter= 5mm	200/-
Guide ways	2	Each Length=1m	--
Processing and Transportation Cost	1000/-		
		Total	Rs.4700/-

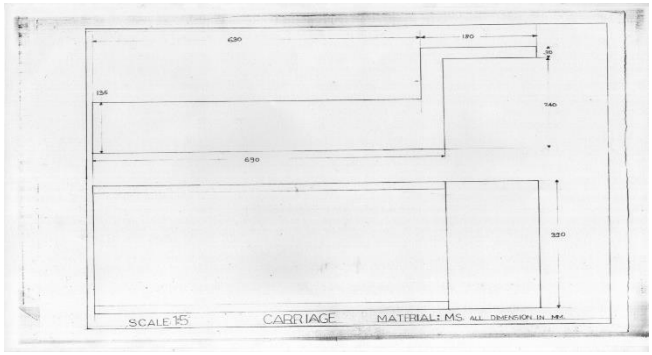
Based on the estimate made, materials were procured from the respective sources.

4.3. Engineering Drawings

CABIN



HOOD

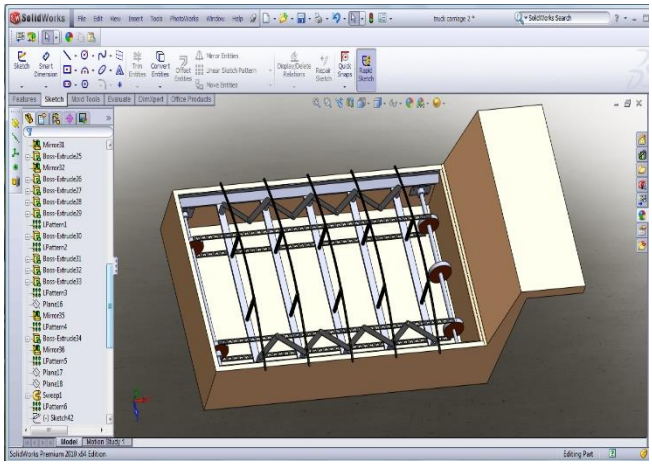


4.4. Mechanism

The mechanism is Collapsible link type with chain.

Principle of operation:

The principle of operation of the mechanism is that pulleys mounted on the horizontal links roll over guide ways resulting in to and fro motion of horizontal links to cover and uncover the carriage. The successive movement of the horizontal links is ensured by the cross links.



Construction

5.1. Prototype

The prototype of a mining tipper truck was constructed in the college workshop based on the engineering drawings made. It was decided to use wood for building the chassis and frame.

Wooden Chassis was built as per the dimensions obtained from the engineering drawings. The structural members of the chassis were cut to the sizes and planned on the wood planning machine. The sized members were joined in appropriate configuration using nail and adhesive. Four holes

were also drilled on the wooden chassis members which would house the wheel axles.

Frame for the hood and the cabin was built of wooden ribs (20mm×10mm cross section).

Tyres were made of wood and were manufactured on a lathe. The tyres were also provided with a circular groove on one side to make it more attractive. On the other side of tyre, a step was provided which would be useful in fixing it onto the axle. The stainless-steel pipe(axle) was cut and positioned in these holes. Tyres were fitted on the axle.

MS sheet (0.7mm thick) was cut into parts of desired dimensions. The cut parts of the sheet were then bent on the edges wherever required using bending machine (manual). The cut parts were fixed to the wooden frame using screws.

5.2. Mechanism

Construction of the mechanism started with manufacture of pulleys. The material selected for the pulleys was M.S. As per the engineering drawings the pulleys were manufactured on lathe machine. The various operations involved were turning, facing, parting, drilling. The outer diameter (ϕ15mm) was turned and the V groove was machined using a forming tool. A 4mm hole was drilled at the centre for the shaft. The pulleys were then polished with emery paper to improve its surface finish.

Horizontal members (4 nos.) were cut as per the dimensions. Holes were precisely drilled to these horizontal links to fix the bolts. Cross links of 1mm M.S. plate were cut to desired dimensions. The cross links had holes which were also precisely drilled so that the pulleys don't get jammed or become loose while operation. The two V guide ways were made from sheet metal using CNC bending machine. Bushes and locks were also fabricated on lathe. Round rods with steps, two in number were also fabricated. Frame was made from thin metal rods to support the tarpaulin which was welded to the horizontal members. Sprockets and chains were procured from the bike garage. The centre holes of the sprockets were enlarged by drilling.

5.3. Assembly

The positions for mounting the guide ways were marked precisely on the inner opposite faces of the hood as it was very much essential for efficient working of the mechanism. V guide ways were mounted on the marked positions using screws. The alignment was checked with the help of water level.

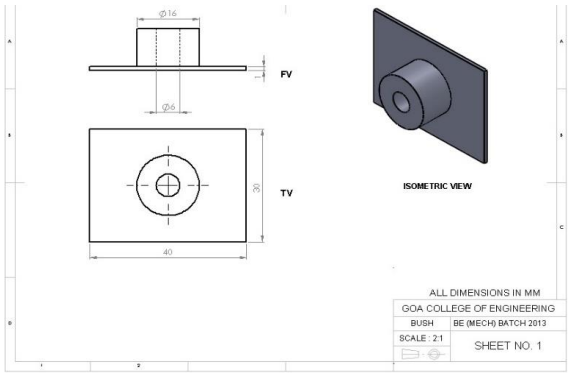
Three sprockets were fixed on the front rod (two on the sides and one at the centre) using araldite. Two sprockets were mounted on the rear end rod. Locks were provided on the rods next to the sprockets to prevent the axial movement of the sprocket. The front and the back rods were mounted in the bushes fixed to the side walls of the carriage.

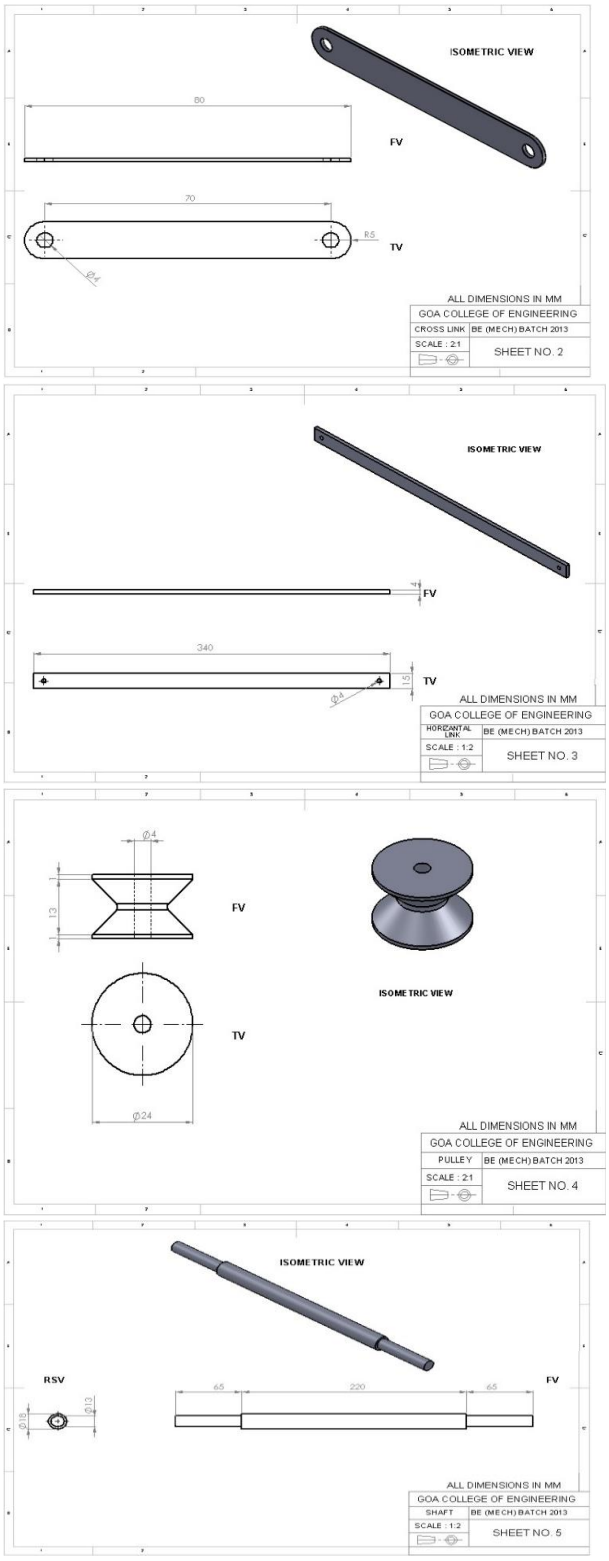
Two chains, one on either side were mounted on the sprockets. The pulleys were properly secured on the bolts attached perpendicular to the horizontal members. On both sides of the pulleys, metal washers were placed so that the pulleys can freely roll. The pulleys attached to the horizontal members were then positioned on the V-guide ways. The first horizontal member was fixed to the body. On the top face of the pulleys cross links were provided to link the adjacent horizontal members. The chain was fixed to the last link using bolt and nut so that it moves along with the chain.

Circular rods were provided parallel to the V guide ways to prevent the derailing of the pulleys during motion.

A sprocket was fixed to the motor shaft and this assembly was then mounted on the body using clamp. A chain was mounted connecting the sprocket on the motor shaft to the centre sprocket on the front rod. Electrical connections were made.

The tarpaulin sheet was fixed to the frame and assembly was completed.





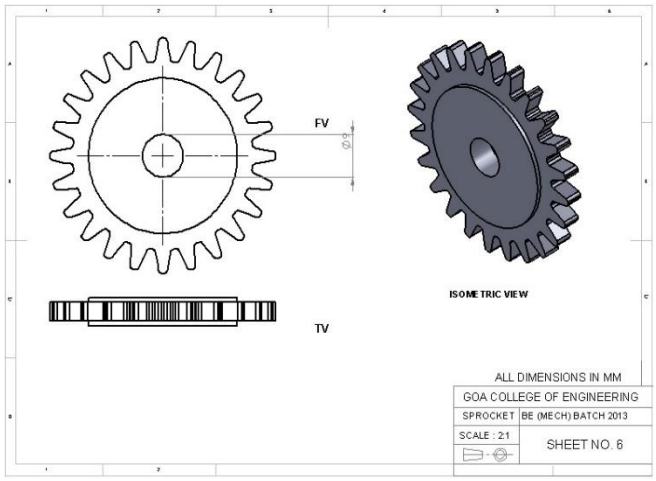


Figure 4: Frame

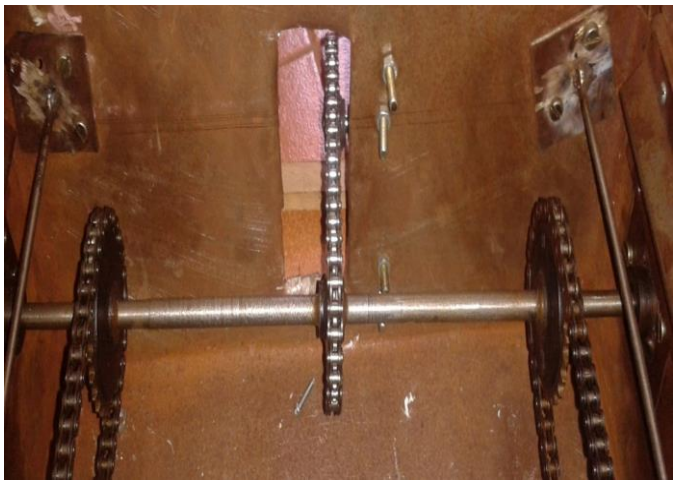


Figure 5: Front Shaft

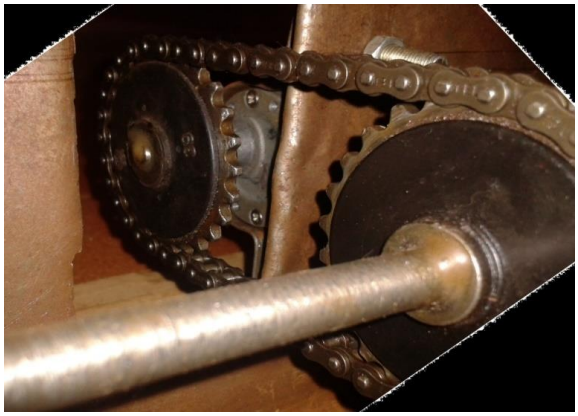


Figure 6: Front shaft powered by single motor using chain and sprockets

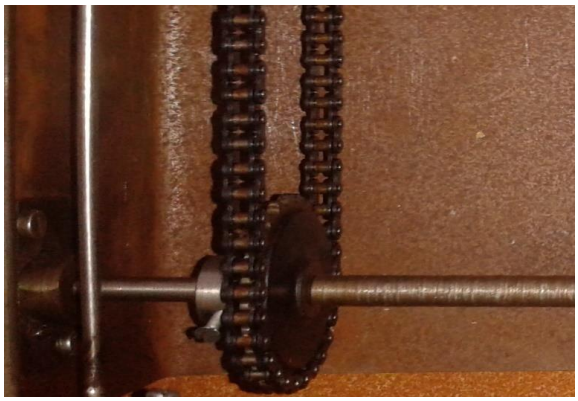


Figure 7: Showing Bush, lock, Sprocket Chain on Back shaft

Working

The electric motor starts by pressing the switch. The drive from the motor is transmitted to the rods via the chains mounted on the sprockets.

As the motor starts, a pull is given to the last horizontal member and the member starts moving towards the rear end along the V-guide ways. Once the cross links connected to the last and the immediate preceding link open fully, the immediate preceding link starts its motion. This happens due to the constraint provided for the maximum angle between the cross links.

Each corresponding adjacent link except the first link moves relative to the motion of the last horizontal member.

The motion is caused and maintained by the rolling of the pulleys on the guide ways provided

While closing, cross links connecting last two horizontal members will close first. Once these cross links close, the successive cross links closes. As a result of this, all the horizontal members move towards the front end and get accumulated at the front end.

Figure 8: Open Roof Position

Figure 9: Closed Roof Position

Finishing And Testing

After the construction and assembly was completed, the prototype was painted to make it pleasing and attractive.

The electric motor was powered use of eliminator as power supply and the mechanism's working was tested. The motion of the horizontal members and the cross links was found to be as desired. Hence the

testing was successful as the mechanism performs its intended function satisfactorily.

The circuit used for clockwise and counter clockwise motion of motor consisted of a single motor in series with Double Pole Double Throw, spring centered switch. The circuit was powered by eliminator supplying 6 volts. The circuit is as follows.

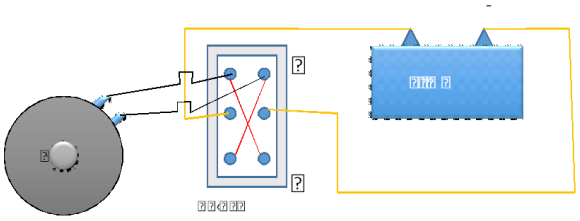


Figure 10: Basic Circuit Diagram

Conclusion

A detailed study and analysis of the problem statement was carried out at the initial stage of the project. The major concern was environmental pollution and safety.

The design based on collapsible link mechanism was done and the same was fabricated and automated.

Testing was also carried out to test the working. It was found to be successful.

Thus, the project successfully meets the requirements of solving the problem of environmental pollution during transportation and the safety of the other motorists on the road.

Scope

- The wastage of ore due to spillage is reduced.
- The environmental pollution is reduced.
- The inconvenience caused to motorists on the road is reduced.
- There is ease in covering and uncovering the carriage.

Recommendations

1. The V-guide ways present on either side of the inner wall of the carriage should be raised by some height by providing a plank so that it does not interfere with the ore filled in the truck.
2. The rods containing the sprockets should project out from the carriage by some small distance and the same should be covered with a flap so as to avoid its damage in case it comes in contact with the shovel during the loading process.
3. Limit on the carrying capacity should be set and strictly followed so that the mechanism is efficiently used.
4. By providing a sloping guide way and accumulating the tarpaulin when in the closed position on the part of carriage above the cabin, the entire area of the carriage can be utilized for loading.

Acknowledgement

We thank Panduronga Timblo Group, Goa for entrusting us with project.

We thank late Prof. Uday Amonkar, former HMED for permitting us to go ahead with the project.

We thank Prof. Akshay Nigalye, Project Guide for his constant support and guidance.

We also thank our workshop in charge for allowing us to use the facilities of the college workshop.

We also thank workshop assistants for extending their help and support whenever required.

References

1. http://satyamelevators.com/doors/
2. http://googleweblight.com/i?u=http://
3. www.scxspecialprojects.co.uk/&hl=en-IN
4. www.google.com
5. www.wikipedia.com

Authors:

S. Rivankar is Assistant Professor in the Department of Mechanical Engineering, Agnel Institute of Technology & Design, Mapusa - Goa, India. He did his M. Tech in Computer Aided Design from SRM University, Kattankulathur. His areas of interests are in the fields of Engineering Material Science, Applied Mechanics, Product Design.

Email: snr@aitdgoa.edu.in

Dr. Akshay Nigalye is Professor in Mechanical Engineering Department, Goa College of Engineering, Farmagudi, Goa, India. He did his PhD in NIT Karnataka, Suratkal, India. His area of PhD work is Modeling of Material Properties using Neural Network Techniques. He did his ME in Machine Design, VJTI, Mumbai, India. His areas of interests are in the fields of Mechanical Engg. Design,

Mechanical Vibrations, Solid Mechanics, Artificial Neural Network. Email: avn@gec.ac.in

Prasanna C. Kattimani is Assistant Professor in the Department of Mechanical Engineering, Agnel Institute of Technology & Design, Mapusa - Goa, India. He did his M. Tech in Production Management from BVBCET, Hubli. His areas of interests are in the fields of Manufacturing, Composites and Fluid Mechanics. Email: pk@aitdgoa.edu.in

Niraj G. Pai Bhale is a Research Scholar in Periyar Maniammai University, Tamilnadu, India and Assistant Professor and Head of Mechanical Engineering at Agnel Institute of Technology and Design, Assagao, Bardez, Goa, India. He did his Master in Industrial Engineering from Goa University in 2007. His research interest is in the field of Six Sigma Management, Supply chain management and Operations and Project management. Email: nirajbhale@gmail.com

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

Optimization of Gas Turbine Liner Thickness Analysis by using CAE Tool

Gopal gowda[1], Dr. Vijendra Kumar[2], Bala kumar[3]

[1]Assistant Professor, Department of Mechanical Engineering, CBIT, Kolar, India, gopalgowdahk@gmail.com

[2]Professor and Head, Department of Mechanical Engineering, MSEC, Bangalore, India, vijendravk@gmail.com

[3]Scientist 'E', Department of Mechanical Engineering, GTRE, Bangalore, India, balakumariisc@gmail.com

ABSTRACT

The aerospace technology the power developed by gas turbines using in defense must produce high thrust to take a lift in short runway and for different motion direction, sudden variation in velocity which is essential in war field. So in fighter jets the gas turbine will be of after burner jet type gas turbine after burner to produce huge thrust extra fuel must be burnt in after burner area, so to safe guard gas turbines from this huge thrust effect a liner is used. The liner must very thin because it should have lesser weight which essential in aircraft and with high strength and subjected under external radial pressure. The thin cylinders under ramped load usually buckle. Hence the liner is designed under buckling analysis and ensured that liner should have buckling factor more than one. So that critical load (P_{cr}) will be more than applied load.

In this paper we optimize the liner thickness on the basis of crest diameter at corrugated section of liner. So first we optimize the crest diameter by iterations method. The thickness is taken equal to its maximum value and diameter will gradually increase until getting buckling factor value more than one. Once we get safe crest diameter then the liner thickness is optimized in iteration method by increasing thickness from minimum value and it is continued until buckling factor value reach more than one.

In the each iteration the model is considered as new model and all the process of analysis is carried out from surface modeling to analysis of buckling factor by using CAE tools. After optimizing the thickness the final liner model with optimized crest diameter is drafted.

1. Introduction

The gas turbine is used in air crafts should be through enough to stay safe in all conditions but the same time it should be less in weight in the designing of linear for gas turbine the optimizing of thickness is very crucial because it should be designed under limited dimensions due to compactness of gas turbine engine as shown in figure 1. And the Figure 2 shows the variation of temperature and pressure. The designing of liner is done by several iterations carried out to reach the safer dimensions which make the radial cylinder to be safe under buckling. By this phenomenon the work was carried out by the fallowing method.

- Basic profile generation
- Surface modeling and meshing
- Applying boundary conditions and meshing
- Optimization of thickness

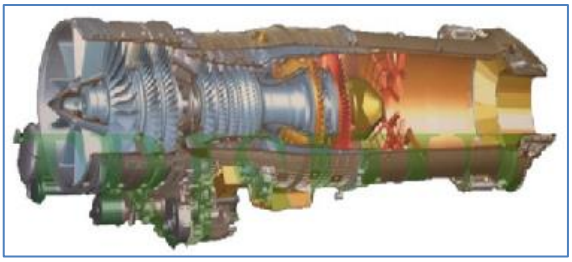


Fig 1. Kaveri Gas Turbine Engine.

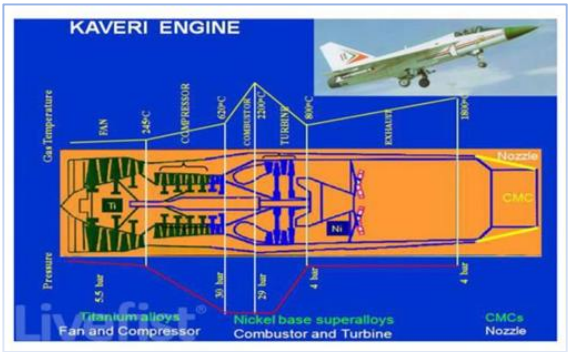


Fig 2.Variation of Temperature and pressure.

Table. 1. Engine Specifications

Engine Specifications	
Rate of air flow	78kg/s
By-pass ratio	0.16
Ratio of overall pressure	21.5
Entry temperature of turbine	1487 – 1700^{0}K
Thrust – dry	52 KN
Specific Fuel Consumption	0.78 Kg/hr/^{0}K
After burner maximum power thrust	81KN
After burner maximum power SFC	2.03kg/hr/kg
Thrust to weight ratio	7.8
Application	Indian LCA

2. Methodology

The profile of the geometry is generated as per the available dimensional data by using Auto-cad. The important factor is the top crest of the profile liner throughout the length of corrugated section of cylinder is kept open for further incremental diameter to check out buckling and Eigen values.

The profile generated is imported to Hyper works and by rotating base line around the axis. Then meshing of surface done by Quadra mesh type and keeping the nodes throughout the length of the cylinder around the diameter in uniform number for continuity and smooth meshing for getting accuracy in analysis and it can be checked by jacobian etc.

Boundary Conditions

- All front nodes are constrained in both axial and tangentially
- At other three sections along the axis at different positions selected 12 nodes at each section around the diameter in equiangular which are constrained tangential only.
- After applying boundary conditions the external pressure of 0.5MPa (ramped)and uniform about 5000K was applied

2 Material Properties

The material properties of Haynes C263 are shown in table 2.

Table 2. Properties of Haynes C263

Property	Value
Material	Isotropic
Young's Modulus	2.1×10^5 N/mm^2
Poisson's Ratio	0.33
Yield Strength	580 MPa.
Tensile strength	973 MPa.
Elongation	0.39

The cylinder was cheeked under static (Von-misis) and dynamic (Eigen values) analysis. If the Eigen value is less than one of the next iteration was done by repeating process after increasing crest radius by 4mm and proceeds all reaching the Eigen value more than one to make cylinder to be safe under buckling.

3. Optimization

The thickness of liner is critical thing in designing of liner because of limited space area so that the thickness should be less than 2mm by iterations again by the value of thickness as 0,9mm, 1,2mm, 1,5mm, and 2mm for each thickness the analysis was done by buckling analysis under Eigen value starting by 0.9mm thickness. If the thickness is less than one then move to next thickness value. If more than one stop and take the thickness is safe for liner. Then do the increment in diameter of crest of liner in corrugated cylindrical section of liner and repeat all the process as fresh model till the reaching of Eigen value more than one.

4. Analysis

The goal of this example is to model the problem as shown in figure 3. This is a thin cylindrical model where ANSYS general shell elements will be used to predict the displacement and stress behavior of the thin cylinder subjected to external radial loads on

outer surface. The structure is constrained at the left end so that no translation or rotations are allowed.

4.1 Geometric Modeling

Figure shows the geometric model of a liner.

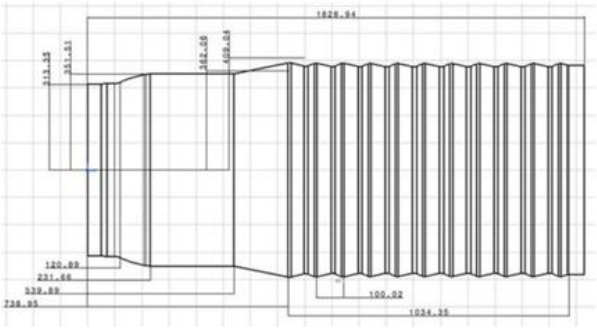


Fig. 3. 2D Basic Liner diagram

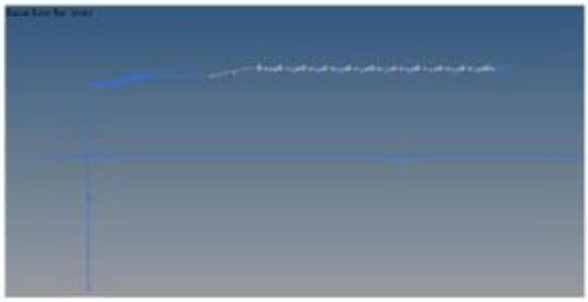


Fig. 4. Profile of a liner

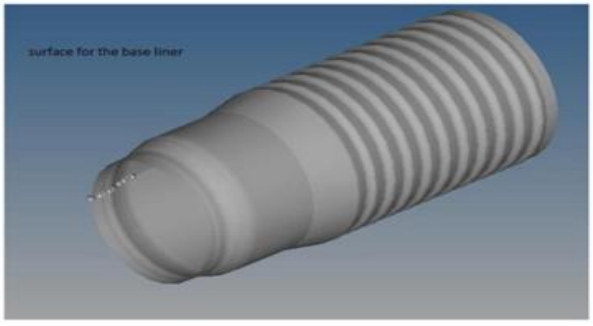


Fig. 5 Surface model of a liner

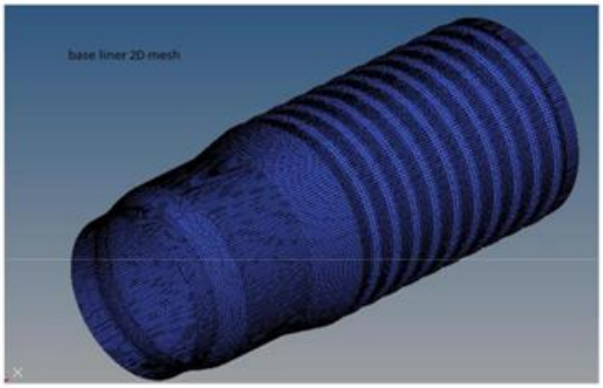


Fig. 6 FE meshed Model of liner

4.2 Boundary Conditions

Front end nodes constrained tangentially and axially. At the other three sections along the length of liner no rotations and only 12 nodes at each sections. The external pressure is ramped pressure of 0.5 MPa on surface of liner.

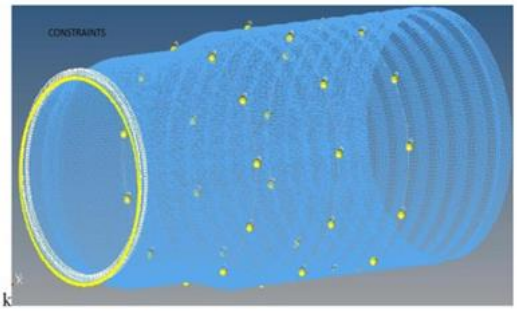


Fig. 7 Constrained FE Model

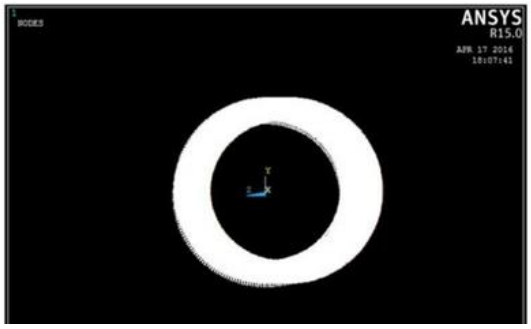


Fig. 8 F E Model under Pressure

Model (A4, B4) > Linear Buckling (B5) > Solution (B6) > Total Deformation

Mode	Load Multiplier
1.	2.0899e-007
2.	1.2119e-006
3.	
4.	1.2143e-006
5.	1.2212e-006
6.	1.2392e-006
7.	1.2394e-006
8.	1.2806e-006
9.	1.281e-006
10.	1.3299e-006

Table 2. Mode shape of liner

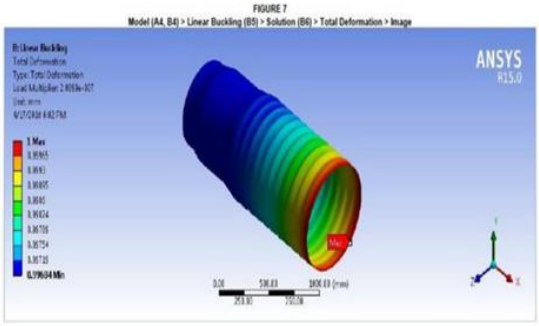


Fig. 8 Results of liner

5. Results and Discussions

In these discussions main focus on buckling factor because the liner of gas turbine is considered as thin cylinder, so we should be make sure that the liner has to be safe under buckling. This can be done if our design parameters are gives the value of buckling factor more than one and which shows that the critical load (P_{cr}) will be more than applied loads as shown in Figure 9. Hence liner will be safe. The result fallows for base profile liner of thickness 2mm which is kept constant throughout the optimization of liner crest diameter.

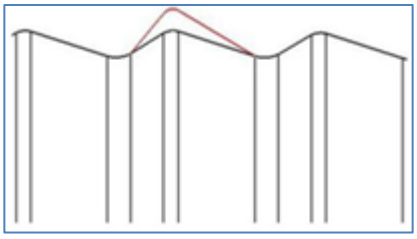


Fig. 9 Results of liner

Tabular Data

	Mode	Load Multiplier
1.	1.	2.0899e-007
2.	2.	1.2119e-006
3.	3.	
4.	4.	1.2143e-006
5.	5.	1.2212e-006
6.	6.	1.2392e-006
7.	7.	1.2394e-006
8.	8.	1.2806e-006
9.	9.	1.281e-006
10.	10.	1.3299e-006

Table. 3 Eigen values of liner

In this analysis we can observe that the buckling factor is very less, it shows that the critical load is lower than applied load. Hence the diameter of liner crest will not safe. Therefore the diameter has to be increased to next increment say 4mm, 10mm, 16mm and 18mm as bellow.

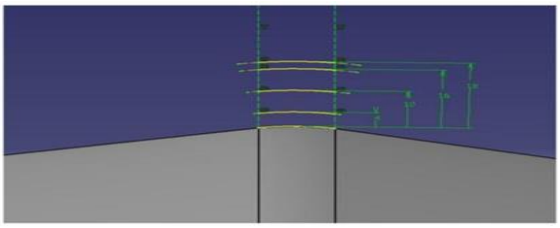


Fig. 10 Increments of base line by 4mm, 10mm, 16mm and 18mm

Analysis for incrementsl crest diameter should begin as new analysis from surface modeling as explained earlier until to reach the buckling factor more than one.

Results for base liner 4mm

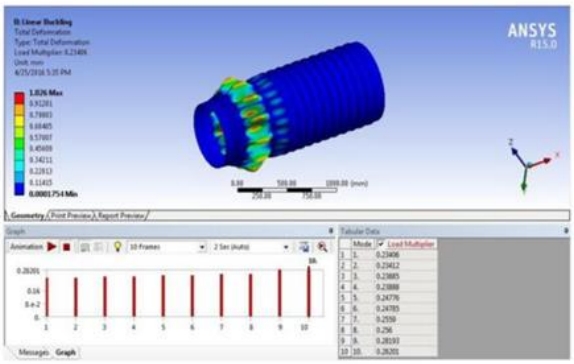


Fig. 11 Results of liner

Tabular Data

	Mode	Load Multiplier
1	1.	0.23406
2	2.	0.23412
3	3.	0.23885
4	4.	0.23888
5	5.	0.24776
6	6.	0.24785
7	7.	0.2559
8	8.	0.256
9	9.	0.28193
10	10.	0.28201

Table. 4 Eigen values of liner

The results for 4mm increment in crest diameter is shown above, we observed that buckling factor is less than. Hence liner is not safe and which is increased to be next increment say 10mm.

Resut analysis for 10mm liner

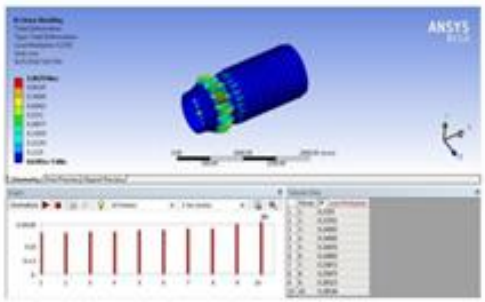


Fig. 12 results for base 10mm liner

Table 5. Eigen values of base 10mm

Tabular Data

	Mode	Load Multiplier
1	1.	0.2355
2	2.	0.23551
3	3.	0.24083
4	4.	0.24085
5	5.	0.24876
6	6.	0.24883
7	7.	0.25872
8	8.	0.25875
9	9.	0.28523
10	10.	0.28526

Here also we observed that buckling factor is less than one hence we should go for next analysis for new incremental value say 16mm.

Resut analysis for 16mm liner

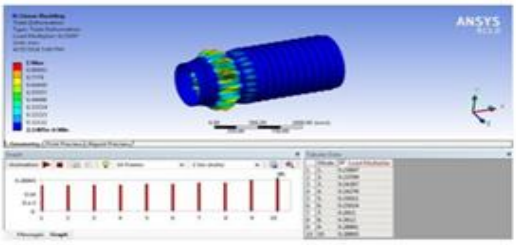


Fig. 13 results for base 16mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	0.23697
2	2.	0.23709
3	3.	0.24267
4	4.	0.24276
5	5.	0.25011
6	6.	0.25024
7	7.	0.2611
8	8.	0.2612
9	9.	0.28861
10	10.	0.28865

Table 6 Eigen values of base 16mm

The result analysis for 16mm base liner is also shows buckling factor is less than one hence next incremental diameter is done for 18mm and the process is continued as earlier.

Results for base liner 18mm

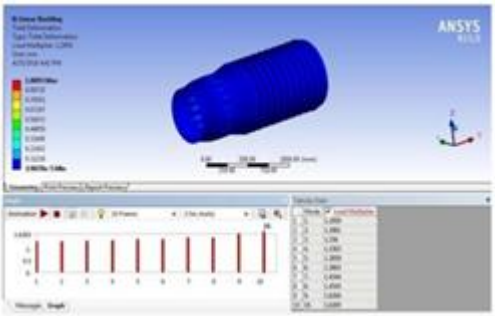


Fig.14 Results for base 18mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	1.2959
2	2.	1.2961
3	3.	1.336
4	4.	1.3363
5	5.	1.3859
6	6.	1.3863
7	7.	1.4544
8	8.	1.4545
9	9.	1.6264
10	10.	1.6265

Table 7. Eigen values of base 18mm

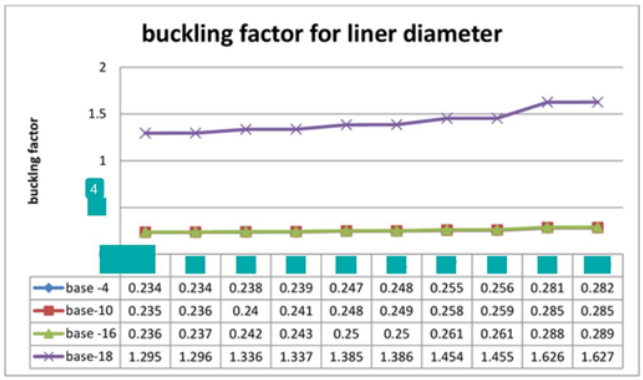


Fig. 15 Graph shows summary of buckling factor for different crest diameter

The results of base diameter 18mm liner are shows the buckling factor value more than so the liner having crest diameter with incremental value of 18mm to base diameter will safe under buckling. Hence this diameter can be taken to design the liner of the gas turbine.

5.1 Optimization

From the above result analysis it is observed that the thickness of the liner kept constant as 2mm throughout the crest diameter optimization process which is the maximum thickness of the liner available within the space limit for gas turbine. This is done by iterations for different incremental thickness of liner started with minimum value. So that we can achieve minimum thickness which is safe under buckling. The increment in thickness is done by 0.1mm and till 2mm. the thickness of liner is optimized for which we get buckling factor value more than one.

Result analysis for base 18mm – 0.9mm liner

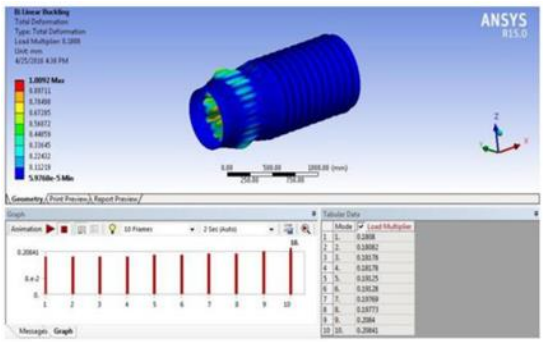


Fig.16 result analysis for base 18mm – 0.9mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	0.1808
2	2.	0.18082
3	3.	0.18178
4	4.	0.18178
5	5.	0.19125
6	6.	0.19128
7	7.	0.19769
8	8.	0.19773
9	9.	0.2084
10	10.	0.20841

Table 8. Eigen value for base 18mm – 0.9mm

We can observe that the buckling factor is less than one, so the process of optimization further is required say 18mm – 1.2mm.

Results for base 18mm – 1,2mm liner

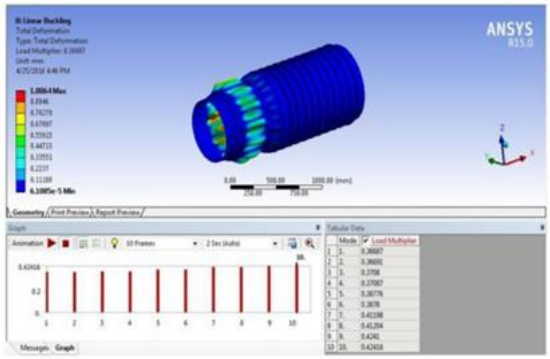


Fig. 17 Result analysis for 18mm - 1.2mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	0.36687
2	2.	0.36691
3	3.	0.3708
4	4.	0.37087
5	5.	0.38776
6	6.	0.3878
7	7.	0.41198
8	8.	0.41204
9	9.	0.4241
10	10.	0.42416

Table. 9 Result analysis for 18mm - 1.2mm liner

The result analysis shows buckling factor is less than one. Hence next iteration is required

Result anlysis for 18mm - 1.5mm liner

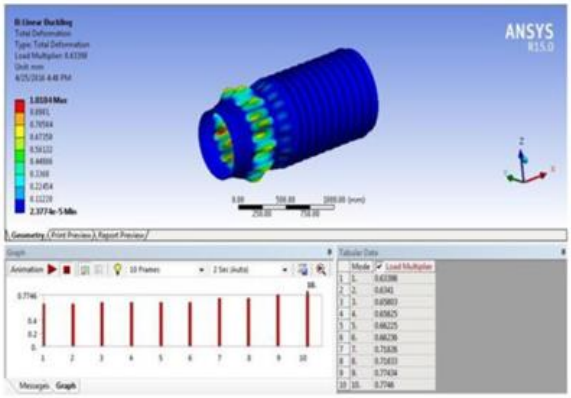


Fig. 18 Result analysis for 18mm - 1.5mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	0.63398
2	2.	0.6341
3	3.	0.65803
4	4.	0.65825
5	5.	0.66225
6	6.	0.66236
7	7.	0.71826
8	8.	0.71833
9	9.	0.77434
10	10.	0.7746

Table. 10 Result anlysis for 18mm - 1.5mm liner

Result analysis for 18mm - 2mm liner

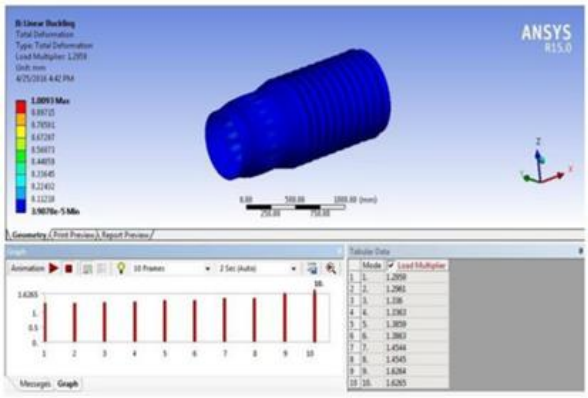


Fig. 19 Result analysis for 18mm - 2mm liner

Tabular Data

	Mode	Load Multiplier
1	1.	1.2959
2	2.	1.2961
3	3.	1.336
4	4.	1.3363
5	5.	1.3859
6	6.	1.3863
7	7.	1.4544
8	8.	1.4545
9	9.	1.6264
10	10.	1.6265

Table. 10 Result analysis for 18mm - 1.2mm liner

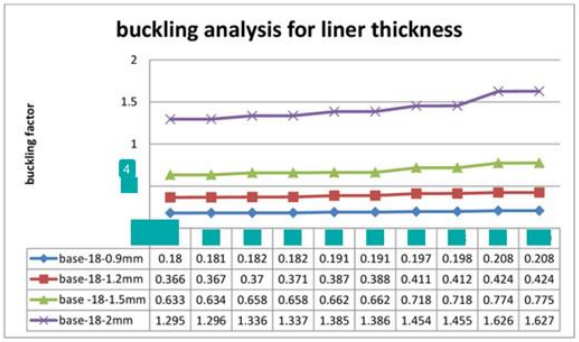


Fig. 13 Graph showing summary of buckling factor for different liner thickness

The results of base 18 – 2 mm liner shows the buckling factor value more than one. So this liner thickness with incremental value of modal base 18mm – 2mm liner along the optimized thickness will safe under buckling. Hence this thickness can be taken to design the liner oh the gas turbine.

6. Conclusions

The paper is selected because of the previous analysis on thin cylinder was analyzed under buckling but the thickness was not optimized by considering the diameter of the thin cylinder. We planned to do the analysis by using the CAE Tools

The work shows the way of optimizing a parameter by considering and designing of other parameter. In this work we consider diameter of liner through which we optimize the thickness of liner. This method of design and analysis gives better and faster way in reaching the final results.

The thin cylinder under external pressure has more tendencies to buckle. This can be avoided by strengthening of cylinder. The liner which is considered as thin cylinder has corrugated section where the chances are more so. We concentrated to give larger strength to the corrugated section. Captivating the variation of crest diameter for different iterations until reach the safe buckling factor.

References

[1]. Finite Element Method studies on the stability behavior of cylindrical shells under axil and radial uniform and Non-uniform loads by MyriamlturgaizElso, Hochschule Niederrhen University, Kreld.

[2]. A study of the effect of Imperfections on buckling capability in thin cylindrical shells Under Axila loading by Lauren Kougias Rensselaer Polytechnic Institute. Hartford.

[3]. G Krishnamoorthy " Buckling of thin Cylinder under combined External pressure and Axil Compression" Journal of the Aircraft. Vol. 11, No.2 (1974), pp 65-68.

[4]. P. W. Sharman, " A theoretical Iteration Equation for the Buckling of Circular shells under Axial compression and External pressure "Journal of the Aerospace Sciences. Vol. 29.No. 7(1962), pp 878-879.

[5]. MASANOBU SHINOZUKA and CLIFFORD J ASTILL, " Random Eigen value Problems in Structural Analysis", AIAA Journal. Vol. 10, No. 4 (1972), pp, 456-462.

[6]. T. Subramani and A. Sugathan, "Finite Element Analysis of Thin Walled-Shell Structures by ANSYS and LSDYNA", International Journal of Modern Engineering Research, Vol.2, Issue.4, page-1576-1587, July-Aug, 2012.

[7]. P. K.Datta and S.Biswas, "Research Advances on Tension Buckling Behaviour of Aerospace Structures:A Review" International journal of Aeronautical & Space Science, Science, vol-12(1),page, 1-15, 2011.

AUTHOR PHOTOS AND BIOGRAPHY

Gopal gowda,
B.E, ME, (Ph.D)
Experience: 16 Years
Specialization : Theraml
CBIT, Kolar, India

Dr. Vijendra Kumar, *Professor and Head, Department of Mechanical* Engineering, MSEC, Bangalore, India *Experience: 23Years*
Specialization : Design and CFD

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

NUMERICAL INVESTIGATIONS OF SHEAR- THINNING FLUID IN A MIXING CHAMBER HAVING A BILOBE ROTOR

Shivakumara P[1], Kushalkumar K[2] , Dr.V.Vijendrakumar[3], Dr. K.S Badrinarayan[4]

[1]Research scholar Department of mechanical engineering, M S Engineering College, skptpr2012@gmail.com

[2]Assistant Professor Department of mechanical engineering, M S Engineering College, kushala77@gmail.com

[3]Professor and H.OD Department of mechanical engineering, M S Engineering College, vijendravk@gmail.com

[4]Professor and principal Department of mechanical engineering, M S Engineering College, principal@msec.ac.in

ABSTRACT

In the chemical and process industries, it is often required to pump industrial fluids over long distances from storage to various processing units and/or from one plant site to another. Pipe fittings like valves, bends, elbows, tees, reducers, expander etc. are the integral part of any piping system. Flows through these piping components are more complex than the straight pipes. There may be a substantial viscous loss, frictional loss and pressure losses in both the pipe line and in the individual units themselves. The problem of determining these losses in pipes is important in design and analysis of the fluid machinery.

The purpose of the project is to understand the characteristics of industrial fluids and structured fluid interaction by capturing the velocity, pressure, viscosity and shear strain rate profiles and then inferring them to produce optimal results and conclusions. By studying the flow characteristics of shearing thinning fluid in a mixing chamber. Computational Fluid Dynamics (CFD) analysis for shearing thinning fluid in a mixing chamber having a bilobe rotor in a cylinder model is presented. The commercial software ANSYS 14.5 has been used for the simulation. Cross model has been used for the simulation of non-Newtonian liquid flow through bilobe rotor cylinder model.

1. INTRODUCTION

Most low molecular weight substances such as organic and inorganic liquids, salts, molten metals and gases exhibit Newtonian flow characteristics, i.e., at constant temperature and pressure, in simple shear [1] , the shear stress is proportional to the rate of shear and the constant of proportionality is the dynamic viscosity (μ). Such fluids are generally known as the Newtonian fluids, albeit the notion of flow and of viscosity predates Newton.

$\tau_{yx} = F/A = \mu(\dot{\gamma}_{yx})$

For most liquids, the viscosity decreases with temperature and increases with pressure. For gases, it increases with both temperature and pressure. Broadly, higher is the viscosity of a substance, more resistance it presents to flow. As we go down the viscosity increases by several orders of magnitude, and thus one can argue that a solid can be treated as a fluid whose viscosity tends towards infinity, $\mu \rightarrow \infty$.

During the past 50-60 years, there has been a growing recognition of the fact that many substances of industrial significance, especially of

multi-phase nature (foams, emulsions, dispersions and suspensions, slurries) and polymeric melts and solutions (both natural and man-made) do not conform to the Newtonian regime of the linear relationship between (τ) and in simple shear. Accordingly, these fluids are variously known as non-Newtonian, non-linear, complex, or rheological complex fluids. suitable distance through pipe. If seeds container have two partitions then seeds separate column to column.

A non-Newtonian fluid flow properties differ in many ways from those of Newtonian fluids. Most commonly the viscosity of non-Newtonian fluids are dependent on shear rate or shear rate history. In practice, many fluid materials exhibits non-Newtonian fluid behaviour such as: salt solutions, molten, ketchup, custard, toothpaste, starch suspensions, paint, blood, and shampoo etc. In a non-Newtonian fluid, the relation between the shear stress and the shear rate is different, and can even be time-dependent. Therefore a constant coefficient of viscosity cannot exist.

A product concept is an approximate description of the technology, working principle and form of the product. It is the concise description of how the product will satisfy the customer needs. Concept is usually expressed as a sketch or as a rough three dimensional model and is often accompanied by a brief textual description. The degree to which a product satisfy customer and can successfully commercialized depends to a large measure on the quality under laying concept.

2. OBJECTIVE

- To review literature on shear thinning fluids
- Develop a model of bilobe rotor in a cylinder
- Applications of boundary condition & solve using CFX14.5
- To produce the results in CFX post and further translate infer & conclude the results

3. METHODOLOGY

Our study begins with literature work on flow characteristics of non-Newtonian fluids and their empirical models by referring some journals, books, websites and other related documents.

The design specifications of cylinder bilobe rotor model is formulated based on our applications and reviewed literature. The model is developed in the commercial ICEM CFD, ANSYS 14.5 design tool, design specifications and the model is shown below

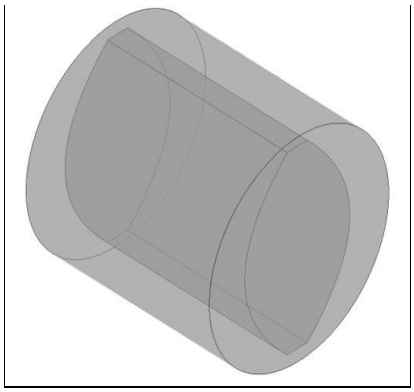


Figure-1 shows design model of Bilobe rotor in a cylinder

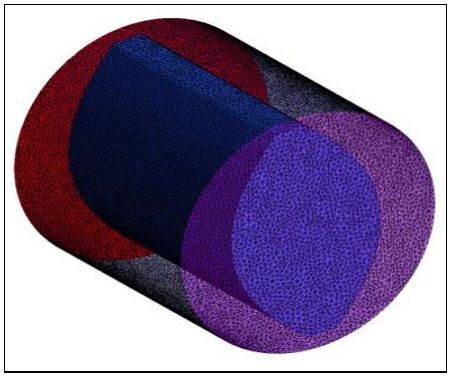


Figure2 shows meshed model

The purpose of the workt is to understand the characteristics of industrial fluids and structured fluid interaction by capturing the velocity, pressure, viscosity and shear strain rate profiles and then inferring them to produce optimal results and conclusions.

The aim of the work is to study the flow of non-Newtonian fluid through pipe and to compare the merits and demerits of different Non-Newtonian fluid models, which are mostly empirical in nature that are available today.

4. RESULTS

Figure 3 shows dynamic viscosity contours for 3 models , here we can cross model clearly represents dynamic viscosity variation (first left figure) in

between cylinder & bilobe rotor compare to careen model & cross model. Figure 4 shows graph of dynamic viscosity v/s shear strain rate, we can see that dynamic viscosity is gradually decreasing with increase in shear strain rate, as this is the behaviour of shear thinning fluids.

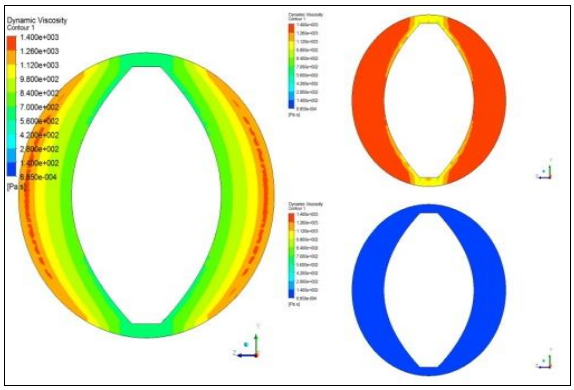


Figure 3 shows Dynamic viscosity comparisons for 3 models for 500 rpm

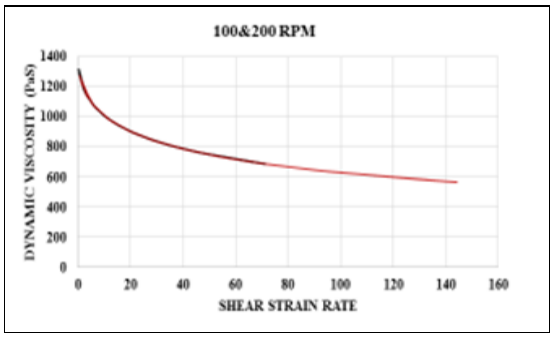


Figure 4 shows graph of Dynamic viscosity v/s shear strain rate

5. CONCLUSION

Computational Fluid Dynamics (CFD) analysis has been reported for non-Newtonian shear thinning fluid in a mixing chamber having bilobe rotor. In all the cases the CFD modeling matches well with the empirical model.

In case of analysis of non-Newtonian shear thinning fluid in a bilobe rotor cylinder the CFD analysis predicts the velocity, shear strain rates, pressure and dynamic viscosity field at different points in the bilobe rotor cylinder. From the velocity contours we concluded that for different speeds, velocity is maximum at the bilobe rotor wall and decreases towards the inner wall of the cylinder.

Contour plots of velocity and shear strain rate shows that both are maximum near the bilobe rotor wall and decreases towards the cylinder inner wall. Contour plot of Dynamic viscosity shows that the viscosity is lower at the regions of bilobe rotor wall and is higher at cylinder inner wall. We conclude that the dynamic viscosity decreases with increase in speed.

Velocity stream lines shows the stream line paths of shear thinning fluid. Shear strain rate v/s dynamic viscosity graphs on three sections shows that dynamic viscosity decreases with increase in shear strain rate or vice versa. From this we conclude that viscosity of shear thinning fluid dependent on shear strain rate. Dynamic viscosity contours for three shear thinning fluid models infers that cross viscosity model clearly shows the dynamic viscosity variation compare to bird-carried model and power law model.

7. REFRENCES

[1]. *Suhas V. Patankar,* Numerical heat transfer and fluid flow

[2]. *Lun-Shin Yao, Md. MamunMolla, S. Ghosh Moulic* Fully-Developed Circular-Pipe Flow of a Non-Newtonian Pseudo plastic Fluid

[3]. *F.T.Pinho and J.H.Whitelaw*Flow of non-Newtonian fluids through pipe

[4]. *R.P. Chhabra* ,Introduction to Non-Newtonian Fluids

[5]. *Prof A.M. Robertson*, Non Newtonian Fluids, Dept. of MechEngg. University of Pittsburgh, 2005

[6]. *James A Fay*, Introduction to fluid mechanics, 1996, Massachusetts IT

[7]. *John D. Anderson, Jr*. Computational fluid dynamics .the basic applications, 1995

[8]. *M. Eesa, M. Barigou,* "CFD investigation of the pipe transport of coarse solids in laminar power law fluids"

[9]. *DietmarKröner, Michaelruzicka, Ioannis Toulopoulos* "Local discontinuous Galerkin numerical solutions of non-Newtonian in compressible flows modeled by p-Navier–Stokes equations"

[10]. *M. Eesa, M. Barigou*"CFD analysis of viscous non-Newtonian flow under the influence of a superimposed rotational vibration"

[11]. *S. Malekmohammadi, M.F. Naccache, I.A. Frigaard, D.M. Martinez* "Buoyancy driven slump flows of non-Newtonian fluids in pipes"

[12]. *Rajeev K. Thakur, Ch. Vial, G. Djelveh, and M. Labbafi"*Mixing of complex fluids with flat-bladed impellers: effect of impeller geometry and highly shear-thinning behaviour"

[13]. *HouariAmeur, Mohamed Bouzit*"Power consumption for stirring shear thinning fluids by two-blade impeller"

[14]. *Gregory T. Jackson, Matthew T. Balhoff, Chun Huh, MojdehDelshad"*CFD-based representation of non-Newtonian polymer injectivity for a horizontal well with coupled formation-wellbore hydraulics"

[15]. *M. Patel and M.G. Timol "Similarity* solutions of boundary layer flow of non-newtonian fluids"

BIOGRAPHIES

Shivakumara.P Research scholar Department of Mechanical Engineering M.S Engineering College Bangalore. He is having 18 years of experience and industrial experience including 6 years of academics experience Area of interest is Thermal science, CFD, Materials

Kushalkumar.K Assistant professor Department of mechanical Engineering M.S engineering college Bangalore .Area of interest is design field and CFD

Dr. Vijendra Kumar, Professor and Head, Department of Mechanical Engineering, MSEC, Bangalore, India Experience: 23Years Specialization: Design and CFD

Dr.K.S.Badarinarayan is principal of M S Engineering College, Bangalore. He is having 28 years of academics and industrial experience including 6 years of research experience. He has presented many journal papers in international and national conferences. His area of interest is Flexible manufacturing system scheduling.
manufacturing system scheduling.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

"DESIGN OF WELDING FIXTURES FOR BOOM ARM ASSEMBLY"

JAYASHANKAR REDDY KN[1], SAI KIRAN.L[2]

[1,2]Student, Sai Vidya Institute of Technology, Rajanukunte, Bangalore

[1]jayashankarreddy09@gmail.com;[2]saik64757@gmail.com

ABSTRACT

There is a necessity for boom arm assembly which is one of the subassemblies of an ongoing project at L&T Construction Equipment Limited. So it is necessary to develop a tack welding fixture to reduce the cycle time and reduce welding distortions Tack welding is a temporary weld used to create an initial joint between two pieces of metal being welded together .Full welding is a continuous welding of metal joints using electric arc. In this work an attempt has been made to develop, modify and generate concepts to mount the sub-assemblies from the boom arm assembly onto fixtures to perform tack welding and full welding.

For developing the welding fixtures some of the important Critical to Quality (CTQ) issues are orientation of the tube, gap between the two sub-assemblies, clamping, land between the mid-plates and the front plate edge in and perpendicularly between mid plates and front plate. After developing this fixture we may save up to 112.3 minutes per boom arm assembly. Assembly of boom arm assembly without using fixture is 45 units per day after developing the fixture it increases to 60 units per day so that the production is increased and the assembly can be carried out faster.

Key Words—L&T Company, Critical to Quality (CTQ), boom arm assembly welding fixture

1 INTRODUCTION

1.1 BOOM ARM ASSEMBLY

The boom arm assembly is one of the sub-assemblies of a portable bridge system employed by the defense sector. Currently the project of developing the boom arm assembly is being carried out by L&T Construction Equipment Limited.

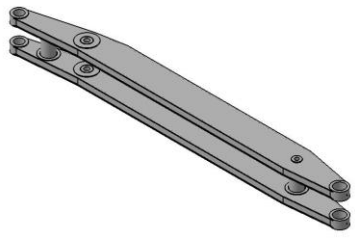


Fig.1: Boom arm assembly

1.2 BOOM ARM ASSEMBLY COMPONENTS

The boom arm assembly mainly consists of the following components:

- Front plates
- Mid plates
- Steel bosses
- Patch plates
- Pitch plates
- Tubes

1.3 TACK WELDING

Tack welding is a temporary type of weld used to create an initial joint between two pieces of metal being welded together. It is an integral part of the welding process and very important to the ultimate success of the welding project.

1.4BENEFITS OF TACK WELDING

- Ease of removal in order to correct any improper alignment of the components to be welded together.
- Stabilizes the overall alignment of components to be welded together.
- Reduces movements during the welding process.

1.5FULL WELDING

Full welding is a continuous welding of metal joints

using electric arc. It is a process used to permanently fuse two surfaces together. Here Gas Metal Arc Welding (GMAW) is used for full welding.

Gas metal arc welding (GMAW) is a welding process in which an electric arc forms between a consumable wire electrode and the work piece metal(s), which heats the Work piece metal(s), causing them to melt and join.

GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation.

Table 1.1: Weld specification

Welding process	Current (in amps)	Voltage (in volts)	Temperature (in c)	Gas
GMAW	280A-340 A	28 V-34 V	150 C°	Ar + CO_2 (98%+2%)

1.6 BENEFITS OF GMAW

- Gas Metal Arc Welding (GMAW) is fast and economical.
- The electrode and inert gas are automatically fed.
- Weld deposition rate is high due to continuous wire feed.
- No flux is used and hence no slag formation which results in clean welds.
- Thin and thick metals can be welded.
- Process can be automated. figures and tables.

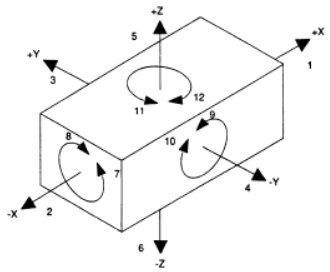
1.7 FIXTURE

A fixture may be defined as a device, which holds and locates the work piece during the inspection or for a manufacturing operation. A fixture is a device for locating, holding and supporting a work piece during a manufacturing operation. The fixture does not guide the tool. In construction, the fixture comprises different standards or specially designed Work holding devices, which are clamped on the machine table to hold the work in a position. The tools are set at the required position on the work by using gauges or by manual adjustments. Fixtures are essential elements of production processes as they are required in most of the automated manufacturing, inspection and assembly operation. Fixtures must correctly locate a work piece in a given orientation with respect to a cutting tool or measuring device, or with respect to another component, as for instance in assembly or welding. Such location must be invariant in the sense that the device must clamp and secure the work piece in that location for the particular processing operation. Fixtures are normally designed for a definite operation to process a specific work piece and are designed and manufactured individually. Jigs are similar to fixtures, but they not only locate and hold the part but also guide the cutting tools in drilling and boring operations. These work holding devices are collectively known as jigs and fixtures.

1.8 OBJECTIVES OF DESIGNING FIXTURE

- To eliminate marking, punching, positioning, alignments etc.
- For easy, quick and consistent accurate location, supporting and clamping the job in alignment of the cutting tool.
- To reduce overall machining cost and also increase interchangeability.
- Provide guidance to the cutting tool like drill, reamer etc.
- To increase productivity and maintain product quality consistently.
- To reduce operators labor and skill – requirement.
- To reduce measurement and its cost.
- To enhance technological capacity of the machine tools.

1.9 PRINCIPLE OF FIXTURE



Any rectangular body many have three axis along x-axis, y-axis and z-axis. It can more along any of these axes or any of its movement can be released to these three axes.

At the same time the body can also rotate about these axes too. So total degree of freedom of the body along which it can move is six. For processing the body it is required to restrain all the degree of freedom (DOF) by arranging suitable locating points and then clamping it in a fixed and required position. The basic principle used to locate the points is described below.

Considering the six degree of freedom of a rectangular block as shown in figure

It is made to rest on several points on the jig body. Provide a rest to job on three points on the bottom x-y surface. This will stop the movement along z-axis, rotation with respect to x-axis and y-axis. Supporting it on the three points is considered as better support then one point or two points. Rest the job on two points of side surface (x-z), this will fix the movement of job along y-axis and rotation with respect to z-axis. Provide a support at one point of the adjacent surface (y-z) that will fix other remaining free movements. This principle of location of fixing points on the job is also named as 3-2-1 principle of fixture design as number of points selected at different faces of the job are 3, 2 and 1 respectively.."

1.10ELEMENTS OF FIXTURES

- LOCATORS:A locator is usually a fixed component of a fixture. It is used to establish and maintain the position of a part in the fixture by constraining the movement of the part. For work pieces of greater variability in shapes and surface conditions, a locator can also be adjustable.
- CLAMPS:A clamp is a force actuating mechanism of a fixture. The forces exerted by the clamps hold a part securely in the fixture against all other external forces.
- SUPPORTS:A support is a fixed or adjustable element of a fixture. When severe part displacement/deflection is expected under the action of imposed clamping and processing forces, supports are added and placed below the work piece so as to prevent or constrain deformation. Supports in excess of what is required for the determination of the location of the part should be compatible with the locators and clamps.
- FIXTURE BODY:Fixture body, or tool body, is the major structural element of a fixture. It maintains the spatial relationship between the fixture elements mentioned above, viz., locators, clamps, supports and the machine tool on which the part is to be processed.

1.11 IMPORTANCE OF FIXTURES IN MANUFACTURING

The use of fixtures has twofold benefits. It eliminates individual marking; positioning and frequent checking before machining operation starts, thereby resulting in considerable saving in set-up time. In addition, the usage of work holding devices saves operator labor through simplifying locating and clamping tasks and makes possible the replacement of skilled workforce with semi-skilled labor, hence effecting substantial saving in labor Furthermore, the use of well-structured fixtures with higher locating and clamping rigidity would allow for increase in cutting speeds and feeds, hence improving production rate.

Besides improving the productivity in terms of the rate of production, there are also other benefits accrued through the use of fixtures. They are:

- Increase machining accuracy because of precise location with fixtures.
- Decreases expenditure on quality control of machined parts as fixtures facilitate uniform quality in manufacturing.
- Widens the technology capacity of machine tools and increases the versatility of machining operations to be performed.

1.12 MEANING OF LOCATOR

The location refers to the establishment of a desired relationship between the job and the fixture. Correctness of location directly influences the accuracy of the finished product. Determination of the locating points and clamping of the job serve to restrict movements of the component in any direction, while setting it in a particular pre-decided position relative to the fixture. Before deciding the locating points it is advisable to find out all the possible degrees of freedom of the job. Then some of the degrees of freedom or all of them are restrained by making suitable arrangements. These

arrangements are called locators.

2 MATERIAL PROPERTIES OF BOOM ARM ASSEMBLY

The boom arm assembly is made of High Strength Low Alloy Steel whose specification is as follows.

Table 2.1: Mechanical properties of boom arm

Yield strength	700 MPA
Ultimate tensile strength	780-930 MPA
% Elongation	16 %

Table 2.2: Chemical composition of boom arm

Carbon(C)	0.20%
Phosphorous(P)	0.02%
Manganese(M n)	1.60%
Silicon(Si)	0.60%
Copper(Cu)	0.30%

Table 2.3: Physical properties of boom arm

Impact toughness	Charpy v-notch at minus 40 degrees Celsius
Energy absorption in joules	27 JOULES –Average taken for 3 specimens

3 PROBLEM DEFINITION AND OBJECTIVES

3.1 PROBLEM DEFINITION

Presently the boom arm is manufactured using first principles of engineering, where all the measurements are done manually, dimensions are measured every time and positioning or fixing of each component is with the help of material handling system which leads to increased manufacturing lead time and so it is necessary to develop a fixture to reduce the cycle time of a boom arm assembly.

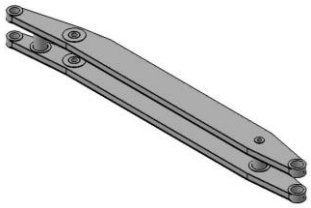


Fig.3.1: Boom arm assembly

During the continuous welding, due to distortion, the gap between the two arms is not maintained as per requirement. As per specifications the gap is 192mm with a tolerance

Up to ±2mm is acceptable but currently a gap of 186 to 189mm is only achieved. So it is necessary to maintain dimensions as per specifications

Fig.3.2: Top view of boom arm assembly

3.2OBJECTIVES

- To increase the productivity by designing tack welding and full welding fixtures.
- Study of the current cycle or process time for tack welding and comparison of the same after designing a fixture.
- To reduce or control welding distortion by proposing a full welding fixture.

4 METHODOLOGY

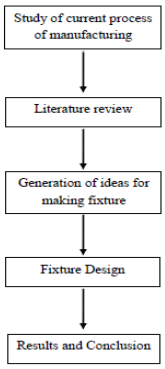


Fig.4.1: Flowchart

Process study: The development of tack welding and full welding fixture started with the study of the existing process used for tack welding and full welding of boom arm assembly. Currently boom arm assembly is being manufactured using first principle of engineering, where all measurements are done manually & positioning or fixing of each component takes a lot of time. Literature review: Based on the problem definition some papers related to fixture design are collected and the papers are studied. After considering the literature gap the further action is to be taken.

Fixture concepts: In this step study related to fixture, types of fixture, and elements of fixture and also fixture design concepts.

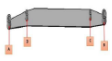
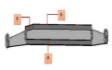
Fixture Design: In this stage study the component drawing of boom arm assembly and collect the data like component material, thickness of components and some of the mechanical properties. After

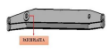
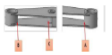
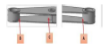
collecting the above inputs some ideas are to be generated and using the best suitable idea some initial drawings are developed in CATIA-V5R20 software.

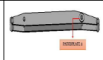
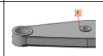
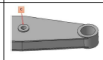
Results and Conclusion: Time comparison is made without using fixture and with using fixture and then results are tabulated. Based on the results, conclusions are made.

5 PROCESS SHEET WITHOUT USING FIXTURE

5.1 TACK WELDING PROCESS SHEET

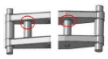
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
1	Remove Front plate from storing rack and keep it on Table ensuring a uniform height of 6.5mm from the table.	8.2		Use packing pieces of 6.5mm
2	Place the steel bosses A, B,C and D at respective places.	25		Tack weld the steel bosses and maintain perpendicularity with respect to front plate using trisquare.
3	Place the mid plates A, E & F over the front plates with a land of 6mm from plate ends.	15		End plates not to be put as there is inside welding of steel bosses
4	Tack weld the mid plates to the front plate. (no. of tacks=9)	15		
Description: Boom Arm Assembly				Sheet 1 of 6

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
5	Remove another front plate from the storing rack.	1		
6	Cover the top of the subassembly with the 2nd front plate and tack weld the front plate.	12		
7	Tack weld the patch plate A at the top of the steel boss D.	4.6		
8	Weld inside the steel bosses A,B and C.	20.2		Weld dimension (6*6)
9	Rotate the subassembly.	10		
10	Weld inside the steel bosses A,B and C	20.2		
Description: Boom Arm Assembly				Sheet 2 of 6

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
11	Tack weld the other patch plate to the opposite side of the steel boss D.	4.6		
12	Tack weld the remaining four mid plates (B, C, D & G) to the front plate.	28.8		
13	Full weld all around the steel boss C.	7.8		Weld dimension (6*6)
14	Rotate the subassembly	10		
15	Full weld the other side of the steel boss C	7.8		Weld dimension (6*6)
16	Tack weld the remaining mid plates to the other front plate.	8		
Description: Boom Arm Assembly				Sheet 3 of 6

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
17	Prepare two subassemblies.	396.4 (198.2×2)		
18	Place one subassembly on the table.	4.1		Provide packing if necessary.
19	Remove two tubes from the storing rack.	4.1		
20	Place one tube over the first subassembly. Maintain a centre to centre distance of 267mm between the steel boss A and the tube.	20		Ensure the tube is perpendicular to the sub assembly.
21	Place the other tube concentrically with the steel boss C and tack weld the tubes to fix their positions.	5		Use strong tacks for tack welding.
Description: Boom Arm Assembly				Sheet 4 of 6

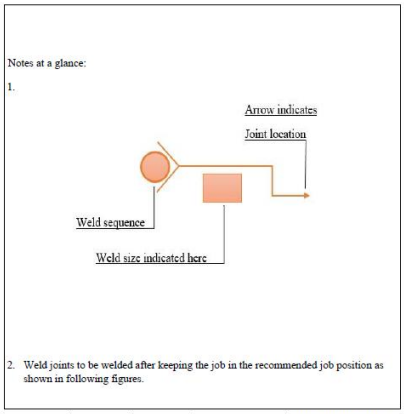
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
22	Tack weld pitch plates to the subassembly around the bottom of both the tubes.	4		
23	Insert two other pitch plates each through one of the tubes.	0.8		
24	Insert two pins through the steel bosses A and B.	5.3		
25	Place the other subassembly on top by locating the bores with the help of the pins.	10		Maintain parallelism between the two sub-assemblies and ensure a distance of 192mm between them.
26	Tack weld the tubes to the other subassembly.	4.6		Use strong tacks for tack welding.
Description: Boom Arm Assembly				Sheet 5 of 6

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
27	Tack weld the previously inserted pitch plates to the other subassembly.	4		
28	Remove the pins and prepare the boom arm assembly.	5		

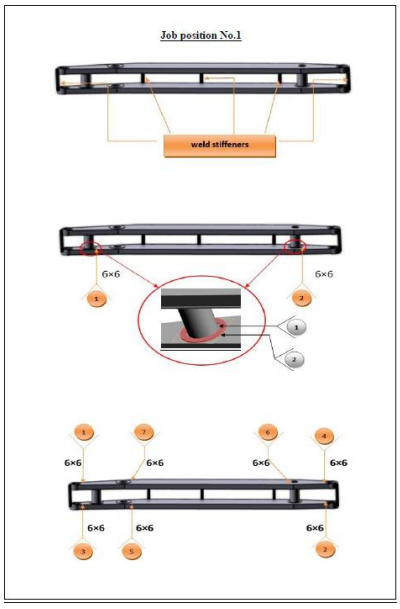
Description	Sheet 6 of 6
Boom Arm Assembly	

Standard time	436.3 min
Setup time	15 min
Total time	478.3 min

5.2 FULL WELDING PROCESS SHEET



Welding process	Current (in amps)	Voltage (in volts)	Temperature (in ˚c)	Boom Arm Assembly
				Full welding
GMAW Consumable Dia 1.2mm Solid Wire	280-340	28-34	150˚C	Sheet 1 of 6



6 FIXTURE DESIGN AND DEVELOPMENT

6.1 FIXTURE DESIGN CONCEPTS

Fixture planning is to conceptualize a fundamental apparatus arrangement through examining all the accessible data in regards to the material and geometry of the work piece, operations obliged, preparing gear for the operations and the administrator. The following design criteria must be observed during the procedure of fixture design:

- Design specification.
- Factory standards.
- Ease of use.
- Minimum changeover/setup.

6.2 FIXTURE DESIGN

Boom arm assembly has mainly two sub-assemblies, so first develop a tack welding fixture for one sub-assembly. It mainly consists of front plates, mid plates, steel bosses, patch plates and pitch plates. In boom arm assembly following are the Critical to Quality (CTQ) Issues

- Orientation of the Tube
- Gap between the two sub-assemblies
- Clamping
- Land between the mid-plates and the front plate edge in a sub-assembly
- Perpendicularity between mid plates and front plate.

6.3 MATERIAL SELECTION

Material selection is a matter of quality and cost. The properties of the material must be adequate to meet design requirements and service conditions. Selection of material depends upon the function of manufacturing parts.

6.4 MATERIAL USED FOR THE FIXTURES

Hot Rolled, Medium and High Tensile, Structural Steel bearing a code IS 2062 is the material used for the fixture components. These steels are suitable for welded, bolted and riveted structures and for general engineering purposes.

This material is used where welding is employed for fabrication and guaranteed weld ability is required. Its specification is as follows.

Table 6.1: Mechanical properties of fixture

Yield stress (in Mpa)			Ultimate tensile strength (in MPa)	% Elongation
<20mm	20-40mm	>40mm		
250	240	230	410	23%

Table 6.2: Chemical composition of fixture

Carbon (C)	0.23 %
Manganese (Mn)	1.50 %
Sulphur (S)	0.05 %
Phosphorous (P)	0.05 %
Silicon (Si)	0.40 %
Carbon equivalent	0.41%

Table 6.3: Physical properties of fixture

Impact tougness	Charpy v-notch (at room temperature)
Energy absorption (in joules)	27 J

6.5 TACK WELDING FIXTURE

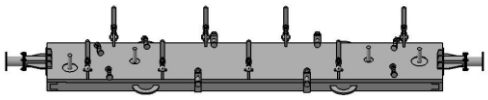


Fig.6.1: Tack welding fixture

Table 6.4 Parts list of Tack Welding fixture

Part no.	Description	Qty.
1	Tack welding fixture bed	1
2	Tack welding fixture support system	1
3	Toggle clamps	8
4	Positioner A	2
5	Positioner E	2
6	Positioner B,C,D,F,G	5
7	Boss clamp bolts	4

6.5TACK WELDING FIXTURE COMPONENTS

Fig.6.1: Tack welding fixture bed

Fig.6.6: Tack welding fixture support system

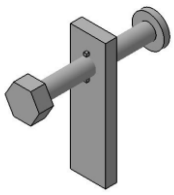


Fig.6.2:Positioner A (open) (close)

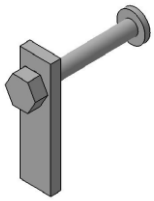


Fig.6.3:Positioner A

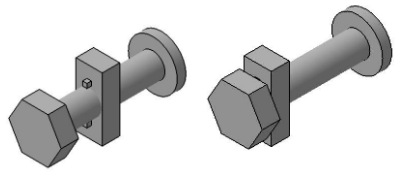


Fig.6.4:Positioner B,C,D,F,G (open) Fig.6.5:Positioner B,C,D,F,G (close)

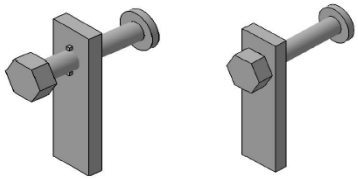


Fig.6.6:Positioner E (open) Fig.6.7:Positioner E (close)

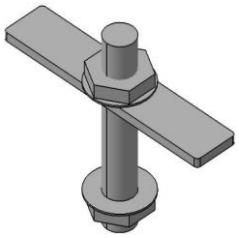


Fig.6.8: Boss clamping arrangement

6.6 FULL WELDING FIXTURE

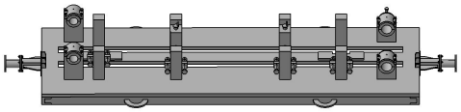
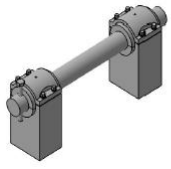


Fig.6.9: Full welding fixture

6.7 FULL WELDING FIXTURE COMPONENTS

Fig.6.10: Full welding fixture bed

Fig.6.11: Full welding fixture support system



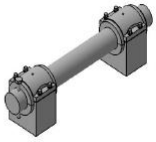


Fig.6.12: Plummer block A assembly Fig.6.13: Plummer block B assembly

Fig.6.14: Stopper block

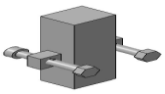


Fig.6.15:Positioner(150)-open

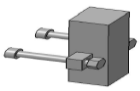


Fig.6.16:Positioner(150)-close

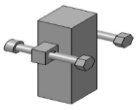


Fig.6.17:Positioner(236)-open

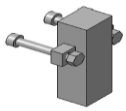


Fig.6.18:Positioner(236)-close

Fig.6.19: Internal stiffener-open

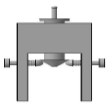
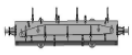
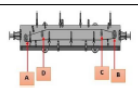
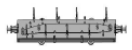
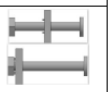
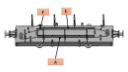
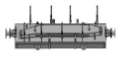


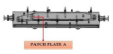
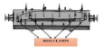
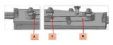
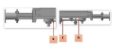
Fig.6.20: Internal stiffener-close

7 PROCESS SHEET AFTER USING FIXTURE

7.1 TACK WELDING PROCESS SHEET

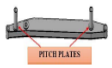
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
1	Remove front plate from storing rack and keep it on the fixture bed by locating bores with the help of the clamping bolts.	5		
2	Place the steel bosses A, B, C & D in the respective holes and tack weld them.	9.1		
3	Bring forward all the 9 positioners by rotating the screw clockwise.	3		

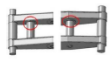
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
4	Place the mid plates A, E & F over the front plate, so that the positioners at that position must support the mid plates placed.	3.6		
5	Tack weld the mid plates to the front plate. (no. of tacks=9)	15		
6	Remove another front plate from the storing rack.	1		
7	Place the 2nd front plate over the mid plates by locating bores with the help of the clamping bolts.	4		
8	Lock all the 8 toggle clamps to securely fix the top plate.	2.5		

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
9	Tack weld the patch plate A on top of the 2nd front plate around the steel boss D.	4.6		
10	Secure the position of the bosses by means of clamping arrangement.	8		
11	Tack weld the 2nd front plate.	4		
12	Weld inside the steel bosses A, B and C.	20.2		Weld dimension (6*6)
13	Rotate the fixture by 180 deg.	5		
14	Weld inside the steel bosses A, B and C.	20.2		Weld dimension (6*6)

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
15	Place the remaining four mid plates (B, C, D & G) in between the two front plates, so that the positioners at that position must support the mid plates placed.	16		The supporting end of the postioners must be thoroughly in surface contact with the mid plates.
16	Tack weld the remaining mid plates to the front plate.	8		
17	Rotate the fixture back by 180 deg.	5		
18	Tack weld the remaining mid plates to the other front plate.	8		
19	Full weld all around the steel boss C.	7.8		Weld dimension (6*6)

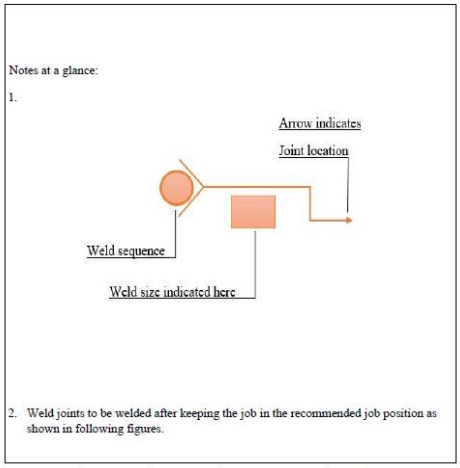
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
20	Prepare two subassemblies	300 (150×2)		
21	Place one subassembly on the table.	4.1		
22	Remove two tubes from the storing rack.	4.1		
23	Place the tube template over the subassembly as indicated.	0.5		
24	Tack weld one tube over the subassembly by locating its position using the tube template.	4		Use strong tacks for tack welding.
25	Tack weld the other tube over the subassembly by locating it concentrically with the steel boss C.	4		Use strong tacks for tack welding.

Opn. No.	Operation Description	Op. Time (min)		Special Instructions
26	Tack weld pitch plates to the subassembly around the bottom of both the tubes.	4		
27	Insert two other pitch plates each through one of the tubes.	0.8		
28	Insert two pins through the steel bosses A and B.	5.3		
29	Place the other subassembly on top by locating the bores with the help of the pins.	7.2		
30	Tack weld the tubes to the other subassembly.	8		Use strong tacks for tack welding.

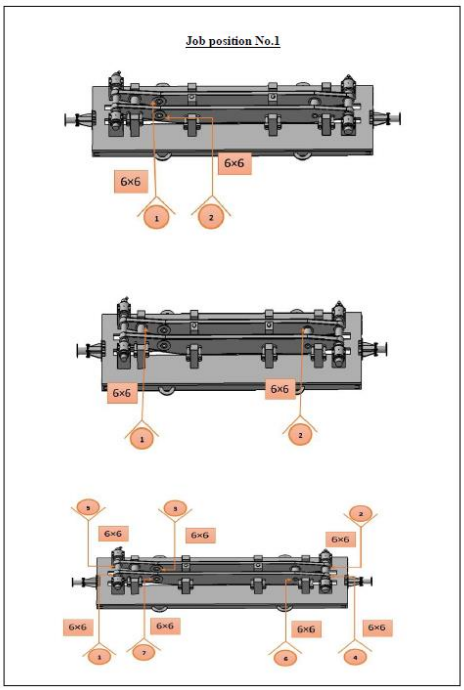
Opn. No.	Operation Description	Op. Time (min)		Special Instructions
31	Tack weld the previously inserted pitch plates to the other subassembly.	4		
32	Remove the pins and prepare the boom arm assembly.	5		

Standard time	351 min
Setup time	15 min
Total time	366 min

7.2 FULL WELDING PROCESS SHEET



Welding process	Current (in amps)	Voltage (in volts)	Temperature (in °c)	Boom arm assembly
				Full welding
GMAW Consumable Dia 1.2mm Solid Wire	280-340	28-34	150°C	Sheet 1 of 6



8 EFFICIENCY

Following are the approximate results of the designed fixtures and are tabulated and shown in the following figures.

- The total time for boom arm assembly without using fixture is 478.3 minutes and after using the fixtures it may reduce to around 366 minutes thus saving valuable112.3minutes.

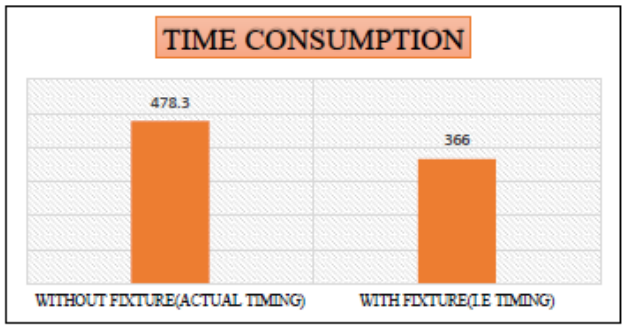


Fig.8.1: Comparison of time consumption

- The productivity of tack welding boom arm assembly without fixture is 45 units per month and after using the fixture it may increase to 60 units per month.

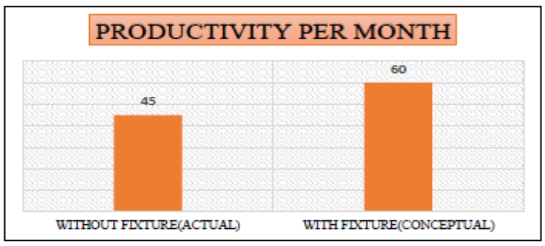


Fig.8.2: Comparison of productivity

- Striking reduction in welding distortion can be achieved due to fixtures and stiffeners designed.

CONCLUSION

In this dissertation work, tack welding and full welding fixtures have been designed to reduce the cycle time and welding distortions for boom arm assembly. Also the 3D model is generated using CATIA-V5R20 modeling software. It is expected that the designed fixtures may satisfy the functional requirements and after implementation of the fixtures the process may be able to produce better product within better time.

In this project the design of fixtures may result in

- Reduced cycle time.
- Increase in production rate.
- Decrease in welding distortions.

REFERENCES

[1]. "A Review on Design of Fixtures" by Shailesh S.Pachbhai and Laukik P.Raut,[2014], International Journal of Engineering Research and General Science Volume 2, Issue 2, Feb-Mar 2014, ISSN 2091-2730.

[2]. "Design of Welding Fixtures and Positiners" by Prof. S.N.Shinde et al.,[2014], International Journal of Engineering Research and General Science Volume 2, Issue 5, August-September, 2014, ISSN 2091-2730.

[3]. "Design & Development of Fixture for CNC – Reviews, Practices & Future Directions" by N. P. Maniar and D. P. Vakharia,[2013], International Journal of Scientific & Engineering Research Volume4, Issue 2, February-1-2013, ISSN 2229-5518.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

REAL TIME MULTI-PURPOSE AGRONOMIC VEHICLE BY USING HYBRID ENERGY

Nitheesh S[1], Ambrish M[1], Glaston Jose[1], Gowtham A N[1], Dr.Vijendra Kumar[2], Dr.K S Badarinarayan[3]

[1]Student,Dept of Mechanical Engineering, MSEC,Bengaluru,India
[2]Professor and HOD, Dept of Mechanical Engineering,MSEC,Bengaluru,India,vijendravk@gmail.com
[3]Principal,MSEC,Bengaluru,India,bakesu@yahoo.com

ABSTRACT

This Agronomic vehicle is an agricultural machine of a considerable power and great soil clearing capacity. This multipurpose system gives an advance method to sow, plow, water and cut the crops with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop. Moreover the vehicle can be controlled manually by driving the vehicle using seating arrangement. This agronomic vehicle will be running with batteries. Batteries will be charged using Solar Energy and Wind Energy. So ultimate aim is to develop a agronomic vehicle which uses renewable sources for operation.

I. INTRODUCTION

Agronomic Vehicle is a real-time vehicle deployed for agricultural purposes. The main area of application of vehicles in agriculture is at the initial and harvesting stage. In most cases Agricultural vehicles can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring. Agronomic vehicles like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs, and a smaller need for manual labour. This Agronomic vehicle is an agricultural machine having 5 different features in one module of a considerable power and great soil clearing capacity. This multipurpose system gives an advance method to plough, water and cut the crops with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at distance depending on crop. Moreover, the vehicle can be controlled manually by driving the vehicle using seating arrangement. This agricultural vehicle will be running with batteries. Batteries will be charged using Solar Energy. So,ultimate aim is to develop a agricultural vehicle which uses renewable sources for operation.

II. PROCEDURE

In this project, we will be fabricating a multipurpose agricultural vehicle that will be able to DIG the Earth, Sow the seeds and Cultivate the crop after the harvest is ready, And also we can run a water pump for wetting the ground and in the dark situations glow a lighting system as well. The vehicle power supply to the motors is provided by a battery, which uses solar energy. A person can drive the vehicle by the help of a high torque motor. The operations are carried out using manual switches.

III. LAYOUT

This is the simple layout of an agronomic vehicle which can do five different operations as explained above.

IV. OBJECTIVES

- To apply the vehicle for cultivating, harvesting & digging.
- To circulate water through pump.
- To apply it for lighting system.
- To reduce the labour consumption.

V. METHODOLOGY

- The electrical system design stage would include wiring the battery, motor and constructing a speed controlling circuitry to ensure proper travel speed control during the operation of the vehicle.
- The mechanical coupling includes the proper welding and arrangements of all these components especially the motor, battery & solar panel on the frame of the vehicle.

Basic Design

Concept to design a project for small scale farmers. And in one machine multi functions can be performed with cheap cost as compared to other agriculture machine. For this concept, not essential to skilled person. Mechanism of the machine should be very simple. so, that for gardening and small-scale farming, design this concept.

Functions

- Cultivation
- Digging
- Pumping
- Lightening
- Harvesting

VI. CONSTRUCTION DETAILS

Multipurpose farming machine consist of following components

- Chassis frame
- Wind Mill
- Pump
- Auger bit drill tool
- Cultivator
- Solar Panel
- 12 V Motor
- 12V Battery
- Switches
- Harvester
- Wheels
- LED Lighting system

1) Cultivator

A cultivator is any of several types of farm implement used for secondary tillage. One sense of the name refers to frames with the teeth (also called shanks) that pierce the soil as they are dragged through it linearly. Another sense refers to machines that use rotary motion of disks or teeth to accomplish a similar result. The rotary tiller is a principle example.

Cultivators stir and pulverize the soil, either before planting (to aerate the soil and prepare a smooth, loose seedbed) or after the crop has begun growing (to kill weeds—controlled disturbance of the topsoil close to the crop plants kills the surrounding weeds by uprooting them, burying their leaves to disrupt their photosynthesis, or a combination of both). Unlike a harrow, which disturbs the entire surface of the soil, cultivators are designed to disturb the soil in careful patterns, sparing the crop plants but disrupting the weeds. Cultivators of the toothed type are often similar in form to chisel plows, but their goals are different. Cultivator teeth work near the surface, usually for weed control, whereas chisel plow shanks work deep beneath the surface, breaking up hardpan. Consequently, cultivating also takes much less power per shank than does chisel plowing.

Small toothed cultivators pushed or pulled by a single person are used as garden tools for small-scale gardening, such as for the household's own use or for small market gardens. Similarly sized rotary tillers combine the functions of harrow and cultivator into one multipurpose machine. Cultivators are usually either self-propelled or drawn as an attachment behind either a two-wheel tractor or four-wheel tractor. For two-wheel tractors they are usually rigidly fixed and powered via couplings to the tractors' transmission. For four-wheel tractors they are usually attached by means of a three- point hitch and driven by a power take- off (PTO). Drawbar hookup is also still commonly used worldwide. Draft-animal power is sometimes still used today, being somewhat common in developing nations although rare in more industrialized economies.

FIG-1 CULTIVATOR

2) Harvester

The modern combine harvester, or simply combine, is a versatile machine designed to efficiently harvest a variety of grain crops. The name derives from its combining three separate operations comprising harvesting—reaping, threshing, and winnowing—into a single process. Among the crops harvested with a combine

are wheat, oats, rye, barley, corn (maize), sorghum, soyb eans, flax (linseed), sunflowers, and canola. The waste straw left behind on the field is the remaining dried stems and leaves of the crop with limited nutrients which is either chopped and spread on the field or baled for feed and bedding for livestock.

Combine harvesters are one of the most economically important labor-saving inventions, significantly reducing the fraction of the population that must be engaged in agriculture.

FIG-2 HARVESTOR

3) Solar Panel

Solar panels absorb the sunlight as a source of energy to generate electricity or heat.

A photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W). The efficiency of a module determines the area of a module given the same rated output – an 8% efficient

230 W module will have twice the area of a 16% efficient 230 W module. There are a few commercially available solar modules that exceed efficiency of 22% [1] and reportedly also exceeding 24%.[2][3] A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

FIG-3 SOLAR PANEL

4) Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars.[1] When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.[2] The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the

external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work.[3] Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.[4]

FIG-4 BATTERY

5) Sprayer Pump

In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers range in size from man- portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self- propelled units similar to tractors, with boom mounts of 60–151 feet in length.

FIG-5 SPRAYER

6) Wind Mill

Wind-powered vehicles derive their power from sails, kites or rotors and ride on wheels—which may be linked to a wind-powered rotor—or runners. Whether powered by sail, kite or rotor, these vehicles share a common trait: As the vehicle increases in speed, the advancing air foil encounters an increasing apparent wind at an angle of attack that is increasingly smaller. At the same time, such vehicles are subject to relatively low forward resistance, compared with traditional sailing craft. As a result, such vehicles are often capable of speeds exceeding that of the wind.

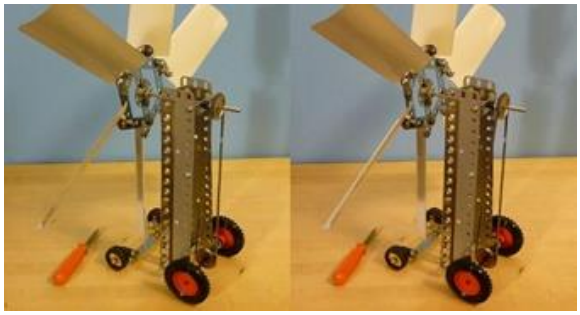


FIG-6 WIND MILL

VII. EXPECTED RESULTS

This multipurpose system gives an advance method to sow, plough and cut the crops with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop which is controlled manually by the driver.

VIII. CONCLUSION

This multipurpose system gives an advance method to plough and cut the crops with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop which is controlled manually by the driver.

REFERNCES

[1]. Dr.C N Sakhale, precision forming approaches on “Multipurpose farm machine” International Research Journal of Engineering & Technology (IRJET). Volume: 3 Issue: 9|Sep-2016.

[2]. Prof. Joshi S.G, Gholap Dipak Dattatraya, Lokhande Manojkumar Shrihari, Community based precission Volume 3, special issue 4, April 2014 proceedings National conference on “Robotic Agriculture Machine” on 21st & 22nd Feb 2014, Pune university Maharastra, India.

[3]. Yamashita, J.S. Yuki, S. Arima, I. Matsumoto and T. Tsurusaki, Development of Gantry Systems for Strawberry Cultivation (Part I),

Journal of the Japanese Society of Agricultural Machinery, 64(2).

[4]. Chamen, W.C.T., Dowler, D., Leede, P. R, and Longstaff, D. J. 1994, Design, operation and performance of a gantry system: Experience in arable cropping, Journal of Agricultura l Engineering Research 59:145-60.

[5]. Shibusawa, S., Community-based precision pp.22-27, 2001.farming for small farm agriculture, Proceedings of the 6'th International Conference on Precision Agriculture, July 14-1 7, Bloomington, Minnesota, USA, 2002.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

AUTOMATION IN SILK REELING TECHNIQUE

Shivakumara. P[1] Ranjeet Kumar[2], Dr. V.VijendraKumar[3], Dr. K.S Badrinarayan[4]

[1] Research scholar, Department of mechanical engineering, M S Engineering College, skptpr2012@gmail.com

[2] Research scholar, Department of mechanical engineering, M S Engineering College, ranjejas@gmail.com

[3] Professor and H.O. D, Department of mechanical engineering, M S Engineering College, vijendravk@gmail.com

[4] Professor and Principal, M S Engineering College, principal@msec.ac.in

ABSTRACT

The major agricultural products can be broadly grouped into foods, fiber, fuels and raw materials. Specific foods include cereals, vegetables, fruits and meat. Fibers include cotton, wool, hemp, silk and flax. An attempt is made to draw a strategic model to strengthen and promote sericulture industry in India to enhance productivity and quality of silk. The work involves development of a mechanical stirrer for silk reeling process. Both continuous improvement and effective dissemination of technology for silk reeling and testing are essential to meet the increasing global demand for quality raw silk and fine silk fabric, as ever more developing countries become interested in both cocoon and silk production.

Our prime concern is to develop a mechanical stirrer which is now being done manually. This mechanical stirrer is driven by 3-phase AC motor and is made to traverse in "8" shaped path for an effective webbing of cocoons end fiber A clear picture of both existing method and proposed method is adopted. This mechanical stirrer improve the production rate, overall production cost, solves various health issues and indeed also help in labour shortage problem which is major issue in small scale silk reeling industry.

1. INTRODUCTION

Agriculture, also called farming or husbandry, is the cultivation of animals, plants, fungi, and other life forms for food, fiber, biofuel, drugs and other products used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that nurtured the development of civilization.

A. The major agricultural products can be broadly grouped into foods, fiber, fuels and raw materials. Specific foods include cereals, vegetables, fruits and meat. Fibres include cotton, wool, hemp, silk and flax. Raw materials include lumber and bamboo. Other useful materials are produced by plants such as resins. Bio fuels include methane from biomass, ethanol and biodiesel. Cut, nursery plants, tropical fish and birds for the pet trade are some of the ornamental products. Agricultural food production and water management is targeted as an increasingly global issue that is fostering an important and growing debate.

If fashion is a fine art, then silk is its biggest canvas and if silk is the canvas, then all its weavers, dyers, designers, embroiderers are the greatest artists. Indian silk has enthralled fashion watchers and all categories of consumers across the world with its vast repertoire of motifs, techniques and brilliant hues. India's traditional and culture bound domestic market and an amazing diversity of silk garments

that reflect 'geographic specificity' has helped the country to achieve a leading position in silk industry.

India is the second largest producer of raw silk after China and the biggest consumer of raw silk and silk fabrics. An analysis of trends in international silk production suggests that sericulture has better prospects for growth in the developing countries rather than in the advanced countries.

The reduction of rural poverty continues to be a paramount goal of the developing countries like India as the majority of the poor population still resides in the countryside. The World Bank, for example, estimates that more than 70 % of the world's poor live in rural areas. So far, various strategies have been pursued to address this concern and among the major ones is rural employment creation.

An attempt has been made to draw a strategic model to strengthen and promote sericulture industry in India to enhance productivity and quality of silk etc. This article would be helpful in recognizing the potential, strength and challenges of the sericulture industry in India so as to formulate certain policies and measures for socio-economic development.

Sericulture is not only a tradition but also a living culture. It is a farm-based, labour intensive and commercially attractive economic activity falling under the cottage and small-scale sector

Silk is a lustrous, tough, elastic FIBER produced by the larvae of silkworms; the term also covers the thread or cloth made from this FIBER. The silk industry originated in China, as early as 2640 BC according to tradition. Towards the 3rd century AD, knowledge of the silkworm and its product reached Japan through Korea; it probably spread to India a little later. From there silk production was slowly carried westward through Europe to the New World.

The production process involves a sequence of steps not necessarily carried out in a single enterprise or plant. They include:

Sericulture: The production of cocoons for their raw silk filament is known as *sericulture*, a term which covers feeding, cocoon formation and so on. The first essential is a stock of mulberry trees adequate to feed the worms in their larval state. The trays on which the worms are reared have to be kept in a room with a constant temperature of 25 °C; this involves artificial heating in colder countries and seasons. The cocoons are spun after about 42 days of feeding.

Spinning or filature: The distinctive process in silk spinning is called *reeling,* in which the filaments from the cocoon are formed into a continuous, uniform and regular strand. First, the natural gum (sericin) is softened in scalding water. Then, in a bath or basin of hot water, the ends of the filaments from several cocoons are caught together, drawn up, attached to a reeling wheel and wound to form raw silk.

2. OBJECTIVE

The distinctive process in silk spinning is called *reeling,* in which the filaments from the cocoon are formed into a continuous, uniform and regular strand. First, the natural gum (sericin) is softened in scalding water. Then, in a bath or basin of hot water, the ends of the filaments from several cocoons are caught together, drawn up, attached to a reeling wheel and wound to form raw silk.

Our objective is to develop a mechanical stirrer which is now being done manually. This mechanical stirrer is driven by 3-phase AC motor and is made to traverse in **"8"** shaped path for an effective webbing of cocoons end fiber. This mechanical stirrer will extract silk end strands from cocoons which is now being done manually in small scale industries.

The mechanical stirrer will improve the production rate, reduces overall production cost, solves various health issues and indeed will help in solving labour shortage problem which is a major issue in silk reeling industry.

Main features of the work:

- Simple in operation.
- Overall production rate can be improved.
- Improves productivity .
- Reduces labor shortage problem.
- Skin problems like washer man's disease and asthma can be prevented.
- Comparatively very economical.

2.1REELING & RE-REELING TECHNIQUES

Silk Reeling is simply the unwinding of filaments from a group of cocoons in hot water bath on to a reel.

There are two systems of reeling cocoons

(i) Sunken System

(ii) Floating System

Figure 1 Sunken System of Reeling

In this system, the cooked cocoons sink in water at the time of reeling

Figure 2 Floating System of Reeling

In floating system, the cocoons are cooked only to the extent the shell becomes wet, but is still impervious to water. The conventional method followed till date is totally manual method which is facing many practical difficulties like health issues, economic issues, production issues, labor issues, etc.

Figure3 Dermatitis of the hands of female workers reeling raw silk

3. METHODOLOGY

Figure 4 Manual Method

The conventional method followed till date is totally manual method which is facing many practical difficulties like health issues, economic issues, production issues, labor issues, etc.

Firstly, the fresh cocoons are steam induced to kill the live pupa inside the cocoons to percent it from break openings once it turns into butterfly

Figure 5. Mechanical stirrer

This mechanical stirrer will improve the production rate, reduces overall production cost, solves various health issues and indeed will help in solving labour shortage problem which is a major issue in silk reeling industry.

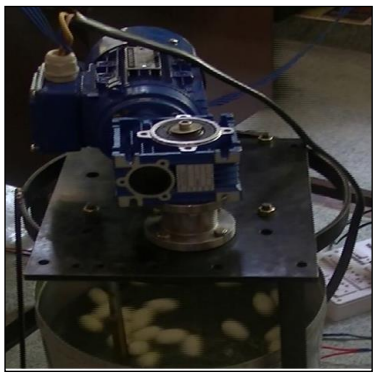


Figure 6. Mechanical stirrer assembly

The mechanical stirrer assembly is fastened to the pulley stand's leg with the help of fixture block. The assembly is aligned to the centre of the container where the water is boiled.

Fresh water is poured into the container to an optimum level. The water is heated to its boiling temperature.

Cocoons(about 150-200grams) are then poured into the container. The stirring action is initiated by 3-phase AC supply. As the stirring process is carried out, the end strands gets webbed to the stirrer. Switch off the power, detach the stirrer & remove the webbed threads.

Pass the cocoons along with the webbed end strands for further reeling process. The above steps are repeated through out the shift.

4. RESULTS

- Overall Production rate is improved.
- Minimizes the Labour shortage problem.
- Skin problems like washer man's hand disease & breathing issues like asthma are reduced.
- Simple in operation.
- Convenient to handle. It requires less maintenance
- Comparatively very economical.

5. CONCLUSION

The mechanical stirring system implemented in cooking process is the major task to be performed with satisfying requirements. It involves specific development, fabrication, assembly and testing.

The existing method encountered drawbacks like labour issues, health problems, high cost of production etc., The mechanical stirrer which is electrically driven, with the aid of present technology.

The main advancement of this system is that it can be easily implemented without disturbing the present setup and is also satisfactorily convenient to operate.

It is of a greater importance as it improves the overall production rate. The mechanical stirrer plays a vital role in solving labour shortage problem which is of prime concern in most of the small scale industries.

Thus by considering the above factors application of the mechanical stirrer a breakthrough in silk reeling industry.

7. REFRENCES

Central Silk Board.
www.google.com
en.wikipedia.org/wiki/Agriculture
en.wikipedia.org/wiki/Agriculture_in_India
www.wormspit.com
www.ilo.org/oshenc/part-xiv/textile-goods-industry/item/882-silk-industry

BIOGRAPHIES

Shivakumara.P Research scholar Department of mechanical Engineering M.S Engineering college Bangalore. *He is having 18 years of* experience *industrial experience including 6 years of* academics . Area of interest is Thermal science, CFD, Materials

Ranjeet Kumar Research scholar Department of mechanical engineering MS Engineering College *Bangalore. He has guided many UG Projects. His area of interest is CAD/CAM, FEA & Composite Materials.*

Dr. Vijendra Kumar, *Professor and Head, Department of Mechanical* Engineering, MSEC, Bangalore, India
Experience: 23Years
Specialization : Design and CFD

Dr.K.S.Badarinarayan is principal of M S Engineering College, Bangalore. He is having 28 years of academics and industrial experience including 6 years of research experience. He has presented many journal papers in international and national conferences. His area of interest is Flexible manufacturing system scheduling.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

FABRICATION OF HOVERCRAFT BY INSTALLING BRAKING SYSTEM

Adil Ahmed S[1], Mohan N[2] , Parashivamurthy L[3] , Prasanna kumar R[4] , Siddharth[5] , Dr. Vijendra Kumar V[6], Dr. Badrinarayana K S[7]

[1]Associate prof. Department of Mechanical Engineering, MSEC, Bengaluru, India, adilahmeds786@gmail.com

[2, 3,4,5]UG Student Department of Mechanical Engineering, MSEC, Bengaluru, India

[6]Professor & HOD, Department of Mechanical engineering,MSEC,Bengaluru,India,vijendravk@gmail.com

7 Principal, MSEC, Bengaluru, India, bakesu@yahoo.co.in

ABSTRACT

Our world is a valley of wonders and the abode of man –kind. Three fourth of its area is occupied by those high and raising seas. Hence the concept of water transportation is a vital for our expansion and survival. Sir Christopher Cockrell came out with a novel and marvel machine the Hovercraft. As a matter of fact, A well designed hovercraft is superior to a boat and aircraft, because it has less drag and requires less horse power to operate, A hovercraft can travel over all types of surface including grass, mud, sand, water and ice. Hovercraft prefer gentle terrain although they are capable of climbing slopes up to 18%. In this paper the craft configuration have also been discussed in this study and all possible type of drag due to resistance of air vehicles are discussed here. Finally the control aspects and breaking efficiency with Braking system of air cushion vehicle is represented.

I. INTRODUCTION

The concept was first proposed by John Thornycroft in the 1870s, but a working model was not produced until 1955, when Christopher Cockerell solved problem of keeping the air cushion from escaping from under the vehicle. A hovercraft is a special type of vehicle that moves on a cushion of air. It is capable of travelling over land, water, mud or ice and other surfaces. The lifting motion is controlled by a fan or fans so that an air gap can be formed. Such separation between the bottom of the hovercraft and the ground provides a motion platform, on which the friction force between the hovercraft and the ground reduces to a very small amount.

Since a hovercraft does not have wheels, hovercraft works on two main principle lift and propulsion, the forward motion is created through the propelling action, which is generated by the use of a propulsion fan or a set of fans. These propelling fans send two third of air out of the back of the hovercraft to produce a thrust force, which moves the hovercraft forward and remaining one third of air send to bottom of the hovercraft to lift the vehicle.

When the hovercraft is finally able to move it will most definitely require steering capabilities. This is achieved through the use of rudders. The shape of the rudder dictates how well it will be able to move air. When riding a hovercraft the natural state of motion is easily seen to be constant vector velocity with a constant rate of rotation. However this cushion is contained within a flexible 'skirt'. They typically hover at heights between 100 mm and 500 mm above any surface and operate above 10 kmph and can clear gradients up to 20 degrees.

II. WORKING PRINCIPLE

Hovercraft works on principles of three laws, namely

1. Law of buoyancy

2. Newton's third law
3. Aerodynamics

1. Law of buoyancy (Archimedes Principle): According to legend Archimedes was struck by this principle while taking a bath when he noticed that the volume of water displaced was equal to the volume of his body. Overjoyed by his discovery, he jumped out of the bathtub and ran through the streets naked shouting, "Eureka! Eureka!" (Greek for "I've found it! I've found it!") Developed in 250 BC, this principal explains why some objects floats in water while others sink. The principle states the following:

"When a body is immersed in fluid at rest it experiences an upward force or buoyant force equal to the weight of the fluid displaced by the body".

Archimedes' Principle says that a buoyant force will push upwards on you when you're in the water, and the strength of the force will be equal to the weight of the water that you pushed out of the way when you got in. The same thing happens with boats. This results in a buoyant force that pushes up of the boat.

The magnitude, or strength, of the force is equal to the weight of the water that would have filled the space that is now taken up by the boat. The boat floats in the water because this upward buoyant force is equal to the downward weight of the boat. In order to do calculations using this principle,

Weight Density = Weight ÷ Volume

The weight density of water is about 62.42 pounds per cubic foot (lb/ft3). In SI units (System International), the weight density of water is about 9806 Newton's per cubic meter (N/m3).

2. Newton's third law: The third law states that all forces exist in pairs: if one object A exerts a force FA on a second object B, then B simultaneously exerts a force FB on A, and the two forces are equal and opposite: FA = −FB. The third law means that all forces are interactions between different bodies, and thus that there is no such thing as a unidirectional force or a force that acts on only one body. This law is sometimes referred to as the action-reaction law, with FA called the "action" and FB the "reaction". The action and the reaction are simultaneous, and it does not matter which is called the action and which is called reaction; both forces are part of a single interaction, and neither force exists without the other. The two forces in Newton's third law are of the same type In swimming, a person interacts with the water, pushing the water backward, while the water simultaneously pushes the person forward—both the person and the water push against each other. The reaction forces account for the motion in these examples. These forces depend on friction; a person or car on ice, for example, may be unable to exert the action force to produce the needed reaction force.

3. Aerodynamics: Aerodynamics is defined as the branch of fluid physics that studies the forces exerted by air or other gases in motion. Examples include the airflow around bodies moving at speed through the atmosphere (such as land vehicles, bullets, rockets, and aircraft), the behavior of gas in engines and furnaces, air conditioning of buildings, the deposition of snow, the operation of air-cushion vehicles (hovercraft), wind loads on buildings and bridges, bird and insect flight, musical wind instruments, and meteorology. For maximum efficiency, the aim is usually to design the shape of an object to produce a streamlined flow, with a minimum of turbulence in the moving air. The behavior of aerosols or the pollution of the atmosphere by foreign particles is other aspects of aerodynamics.

III. CONSTRUCTION

1. Lifting fan: Firstly the volume of air needed is very large and a propeller is designed to be most efficient in open air like on an aircraft. Also the fan needs to force air into the chamber below the craft so creating a specific pressure under the craft. When the assembly is rotated at high speed air is sucked into the centre hole in the fan and the slats force it out at the edges. The advantages of the fan are two-fold. They operate efficiently in an environment when backpressure is high and they will move larger volumes of air for a given rotation speed than a propeller with the same speed and power input. The lifting fan is coupled via a gearbox to the engine. The

engine also drives the propeller on the craft, which provides thrust for forward motion of the Hovercraft.

2. Thrust propeller: The propeller used to drive the hovercraft along is usually an aircraft type with variable pitch blades. Its speed of rotation must remain fixed to that of the engine and the lift fan. This is because the amount of lift air required dictates the engine speed to drives the lift fan. In turn the amount of propulsion, which the propellers provide, must be obtained by varying the propeller pitch and not its rate of rotation. This system is termed 'integrated lift/ propulsion'.

3. Hull: The base of the hovercraft made should protect the craft from any external causes. It also should be water resistant as the vehicle will be travelling on water. The base should be enough strong to withstand the weight or the loads on the craft. All the equipments of the craft is being mounted on this hull component. The hull is made up of hollow square pipe made of mild steel and plywood sheets. Since the wood is taken for the base, it would withstand the load due to its light elastic property.

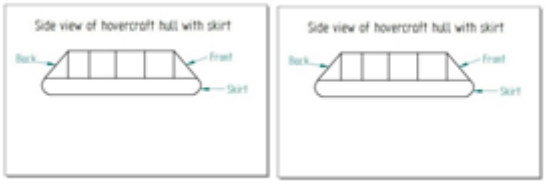


Fig 1: Side view of hull

4. The engine: A power of 2.2 horsepower at a rotational speed of 2000 revolutions per minute was required to achieve the desired fan characteristics. This engine was capable of outputting 11.50 horsepower at 5800 rpm, with a
torque of 8.60 Nm. A table of this engines data is shown below:-

Engine specification

Engine Displacement	98cc
Max Engine Power	11.50HP @ 7500 RMP
Top Speed	125.0km/h(77.7 mph)
Weight	18.5kg

5. Hovercraft skirt: All modern hovercraft large and small, use a skirt of one sort or another for their suspension system so that the power required to lift the craft can be minimized. A hovercraft skirt is required to fulfil the following function:-

I. Contain the cushion of air beneath the craft at the required hover height.
II. Have the ability to confirm of contour efficiently over obstacles so has keep the loss of cushion air to a minimum.
III. Return to its original shape after having been deformed.
IV. Give adequate stability.
V. Offer little resistance to the passage of obstacles beneath it.
VI. Have the ability to absorb a large proportion of the energy which is produced on impacts or collisions with obstacles greater than hover height or cushion depth.

6. Air box: The air box takes about 10% of the air being pushed backward by the propeller and forces it downward, underneath the hovercraft. There are three small ducts cuts into the base of the hovercraft, underneath the air box. Two of these ducts lead into the skirt, which is basically a bag that goes all the way around the perimeter of the craft, while the third duct leads directly underneath the hovercraft.

7. Lift system: The hovercraft relies on a stable cushion of air to maintain sufficient lift. The weight distribution on top of the deck is arranged so that the air is distributed the air from the rear of the deck throughout the cushion volume in an approximately even fashion to provide the necessary support. The skirt extending below the deck provides containment, improves balance, and allows the craft to traverse more varied terrain.

8. Thrust system: The air not directed to the cushion and skirt is propelled backwards, providing forward thrust to the craft. The size of the propeller, rpm output of the engine, and height of the lift/thrust divider are the determining parameters for the thrust force.

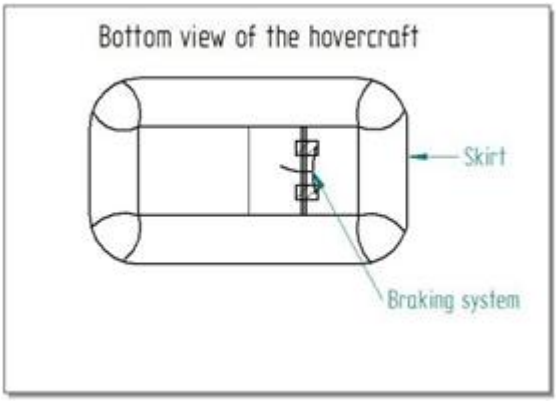


Fig 2: Braking pads at the bottom.

9. Braking system: Earlier hovercraft are not being used on the road because poor braking efficiency. So we are introducing the braking system in our hovercraft. This is done by two steps.

1. Closing the propeller
2. Braking pads installing

Closing the propeller: By closing the propeller of the hovercraft by the use of rudders the thrust required for the forward movement of the hovercraft will be cut off or stopped, Hence the movement of the craft will be reduced. The remaining movement or the force will be stopped by using of pads made of mild steel provided at the bottom (front base) of the craft which lifts the craft up to a small height and stops the vehicle by friction.

APPLICATIONS

1. The hovercraft can travel with no reduction speed against a current of speed.
2. Hovercraft can travel over landmines without exploding.
3. The hovercraft can travel over any depth of water.
4. The obstacles present in the path will not stop the craft.
5. Remote mining access support vehicle.
6. This hovercraft can be stopped at any required point.

CONCLUSION

The craft principle has been demonstrated using low cost material and has proved capable as a variable means of transport on both land and water. The problem of travelling of craft on roads is being eliminated in our craft by introducing and installing the braking system. The driving mode is as simple as riding the bike.

REFERENCES

[1] Vasanthakumar.P, Vignesh. K, Rajkumar. G "Design and Fabrication of Minihovercraft" volume 4, special issue 2, Feb 2015

[2] Amit Tiwari "To Study and Fabrication of Air Cushion Vehicle" volume 3,issue 3, March 2015

[3] A. Anandhakumar, S. Ganesha , S. Goutham, K. Pasupathi "Design and Fabrication of Hovercraft" vol. 4, special issue6, May 2015

[4] Rakesh, Manish, Rajeev, Manishkumar "Air Cushion Vehicle" vol 4, issue 11,2014

[5] Okafor, B.E "Development of a Hovercraft Prototype" vol 3, issue 3, March,2013

[6] V Abhiram, N Suman Krisna, Murali Mohan and M Anjiah "vol 3, No. 4, Oct 2014

[7] Ediwn Chan Hanjiang "Design of a Working Model Hovercraft" June 2012

[8] Rohith, Ravi, Rajesh, Prakash, Shailendra " A Study About Hovercraft" vol. 2, issue 8, 2014

[9] Abhijith reddy, adil karthik "Design, Analysis and Development of Hovercraft Prototype" vol. 4, issue 3, March 2014

[10] P. Fitz Patrick "Understanding and Selecting Lift Fans" Hovercraft Club of Great Britain

[11] S.B. Gates "A Crude Theory of Hovercraft Performance at Zero Tilt" Ministry of Aviation Aeronautical Research Council

[12] Sasiranga, Kishan, Jayasurya, Janaka, Chathuranga "Advanced Controllig Methodology for Hovercraft Maneuverability"

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

TRIPLE STACKER PARKING SYSTEM

Prathipa B[1], Himanshu Gaur[2],Aman kumar[3], Raj Kapoor[4], Dr. Vijendra Kumar V[5], Dr. Badarinarayan[6]

[1]Asst. Prof Dept. Mechanical Engineering, MSEC, Bangalore-562110, Karnataka. India.
Prathipamech@gmail.com

[2.3.4] Students Dept. Mechanical Engineering, MSEC, Bangalore-562110, Karnataka. India.
Himanshugaur99@gmail.com

[5]H.O.D Dept. Mechanical Engineering, MSEC, Bangalore-562110, Karnataka. India.
vijendravk@gmail.com

[6]Principal MSEC, Bangalore- Karnataka. India.baktsu@yahoo.co.in

ABSTRACT

The paper entitled Automated Car Parking system is about management of car parking bay There are several advantages of employing a car park system for urban planners, business owners and vehicle drivers. They offer convenience for vehicle users and efficient usage of space for urban based companies. Automated car park systems save time, money, space and simplify the often tedious task of parking. Automatic multistoried car parking system helps to minimize the car parking area. The modern world, where parking space has become a very big problem, it has become very important to avoid the wastage of space in modern big companies and apartments etc, places where more than cars need to be parked, this system proves to be useful in reducing wastage of space.

INTRODUCTION

Automated (car) parking system (APS) is a mechanical system designed to minimize the area and/or volume required for parking cars. Like a multi-story parking garage, an APS provides parking for cars on multiple levels stacked vertically to maximize the number of parking spaces while minimizing land usage. The APS, however, utilizes a mechanical system to transport cars to and from parking spaces (rather than the driver) in order to eliminate much of the space wasted in a multi-story parking garage. While a multi-story parking garage is similar to multiple parking lots stacked vertically, an APS is more similar to an automated storage and retrieval system for cars. The paternoster (shown animated at the right) is an example of one of the earliest and most common types of APS. APS are generically known by a variety of names, including. Automatic parking system (not to be confused with in-car parking guidance system, Automated parking facility (APF) ,Automated vehicle storage & retrieval system (AVSRS), car parking system , mechanical parking , robotic parking gaage.

People owning vehicles face parking problems in most metropolitan area, especially during peak hours.The difficulty roots from not knowing where the parking spaces are available at the given time, even if this is known; many vehicles may pursue a small number of parking spaces which in turn leads to serious traffic congestion. This paper focuses on different smart parking techniques developed to overcome said problem using various wireless sensor network and providing real-time data analysis from the sensors, some papers include system based on resource allocation and reservation of parking lot which have various problems in efficiently achieving the goals. The given paper would be useful for new researchers for study of

various guided parking and information techniques and algorithms which are covered in this paper.

Nikhilkumar B. Shardoor et.al, developed a Smart Parking System Based on Embedded System and Sensor Network concluded that Various system proposed by different authors helps us to cogently in reserving and also annihilating the need of searching for parking spaces in private parking lots. Researchers have acquired the systems which dynamically arrange the scheme for different drivers as per their requirement, based on the real-time parking information. Thus, this concludes that the paper simplifies the context for the researchers for innovating various techniques to administrate and solve the problems faced by drivers on day to day basis.

In future, the system can be extended which is not only specific to a private parking like Malls, Company parking, etc. but also can be implemented over various multiple platforms such as public parking also extending the feature by giving parking information based on cost in real time. This will make the management of the parking spaces more efficient, by purging the need of human labor.

Locating a parking space in central city areas, especially during the peak hours, is cumbersome for drivers. The issue arises from not having the knowledge of where the available spaces may be at the time, even if known, many vehicles may seek very limited parking spaces to cause severe traffic congestion. In this paper the design and implementation with a prototype of Reservation-based Smart Parking System (RSPS) that permits drivers to effectively locate and withhold the vacant parking spaces in mentioned. This system use cluster based algorithm which helps in periodically learning the parking status from the sensor networks deployed in parking spaces, the reservation service is influenced by the change of parking status. The drivers are allowed to access this said cyber-physical system with their personal communication devices. The system implemented is cost efficient smart parking system for multi-level parking facility using WSN (IR Sensor) and develop an android based application, by cluster based allocation method and performs automatic billing process. The system monitors the availability of idle parking slots and guides the vehicle to the nearest free slot. Cost is minimized by keeping the number of sensors low without sacrificing the reliability. Energy consumption of each mote is kept in check by allowing the systems to sleep periodically and by reducing their communication range. This system‟s reservation-based parking policy has the potential to smoothen the operations of parking systems, as well as mitigate traffic congestion caused by searching for parking.

II. OBJECTIVES:

The objective of our project is to minimize the parking problems occurring in present days by introducing stair case parking facility

- To make the system fully automated.
- To park maximum no of vehicles.
- To make the system feasible, cost effective, simple in design, and can also be implemented in small cities.
- To adapt underground facilities so as to decrease area occupied.
- To provide ease of accessibility whenever needed.

III. METHODOLOGY:

The system works on the principle of lead screw arrangement and rack and pinion arrangement the diagram is as shown below. The lead screw is use to lift the column on which cars are placed and dc servo motors are used to rotate the stackers.

- A **conveyor system** is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors

are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, I-Beam, towline, power & free, and hand pushed trolleys.

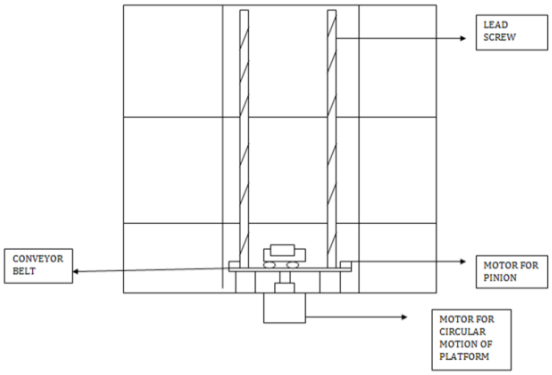
A **rack and pinion** is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope.For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius (i.e. a toothed straight edge).A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter

A lead screw (or **lead screw**), also known as a **power screw** or **translation screw**, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. Common applications are linear actuators, machine slides (such as in machine tools), vices, presses, and jacks Lead screws are manufactured in the same way as other thread forms (they may be rolled, cut, or ground).A lead screw is sometimes used with a split nut also called half nut which allows the nut to be disengaged from the threads and moved axially, independently of the screw's rotation, when needed (such as in single-point threading on a manual lathe)

A dc motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the **working principle of DC motor** in details.

- It Uses A Voltage Of 12V
- Runs In An Rpm Of 10 Rpm
- CURRENT – 60 M

- 2 D Model Triple Stacker Parking System



2D Arrangement of the system

- **MAIN ADVANTAGES:**

- Highly automated
- Fills more vehicles in less area space
- Reduces traffic in parking
- Saves time

IV. Conclusion

By working on this project we got to know that parking space got reduced, compare to previous parking system more vehicles can be parked at a time, it is easily feasible in small cities. The entire system is fully automated by using IR sensors which will reduce parking time and traffic in parking.

References

[1]. V. Hans, , P. S. Sethi, , J. Kinra," An approach to IoT based car parking and reservation system on Cloud", 2015 International Conference on Green Computing and Internet of Things (ICGCIoT). 2015

[2]. M. S R, "Automatic Smart Parking System using Internet of Things (IOT)", International Journal of Scientific and Research Publications, vol. 5, no. 12, 2015.

[3]. D.J. Bonde, R. Shende, K. Gaikwad, A. Kedari and A. Bhokre, "Automated car parking system commanded by android application", International Conference on Computer Communication and Informatics, p. 4, 2014

[4]. P. Parkhi, S. Thakur and S. Chauhan, "RFID-based Parking Management System", International Journal of Advanced Research in Computer and Communication Engineering, vol. 3, no. 2, 2014.

[5]. Supriya Sunil Kadam, Monali Manoj Desai, Priyanka Ganpati Deshmukh and Vijaymala Sadashiv Shinde, "RFID Based Car Parking Security System Using Microcontroller IC89c52", IJERT, vol. 4, no. 03, 2015.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
Category: Mechanical

Investigation on shell side and the Effect of Baffle spacing in a shell and tube oil cooler Heat Exchanger for a Locomotive

Dr. Vijendra Kumar[1], Gopala gowda[2] Shiva kumar[3] Dr. K.S. Badarinarayan[4]

[1]Professor, Department of Mechanical Engineering, MSEC, Bangalore, India, vijendravk@gmail.com

[2]Assistant Professor, CBIT, Kolar, India, gopalgowdahk@gmai.com

[3]Research scholar. Department of Mechanical Engineering, MSEC, Bangalore, India, vijendravk@gmail.com

[4]Principal, M S Engineering College, Bangalore, India, principal@msec.ac.in

ABSTRACT

In this tabloid flow investigation in shell side on the effect of baffle spacing of shell and tube heat exchanger of an oil cooler has been studied by using theoretical and numerical methods. The investigation is carried out in shell and tube heat exchanger for oil cooler of a Locomotive. The shell side pressure drop for the conventional limit is 0.3 MPa for shell and tube heat exchanger of an oil cooler of a Locomotive. In theoretical method, the effect of various geometric parameters and the exchange of thermal energy in shell side flow has been considered. Theoretical values were calculated for all eight baffle spacings are 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9 of internal diameter of the shell .Then suitable baffle spacing occur at 0.5 of internal diameter of the shell because it is less than the allowable pressure drop. The design is satisfied because of the pressure drop for shell side is found to be 0.289 Mpa which is lower than the limited pressure drop of 0.3 Mpa. The flow of the shell side was also analyzed using the tool COMSOL Multiphysis with a suitable baffle spacings. The pressure values from the simulations results are compared with the theoretical values.

I. INTRODUCTION

The shell and tube heat exchangers are the heart of the chemical process industry, when it comes to transferring of heat from one surface to another surface. These devices are available in a wide range of patterns as defined by the Tubular heat Exchanger Manufacturers Association. The applications of theses single-phase shell-and-tube heat exchangers are quite large because these are widely used in chemical, petroleum, power generation and other process industries. In spirit, a shell and tube exchanger is a pressure vessel with many tubes inside the shell. The fluids flows through the tubes of the exchanger while the other flows outside of the tubes within the shell. The tube side and shell side fluids are separated by a tube sheet. In these heat exchangers, one fluid flows through tubes while the other fluid flows in the shell across the tube bundle. The design of a heat exchanger requires a balanced approach between the thermal design and pressure drop. The performance parameters include heat transfer, pressure drop, effectiveness etc. [1]

The tubes of a U-tube heat exchanger Figure 1 are bent in U shape. There is only one tube sheet in a U tube heat exchanger. However, the lower cost for the single tube sheet is offset by the additional costs experienced for the bending of the tubes and the somewhat larger shell diameter, making the cost of a U-tube heat exchanger analogous to that of a fixed tube heat exchanger. The advantage of a U-tube heat exchanger is that because one end is free, the bundle can expand or contract in response to stress differentials. In addition, the outsides of the tubes can be cleaned, as the tube bundle can be removed. The disadvantage of the U-tube construction is that

the inside of the tubes cannot be cleaned effectively, since the U-bends would require flexible-end drill shafts for cleaning. Thus, U-tube heat exchangers should not be used for services with a dirty fluid inside tubes.

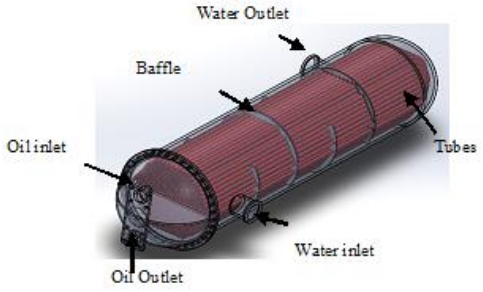


Fig 1. U Tube Heat exchanger

A. Baffle Spacing

Baffle is used as single segmental. Baffle spacing is the centerline-to-centerline distance between adjacent baffles. It is the most vital parameter in STHE design. The TEMA standards specify the minimum baffle spacing as one-fifth of the shell inside diameter or 2 inch, whichever is greater. Closer spacing will result in poor bundle penetration by the shell-side fluid and difficulty in cleaning the outsides of the tubes. Furthermore, low baffle spacing results in a poor stream distribution. The maximum baffle spacing is the shell inside diameter. Higher baffle spacing will lead to predominantly longitudinal flow, which is less efficient than cross-flow, and large unsupported tube spans, which will make the exchanger prone to tube failure due to flow-induced vibration. [3]

Figure 2 depicts a single-segmental shell-and-tube bundle geometry with fixed tube sheets at both heads in which the shell-side flow makes one shell pass from one end of the tube bundle to the other with the flow directed across the tube bundle by the baffles. The inlet, central and outlet baffle spacing are shown and are identifies as Lbi, Lbc and Lbo, respectively.

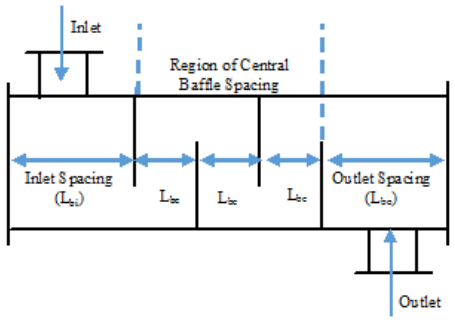


Fig 2. Single-segmental Shell and Tube Heat Exchanger Showing Baffle

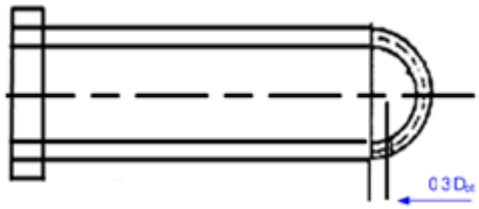


Fig 3. Tube Length Dimension for U Tube

Baffle Cut

Baffle cut is the height of the segment that is cut in each baffle to permit the shell-side fluid to flow across the baffle. This is expressed as a percentage of the shell inside diameter. Although this, too, is an important parameter for STHE design, its effect is less profound than that of baffle spacing. Baffle cut can vary between 15% and 45% of the shell inside diameter. Both very small and very large baffle cuts are detrimental to efficient heat transfer on the shell side due to large deviation from an ideal situation, as illustrated in Figure 4.

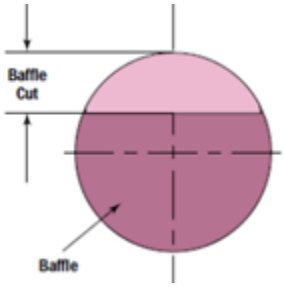


Fig 4. Segmental Baffle Cut (%)

Pressure Drop in Preliminary Calculation

A selected shell and tube heat exchanger must satisfy the process requirements with the allowable pressure drops until the next scheduled cleaning of plant. The methodology to evaluate thermal parameters is explained with suitable assumptions. The following are the major

assumptions made for the pressure drop analysis;

1. Flow is steady and isothermal, and fluid properties are independents of time.
2. Fluid density is dependent on the local temperature only or is treated as constant.
3. The pressure at a point in the fluid is independent of direction of flow.
4. Body force is caused only by the gravity.
5. There are no energy sink or sources along streamline; flow stream mechanical energy dissipation is idealized as zero.
6. The friction factor is considered as constant with passage flow length.[2]

In the present study, a cast iron steel shell and tube heat exchanger is used to study the various parameters of the heat exchanger such as heat transfer coefficient, Reynold's number, pressure drop, overall heat transfer coefficient etc using water as a heat transfer medium. The design method used in calculating the parameter is Bell Delaware Method.

Table 1. Specifications of theShell and Tube Heat Exchanger for Oil Cooler

Shell diameter,D_s	380 mm
Tube inside diameter,d_o	15 mm
Tube outside diameter, d_i	13.5 mm
Pitch,pt	1.25
Length of tube, L	1250 mm
Number of baffles	4
Number of tubes	262
Number of shell pases	1
Number of tube pases	2
Clearance	5 mm
Bundle to shell clearance	28 mm
Shell to baffle diameterical clearance	10 mm
Centeral Baffle Spacing, L_{bc}	$0.2D_s$ to $0.9D_s$

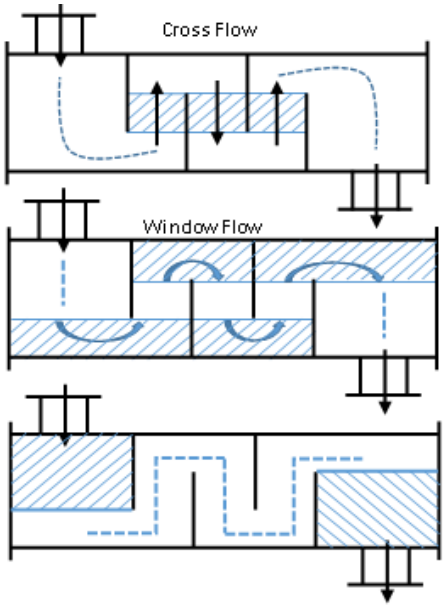


Fig 6. Pressure Drop Regions in Shell Side Flow

The shell side pressure drop depends on the number of tubes, the number of times the fluid passes the tube bundle between the baffles and the length of each crossing[7] The pressure drop on the shell side is calculated by the following expression;

Step 1: To Calculate the number of tube rows crossed in one crossflow section Nc.[5]

$$N_{tcc}=\frac{D_s}{L_{pp}}\left[1-2\left(\frac{B_c}{100}\right)\right]$$

$$L_{pp}=0.866L_{tp}$$

Step 2: To Calculate the window flow area Sw.

$$S_w=\frac{D^2_s}{4}\left[\cos^{-1}(D_B)-D_B\sqrt{\left(1-D^2_B\right)}\right]-\frac{N_t}{8}\left(1-F_c\right)\pi d^2_o$$

$$D_B=1-2\left(\frac{B_c}{100}\right)$$

Step 3: To Calculate the number of effective N_{cw}.

$$N_{cw}=\frac{0.8}{L_{pp}}\left[\left(\frac{B_cD_s}{100}\right)\right]$$

Step 4: To Calculate the window zone pressure drop Δpw.

$$\Delta_{pw}=R_\mu R_1\left\{(2+0.6N_{cw})\frac{m^2w}{2\rho}\right\}$$

$$m_w = \frac{m_s^o}{\sqrt{S_m S_w}}$$

Step 5: To Estimate the correction factor on pressure drop for by pass flow R_b.

$$F_{sbp} = \frac{S_b}{S_m}$$

$$S_b = L_{bc}\left\{(D_s - D_{ot1}) + L_{pi}\right\}$$

$$r_{ss} = \frac{N_{ss}}{N_{tc}}$$

$$R_b = e^{-C_{bp}F_{sbp}\left(1-\sqrt[3]{2r_{ss}}\right)}$$

Step 6: Estimate the correction factor for baffle leakage effect on pressure drop R_l.

$$R_1 = e^{-1.33(1+r_{ss})r_{im}^{\,p}}$$

$$p = -1.15(1+r_s) + 0.8$$

Step 7: Calculate the ideal cross flow pressure drop through one baffle space ΔPb.

$$\Delta p_{bi} = \frac{2 f_i N_{tcc} m^2 s}{\rho_s S_m} R_\mu$$

$$\Delta p_b = \Delta p_{bi} R_b R_i$$

$$S_m = L_{bc}\left\{(D_s - D_{ot_1}) + \frac{(D_{ot_1} - d_o)(L_{tp} - d_o)}{L_{tp}}\right\}$$

$$S_m = L_{bc}\left[(D_s - D_{otl}) + \frac{(D_{otl} - d_o)(L_{tp} - d_o)}{L_{tp}}\right]$$

Step 8: Calculate the pressure drop in the two end zones of the tube bundle Δpe.

$$\Delta p_e = \Delta p_{bi}\left(1 + \frac{N_{tcw}}{N_{tcc}}\right) R_b R_s \quad R_s = \left(\frac{L_{bc}}{L_{bo}}\right)^{2-n} + \left(\frac{L_{bc}}{L_{bi}}\right)^{2-n}$$

Step 9: Calculate the total shell side pressure drop ΔPs. [4]

$$\Delta p_s = (N_b - 1)\Delta p_b + N_b \Delta p_w + 2\Delta p_e$$

Results and Discussion

In this paper, the effect of baffle spacing of shell and tube heat exchanger for oil cooler of Locomotive with geometry parameters is considered. Segmental baffles normally should not be spaced closer than 0.4 of the shell inside diameter or 0.152 meters, whichever is greater and 0.6 of shell inside diameter, the least baffle spacing is considered 0.228 meters.

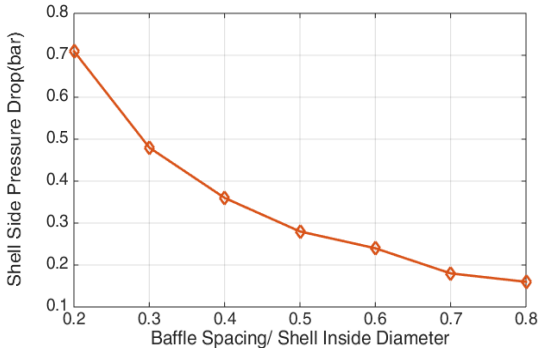


Fig 7. Pressure Drop in Shell Side on Baffle Spacing

Variation of shell side pressure drop versus baffle spacing is shown in Figure 7. It is found that with the increase of baffle spacing, pressure drop decreases. The maximum allowable pressure drop for transmission oil cooler of Diesel Locomotive occurs at baffle spacing 0.19 m (0.5Ds) under the shell side pressure drop for acceptable limits 0.3bar.

In all of the preliminary simulation, flow inside the shell is observed to be turbulent viscous model is selected to be K-ε turbulent model. [8] The result is investigated using the heat exchanger model with 0.4Ds to 0.6Ds baffle spacing for 25% baffle cut. In Figure 8, 10 and 12, velocity path lines for four baffles are given for the shell side velocity flow of 1.2m/sec , inlet boundary condition and outlet boundary condition is pressure, no viscous stress.

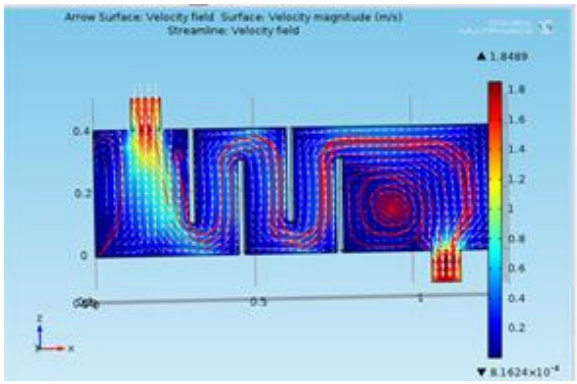


Fig 8. Velocity on Shell Side when Baffle Spacing 0.4Ds

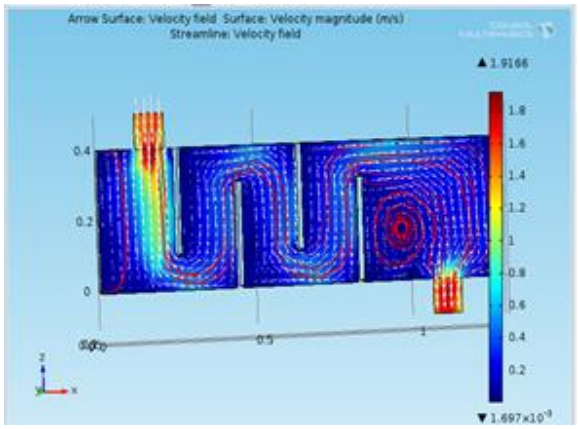


Fig 9. Pressure on Shell Side when Baffle Spacing 0.4Ds

The flows hits the baffle plate, and the direction of the flow is changed. In Figure 8 the shell space behind the baffle is not effectively used for cross flow, as marked with a circle. For this reason, the pressure drop occurs high mark in Figure 9 and total pressure drop is 0.3 bar.

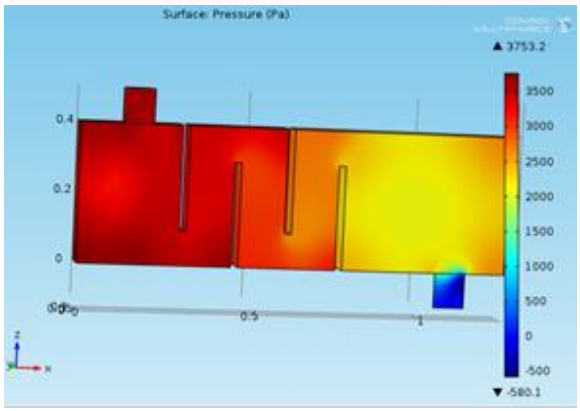


Fig 10. Velocity on Shell Side when Baffle Spacing 0.5Ds

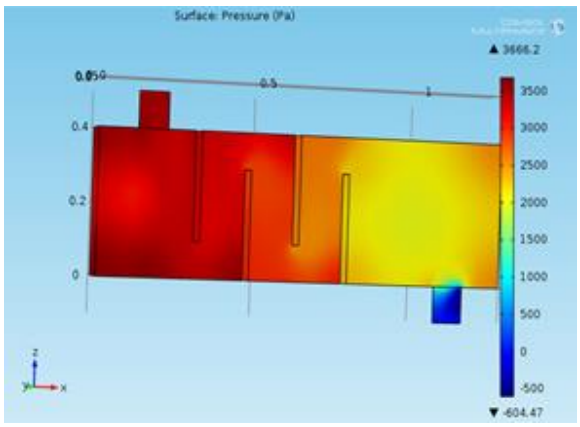


Fig11. Pressure on Shell Side when Baffle Spacing0.5Ds

In Figure 10, the flow is obseved to be well developed.The cross flow throughout the shell volume and the recirculation zone appears little .So, pressure drop is effectively average in Figure 11, the simulation result gain 0.3 bar.

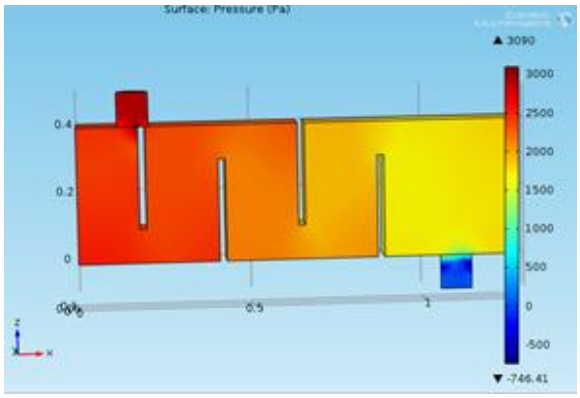


Fig 12. Velocity on Shell Side when Baffle Spacing 0.6Ds

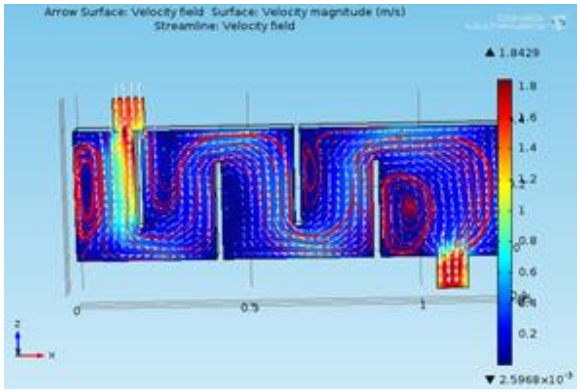


Fig13. Pressure on Shell Side when Baffle Spacing 0.6Ds

In Figure 12, the velocity stream line of recirculation two zones appear and also occur decreasing pressure drop result in figure 13 and is 0.23 bar .

Hence, it is observed that 0.5Ds baffle spacing gives better pressure drop compare with other baffle spacing under allowable pressure drop for transmission oil cooler for Locomotive. It occurs same pressure drop in simulation. So, 0.5Ds baffle spacing is good for theoretical and simulation.

Conclusion

In this research, in current numerical analysis, entire geometry to shell and tube heat exchanger including entrance and exist regions were considered as a domain of calculation, theoretical and numerical results have been compared a wide

range of baffle spacing. Thus, as baffle spacing is reduced, pressure drop increases at a much faster rate than does the heat-transfer coefficient. This means that there will able baffle spacing to shell inside diameter that will result in the highest of pressure drop to heat transfer. This optimum ratio is normally between 0.4 and 0.6Ds for oil cooler of Locomotive..

Nomenclature

Symbol	Quantity
Do	Outside diameter
Gs	Shell side mass velocity(kg/ m^2-s)
L	Tube Length(m)
Ms	Mass flow rate of water on shell side(m/s)
Ds	Shell inside diameter(m)
Lb	Baffle Spacing(m)
ΔPtotal	Shell side pressure drop (bar)
Sm	Area of the shell side cross flow section (m^2
Ssb	Shell to baffle leakage area (m^2)
Stp	Tube to baffle leakage area (m^2)
Fbp	Fraction of the crossflow area for bypass flow (m^2)
Sw	Window area flow (m^2)
Nc	Number of tube rows crossed in crossflow section
N_{cw}	Effective number of crossflow rows in window zone
ΔPc	Ideal crossflow pressure drop through one baffle space (bar)
ΔPw	Window zone pressure drop (bar)
Rl	Correction factor for baffle leakage effect on pressure drop

REFERENCES

[1] J.P. Holman, 1963, Heat Transfer, 8th ed, McGraw-Hill Book Company

[2] Hell KJ. Delaware method for shell side design. In: Kakac S, Bergles AE, Mayinger F, editors. Heat exchanger: thermal- hydraulic fundamentals and design. New York: Hemisphere; 1981.p. 581 -618.

[3] Halle H, Chenoweth JM, Wabsganas MW. Shell side water flow pressure drop distribution measurements in an industrial-sized test heat exchanger Eng 1994; 15: 42-56.

[4] Gaddis ES, Gnielinski V. Pressure drop on the shell side of the shell side of shell and tube heat exchangers with segmental baffles. Chem Eng Process 1997; 36: 149-59.

[5] Taborek, J., 1998. Shell and Tube Heat Exchangers in Single Phase Flow. In Handbook of Heat Exchanger Design. Begell House, New York.

[6] .Shan, R.K. and D. Sekulic, 2003. Fundamentals of Heat Exchanger Design. Wiley New York.

[7] Professor John R. Thom, 2004, "Wolverine. Single Phase Shell Side Flows and Heat Transfer Data BookII", Wolverine Tube Inc, www.Wolverine.com.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
Category: Mechanical

FIRING OF UNMANNED GROUND VEHICLE USING ARDUINO

ANUSHA C INAMDAR [1], NANDISHWARAYYA R SALIMATH[2], MANU KUMAR K R[3], DR.VIJENDRA KUMAR[4], DR.K S BADARINARAYAN[5]

[1]Assistant Professor, Department of Mechanical engineering, MSEC, Bengaluru, India aanu.amazing@gmail.com

[2]Student, Department of Mechanical engineering, MSEC, Bengaluru,India nandishrs586@gmail.com

[3]Student, Department of Mechanical engineering, MSEC, Bengaluru,India manukrgowda039@gmail.com

[4]Professor & HOD, Department of Mechanical engineering, MSEC, Bengaluru,India vijendravk@gmail.com

[5]Principal, MSEC, Bengaluru, India bakesu@yahoo.co.in

ABSTRACT

Indian Army are the first users of new technologies and developments. It's Necessary for the country to invent new technologies for military systems. Now a days robots play an important role in human beings day-to-day life. Soldiers form the backbone for our country and they are very precious gem our country. Soldier's life becomes more valuable, hence this paper tells how machine performs the functions of a soldier like firing, walking into the field. With the help of sensors and wireless camera the robots acts as a soldier and the commands are given to the robot through Bluetooth .The robot is more of an intelligent, flexible, mass production machine. In the future, the use of industrial robots for military applications will become ever more possible. Price, development of the technical abilities of the modern robot will increase the interest of military users. In this article, the authors discuss about the motivation for the use of robots, within the military and within industry, for Replacement of humans. The reasons for this replacement are: quality, cost and safety of Human.

INTRODUCTION

This project work is one which isa series of discussions and advancement creativity on Future Technology and this particular work belongs to a sub-series of Battlespace. The development of unmanned ground vehicles (UGV), is becoming ever more popular across the world. The idea behind this machinery is that Under GroundVehicles is that it can serve as a protection to the soldiers of our country on the ground and eventually replace them in the future of Indian defence. The UGV's are programmed to perform daily routine and boring tasks with precision and minimum efficiency. They are be designed to withstand pressure and other external conditions with complete various tasks which could potentially harm or threaten the life of a soldier thus significantly improving combat effectiveness on the battlefield and also in terrorist attack. Transformation is of the army from heavy Armor and firepower to a lighter, responsive force capable of dealing lethal damage but also surviving adversary's fire power became a top priority. There was a necessity of Development of these vehicles which is more complex than those of UAV's since they need to able to traverse various terrains and accomplish various military assignments and it must travel through the unknown explored path.. There is a small-unit logistic mover also known as the *Tiger*

which is a concept of supply, weapons and even wounded soldier carrier Under Ground Vehicle which could operate across the battlefield at any conditions. Since ever the ancient times logistic issues were one of the main components of a successful battle. Weapons, food, water and various tools are needed by the soldiers in different situations on the war field but some of this can be carried by servicemen, but, heavy loads can cause unwanted fatigue resulting in negative combat on the soldiers. Under GroundVehicle is capable of providing solutions in the logistic situations. This small-unit of logistic mover is a semi-autonomous medium size precede Under Ground Vehicle with the capacity to carry a couple hundred kilos. Benefits of this include lightening the soldiers backpack, but also with good sensors it can follow a path across an active battlefield thus it is not depending on the remote control operators. Fully autonomous Tiger could provide a constant flow of supplies to soldiers whether they are in urban, rural or any other terrain without the direct line of sight to the operators, rendering potential signal jamming useless.

Procedure

In development of an unmanned ground vehicle we are concentrating on developing a firing mechanism in the UGV hence we are developing a prototype here.We cannot use here all the firing products here like gun powder etc. Instead we are developing a simple prototype which we have led for it as a symbol of firing in the war tank. Clap switch which senses any sounds around it will make its bit high and passes it to the microcontroller, the particular duration PWM signal will be sent to the servo motor which makes its shaft to rotate the firing point of the rifle towards the enemy and starts firing. Another servo motor will be controlled by the user so that he can adjust the direction of the camera and sense any foreign object. The movement of the robot is mainly based on the commands send through the Bluetooth Unmanned robot vehicles are increasingly being used in a variety of military missions. One such mission is that of Intelligence, Reconnaissance, and Surveillance. In these missions, unmanned robot vehicles collect sensor data and communicate it to ground, air, and space assets to support decision-making. The model comprises of aBluetooth controlled robot. Transmitter is the robot which provides the conditions of the surrounding environment and sends to the through Bluetooth module.

Receiver consists of with Bluetooth module through which the commands are send. The robot observes for any noise within its locality, if any sound like, firing towards the Tanker gets noticed a motor turned towards it which has got a rifle on it will start firing back towards the enemy region. Another DC motor has been fitted with wireless camera on it to observe the surroundings where the Tanker is moving.

SYSTEM ARCHITECT

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button,or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

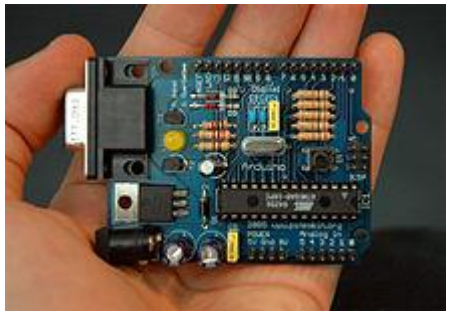


Fig 3.1 Arduino Uno ATmega

An Arduino board consists of an Atmel 8-, 16- or 32-bit AVR microcontroller (although since 2015 other makers' microcontrollers have been used) with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which let users connect the CPU board to a variety of interchangeable add-on modules

termed *shields*. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²Cserial bus—so many shields can be stacked and used in parallel.

Fig 3.2 Brushed DC motor

Brush DC motors are mechanically commutated motors that are good for high speed applications where responsiveness and small package size is needed. Brush DC motors are easy to drive and cost effective when long life is not required. Brushed DC motors are widely used in robotics field ranging to all the fields of engineering Brushed DC (BDC) motors are not so costly and they are easy to drive, and are readily available in all sizes and shapes.it mainly consist of two things stators and rotors. The stator will generates a stationary magnetic field that surrounds the rotor. This field is generated by passage of electric current in it Permanent magnets and next is the rotor part the rotor it is also called the armature and is made up of one or more windings which have high strength in nature and good conductive usually copper. When these windings are energized by the help of electric current they produce a magnetic field. The magnetic poles of this rotor field will be attracted to the opposite poles generated by the stator and this is the reason causes the rotor to turn. As the motor turns, the windings are constantly being electrified in a different sequence so that the magnetic poles generated by the rotor do not overrun the poles generated in the stator. This switching of the field in the rotor windings is called often as commutation.

Fig 3.3 LED light

We are aware about the importance of an LED which is a very efficient, potentially good and has a high frequency, light diode .Nothing such Inside each LED is a very small bit of chemical that when electrons (Electricity is passed through it)are passed through, it emits radiation (i.e. light).By changing this chemical composition, it effect change the wavelength emitted - infrared, green/blue/red, near-ultraviolet, etc.A LED is essentially a PN junction diode. When carriers are

Passed across a forward-biased junction, it just emits an incoherent light. Most of thecommercial LEDs are realized using a highly doped n and a p Junction. In case of robotics we here are using LED light for sign of connectivity but in this project we are using as a sign of shooting.

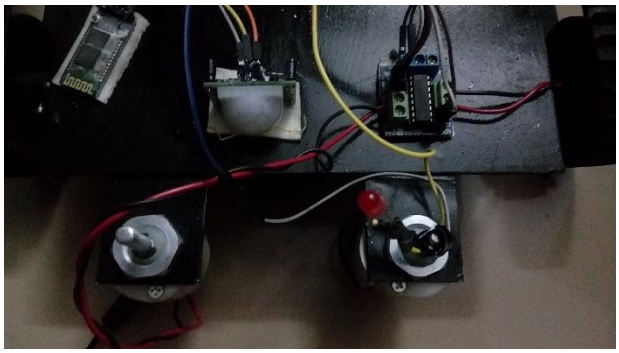


Fig 3.4 Fitting of LED light

Fig 3.5 Firing of LED

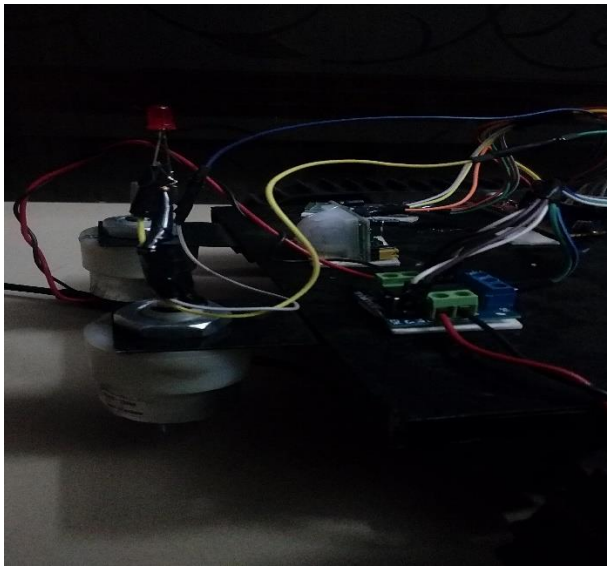


Fig 3.6 LED and motor both coming to rest

IV. ALGORITHM

```
#define LED_PIN 13          // Pin number attached to LED.


void setup() {
pinMode(LED_PIN,  OUTPUT);          // Configure pin 13 to be a digital output.
}

void loop() {
digitalWrite(LED_PIN, HIGH);    // Turn on the LED.
delay(1000);                // Wait 1 second (1000 milliseconds).
digitalWrite(LED_PIN, LOW);     // Turn off the LED.
delay(1000);                // Wait 1 second.
```

Fig 4.1 Coding of LED light blinking in Arduino Language

The code consist of the Arduino language here we are using the pin number 13 which is attached to the LED light as a symbol of firing (LED). The main thing it consist *setup* (): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch 4.1 After setup() is called, this function is called repeatedly by a program loop in the main program. It controls the board until it is powered off or is reset.Most Arduino boards contain a light-emitting diode (LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions. A typical program for a beginning Arduino programmer blinks an LED repeatedly. This program is usually loaded in the Arduino by the manufacturer. In the Arduino environment, a user might write such a program as shown in figure 4.1 and after this we are going to initialise the pin mode to the Arduino which acts as a source of output. Then we have write a program which repeats itself in the void loop so that it cannot be always be written again and again in the void loop so as we have mentioned in the abstract part that we are using clap switched so when the clap switched hear the sound it instructs the Arduino to turn the firing mode (LED) carried by servo motor to turn and shoot the code says that on the light after turning which has been highlighted as pin high and it's going to delay 1000 sec and switch off and the servo motor comes to its initial position this process always repeats again and again until the robot sees the enemy this can be controlled using Bluetooth and seen that in the camera it does not shoot itself or the own person.

VI.EXPECTED RESULTS

We compare our result with existing system. Time efficiency of existing system is more compared to our system. Our system is more secured compared to existing system. After the installation and writing the code the expected result was efficient in firing (i.e. blinking of LED light).and turning the LED light to a certain degree must be done.

VII. CONCLUSION

The main application in mind during the design of the project is to use it for Defense Organizations, The Army, The Navy, BSF and Air force. Loss of lives of tanker operators can be prevented which are used in war fields. It acts like a geographical explorer to survey the places where human presence is inhospitable, one can use it to excavate resources. It

can also be used for remote sensing with some additional features to sense resources.The system can be operated remotely within distance of 20 meters. It can move 22.5 degrees left and 22.5 degrees right (total 45 degrees) from center position. It is fully electromechanical system. It can be used to deceive the enemy during war time. The system is very useful for fixed line firing. It is unmanned and easy to operate. It will fire automatically, when there is an attack. It can be used as home security system without rifle. We can monitor the activities in PC through wireless spy camera which is mounted on vehicle. It can also be used as a spy ground vehicle.

REFERENCES

[1]. AmeyKelkar, "Implementation of Unmanned Vehicle using GSM Network with Arduino"

[2]. SourangsuBanerji"Design and Implementation of an Unmanned Vehicle Using A GSM Network without Microcontrollers*"Journal of Electrical Engineering, Vol. 14, Issue. 1, 2014.*

[3]. Jen-HaoTeng, Kuo-Yi Hsiao, Shang-Wen Luan, Rong-CengLeou and Shun-Yu Chan "RFID-based Autonomous Mobile Car*"*, IEEE Conference. (2010).

[4]. Binoy B. Nair, Abhinav Kaushik, T. Keerthana, AswathySathees, P. Rathnaabarani and Aswathy S Nair*"*A GSM-based Versatile Unmanned Ground Vehicle*",* IEEE Confernce. 2010

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

MULTIPLE OPERATIONS USING PNEUMATIC SYSTEM

Sumangala.G.Patil[1], G. Muni Krishna[2], Vinayak V Kammar[3], Sandesh Kumar SK[4], Jai Krishna Rao. B[5], Dr K. S. Badarinarayan[6], Dr V Vijendrakumar[7]

[1]Assistant Professor, M.S.Engineering College, Bengaluru KARNATAKA, INDIA
E.mail:Sumangala.patil2901@gmail.com

[2 & 3] B.E Student, M.S.Engineering College, Bengaluru, KARNATAKA, INDIA
E. mail: munikrishna0095@gmail.com; E. mail: vinayakkumar.vk@gmail.com

[4 & 5] B.E Student, M.S.Engineering College, Bengaluru, KARNATAKA, INDIA
E. mail: sandeshroshan6565@gmail.com; E. mail: jeevu1996@gmail.com

[6]Principal. M.S.Engineering College, Bengaluru, KARNATAKA, INDIA
E-mail: bakesu@yahoo.co.in

[7]HOD. M.S.Engineering College, Bengaluru, KARNATAKA, INDIA E-mail: vijendravk@gmail.com

ABSTRACT

Industries are developing rapidly; man power reduces gradually in industries. In olden days almost all industries were using conventional machines for manufacturing processes, here time consumption and labour costs were very high and which increases the manufacturing cost of the product. For producing economically better quality products with high productivity, accuracy and quality, the conventional machine tools are being replaced gradually by the automated machine tool devices. In this paper the machines is made with help of Pneumatic device.This machine is for small scale industries and can be made into multiple operations that should be used as straight cutting machine and to obtain good surface finish. Hence we tried out hands on multiple operations using a pneumatic system like shaping, drilling, reaming and grinding. In this operation the pressure exerted on the ram causes the removal of metal. Since the clearance between the tool and the work piece is small, the removal of material takes place in a localized area. This machine eliminates the operation time performing on different machines and to minimize the operation cost.

I. INTRODUCTION

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation [4]. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz.

1. Full automation.
2. Semi automation.

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible [5].

Pneumatic system use pressurized gases to transmit and control power, as the name implies, pneumatic systems typically use air as fluid medium, because air is a safe, low cost and readily available fluid. It is particularly safe environments where an electrical spark could ignite leaks from the system components.

There are several reasons for considering the use of pneumatic system instead of hydraulic system Liquid exhibit greater inertia than gases. Therefore, in hydraulic system the weight of the oil is a potential problem [6]. To design and development a material handling system for automation /semi automation of industries by using pneumatic control system, which is used for low cost automation.

Ram or the cylinder piston to obtain the forward and return strokes. By this arrangement the forward/reverse stroke of the pneumatic cylinder is adjustable type when compared with the conventional machines. The designed a machine which will automatically index the job and gives automatic tool feed to the pneumatic cylinder.

II. DESIGN

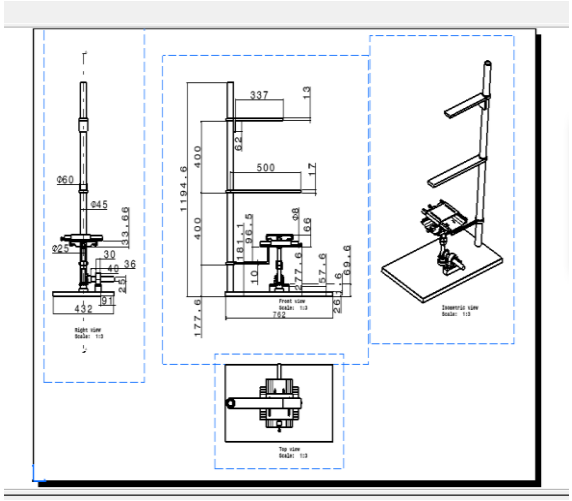


Fig 2.1 Catia Drawing 1in 2D

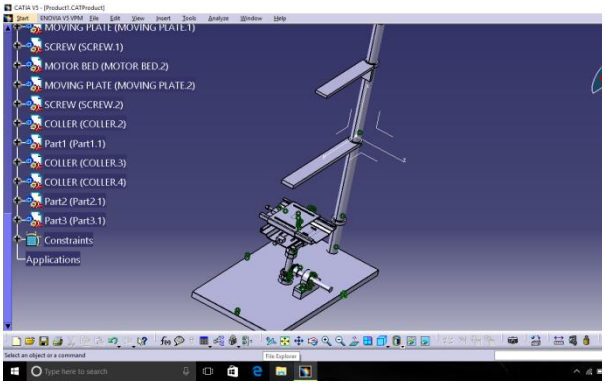


Fig 2.2 Catia Drawing, Isometric View

III. EQUIPMENTS

1. Compressor

Fig.3.1 Compressor

- Pressure from the compressor is 10 bar pressure
- Motor-2 HP capacity 3 Phase induction motor.

2. Double acting cylinder

Fig.3.2 Double acting cylinder

Double acting is provided on equipment in both horizontal and vertical position with respect to the operation. The required air is passed from the compressor through the solenoidal valve Piston Diameter = 50mm.

Piston Rod Diameter = 25mm.

Stroke Length =80mm.

3. 5/3 Solenoidal valve

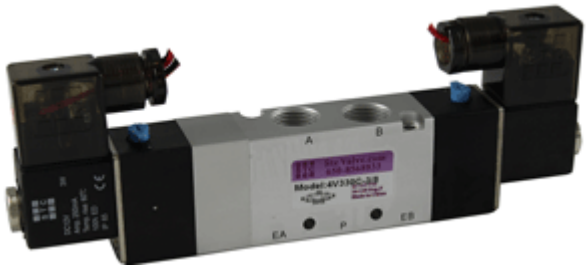


Fig 3.3 Solenoid valve

5 ways, 3 position type operated solenoidal valve.

4. Pneumatic straight drill.

Fig 3.4 Pneumatic Drill

A pneumatic drill may refer to Drill run by compressed air.

- Free speed: 2600 r/minute.
- Air consumption: 14CFM (400 L/minute).
- Drilling cap: 3/8"(10mm).

IV. CALCULATIONS

1. Calculate the area of the cylinder

2. Area, $A = 2\pi r^2$.

Multiply the piston area by the air pressure to be used

3. Area x Pressure = Force Output

Note: The force output on the rod end of a cylinder will be slightly less due to the friction of the rod. The real force output of a cylinder will be less than the theoretical output because of internal friction and external side loading. It is best to use a cylinder that will generate from 10bar

Double acting cylinder has a cylinder D_1=50mm,

Piston rod diameter D_2=25mm

Stroke length=80mm,

Internal air pressure P= 10 bar

Calculate of Force to Move the Piston

Extension force $F_{ext} = \frac{P\pi(d_1{}^2)}{4}$ [1]

$= \frac{1*\pi*(50^2)}{4}$

=1963.495N

Retraction force $F_{ret} = \frac{P\pi(d_1{}^2 - d_2{}^2)}{4}$ [1]

$$F = \frac{1(\pi)(50^2 - 25^2)}{4}$$

$$F = 1472.62N$$

Where

P= Pressure (in N/mm^2)

$D_1 = Diameter\ of cylinder\ (in\ mm)$

$D_2 = Diameter\ of\ piston\ rod\ (in\ mm)$

Cylinder air consumption =

$(A_{1+}\ A_2)$*S*n*$\frac{P_{at+P_o}}{P_{at}}*\frac{1}{1000}$

=

(1963.495$_+$ 1472.62)*80*6*$\frac{0.101325+1}{0.101325}*\frac{1}{1000}$

For 6 cycles =17927.0 LPM

For 1 cycle =2987.834 LPM

Calculate the volume of air required for one cycle

$$\boldsymbol{cubic\ feet\ per\ minute\ (CFM)} = \frac{[(2 * A - R) * S * C]}{1728}$$

Where,

A= Area of piston (inches)

R= Area of rod (inches)

S= Stroke length (inches)

C= Cycles per minute

For extended cycle CFM =$\frac{(A*S*EC)}{1728}$

Where,

A = Area of piston (inches)

EC = Extended cycle

S = Stroke length (inches)

CFM =$\frac{(1.97*3.15*1)}{1728}$

CFM = 3.5911*10^{-3}

In LPM

=3.5911*10^{-3}*28.32

=0.10170 LPM

For retract cycle CFM =$\frac{(A-R)*S*RC)}{1728}$

CFM =$\frac{(1.97-.98)*3.15*1)}{1728}$

CFM = 1.8046*10^{-3}

In LPM

= 1.8046*10^{-3}*28.32

=0.0511 LPM

Total volume of air required

=0.10170+0.0511

=0.15264 LPM.

V MECHANISMS

1. Reciprocating Mechanism: Hydraulic or pneumatic cylinders are common components used to drive a mechanism with a limited linear stroke. Figure 5.1(a) illustrates a hydraulic cylinder. Figure 5.1(b) shows the common kinematic representation for the cylinder unit. The cylinder unit contains a rod and piston assembly that slides relative to a cylinder. For kinematic purposes, these are two links (piston/rod and cylinder), Connected with a sliding joint. In addition, the cylinder and rod end usually have provisions for pin joints[2].

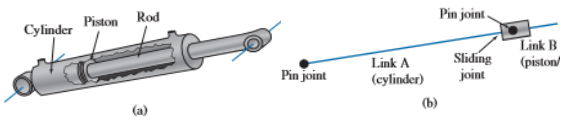


Fig 5.1 (a) hydraulic cylinder, (b) kinematic representation for the cylinder unit

2. Rotary Mechanism: Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90^0 apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone [3].

Fig 5.2 Rotary Mechanism

Two bevel gears in mesh is known as bevel gearing. In bevel gearing, the pitch cone angles of the pinion and gear are to be determined from the shaft angle, i.e., the angle between the intersecting shafts. Figure shows views of a bevel gearing.

A bevel gear. This can also speed up rotation if the gears have different numbers of teeth.

For example if the small gear had 10 teeth and the large gear had 40 teeth the small gear would rotate 4 times as fast.

3. Power screw Mechanism: A power screw is a drive used in machinery to convert a rotary motion into a linear motion for

Power transmission. It produces uniform motion and the design of the power screw

May be such that

(a) Either the screw or the nut is held at rest and the other member rotates as

it moves axially. A typical example of this is a screw clamp.

(b) Either the screw or the nut rotates but does not move axially.

A typical example for this is a press.

Other applications of power screws are jack screws, lead screws of a lathe,

Screws for vices, presses etc.

VI. WORK IN PROGRESS

1. Design Analysis :
   - Stress Analysis
   - Strain Analysis
   - Deflection
2. Fabrication

VII. REFERENCES

[1]. "HYDRAULICS AND PNEUMATICS" by "AC NIRANJAN" FOURTH Edition 2014-2015 Sapna Publications

[2]. "MACHINES AND MECHANISMS APPLIED KINEMATIC ANALYSIS" Fourth Edition David H. Myszka University of Datyon.

[3]. "DESIGN OF MACHINE ELEMENTS-II "J.B.K DAS" SECOND Edition 2015 Sapna Publications.

[4]. M.V.N SrujanManohar, S.Hari Krishna made an effort on"AUTO INDEXING GEAR CUTTING ATTACHMENT FOR SHAPING MACHINE".International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 1 Issue 6, August - 2012.

[5]. P. P. Mane and Mr. S. H. Burande made an effort on "EXPERIMENTAL ANALYSIS OF HYDRAULIC SHAPER MACHINE". IJIRST – International Journal for Innovative Research in Science & Technology| Volume 2 | Issue 12 | May 2016 ISSN (online): 2349-6010

[6]. .Bharath, Siddharam Patil, R M Lathe conducted work on"SHAPER AUTOMATION USING ELECTRO-PNEUMATIC DEVICES AND PLC'S. International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 8, Issue 2 (August 2013), PP. 49-56.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

AUTOMOBILE SCREW JACK USING SMART PHONE

Akshay A[1], Ashoka K H[2], Jagadeeshwara M P[3], Sumit Kumar[4] , Dr.V.Vijendra Kumar[5], Dr.K S Badrinarayan[6]

[1]Student , Department of mechanical engineering, M S Engineering College, akshayakshi001@gmail.com

[2]Student, Department of mechanical engineering, M S Engineering College, ashokakh407@gmail.com

[3]Student , Department of mechanical engineering, M S Engineering College, jagadeesh010893@gmail.com

[4]Student, Department of mechanical engineering, M S Engineering College, sumithshetty.v@gmail.com

[5]Professor and H.O. D, Department of mechanical engineering, M S Engineering College, vijendravk@gmail.com

[6]Professor and Principal, M S Engineering College, principal@msec.ac.in

ABSTRACT

This project work has been conceived having studied the difficulty in lifting the any type of light vehicles through smart phone apps. Our survey in this regard in several car owners or drivers, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles where in need of maintenance, repair and while the tyre gets punchered. Now a day's smart phones are becoming more powerful and have gradually turned into an all-purpose portable devices and provided people for their daily use. Bluetooth is mainly used for data exchange; add new features to smart phones. Bluetooth technology shows its advantage by integrating with smart phones. It has changed how people use digital device at any were, and has transferred traditional wired digital devices into wireless devices.

1. INTRODUCTION

A screw jack that has a built-in motor is now referred to as a linear actuator but is essentially still a screw jack. Today, screw jacks can be linked mechanically or electronically and with the advances in motion-control, loads can be positioned to within microns. Improvements in gear technology together with the addition of precision ball screws and roller screws mean the applications for screw jacks today are endless and a real alternative to hydraulics in terms of duty cycles and speed at a time when industry demands cleaner and more reliable solutions. Screws Application is used in the elevation of vehicles or objects. The operation of the jack manually makes it difficult for most women and the elderly to operate since much effort is needed to drive the screw jack which results in low linear speed and time consuming. These presently available jacks further require the operator to remain in prolonged bent or squatting position to operate the jack. Suppose car jacks must be easy to use by women or whoever had problem with the tyres along the road. The objective of this paper is therefore to modify the existing design of car jack by incorporating an electric motor into the existing screw jack to make the operation easier, safer faster and more reliable.

2 LITERATURE REVIEW

Screw jack is a device which s used to lift and support a heavy load in automotive vehicles, such as a car. Generally, human effort is required to rotate the screw, but in present work, it is eliminated by solar operated push button type equipment. A set of experiments were performed and a mathematical model was experimentally framed to predict the power requirement at a given load [1].

With the increasing level of technology. Power screws are used to convert rotary motion into reciprocating motion. An object lifting jack is an example of a power screw in which a small force applied in a horizontal plans is used to raise or lower a large load. An electric motor will be integrated with the object lifting jack and the electricity needed for the operation will be taken from the D.C battery and thereby the mechanical advantage will be increased [2].

Automobiles prove to be the heart of locomotion. A long drive might be a something one to the heart but a flat tyre on such a drive collapses everything. Even a flat tyre on the way to the office may cause the day sick. There is no way out to call a mechanic or in case of barren roads, change the tyre ourselves. Present day methods for changing the tyre requires a lot of mechanical power which may prove to be difficult for the weak and old people. Even heavy duty vehicles like trucks, lorry, and buses can be lifted at a very minimal cost. The deceive will be of low maintenance and the initial cost is also low when regarding its use[3].

An inbuilt hydraulic jack system is attached to automobile vehicle on front and rear par of the chassis. An automobile hydraulic jack system can be attached to all currently manufacture automobile chassis and frames. There is a front suspension hydraulic jack that is mounted centrally to the front suspension of an automobile between its front wheels. There is also a rear suspension hydraulic jack that is mounted centrally to the rear suspension of the automobile between its rear wheels. The system operated from a compressed fluid reservoir tank has connection for the front and rear car jack outlets. Additional outlets can be added to the compressed fluid reservoir tank for connection a hydraulic lug wrench and another for a tire inflating hose.

3. OBJECTIVE

- To make use of available technology.
- To avoid human effort to lift the vehicle.
- To design compact as possible.
- It is very easy to use to screw jack.
- Anyone can be operated with app without strain.
- Which will be very useful for oldage people.

4.METHODOLOGY

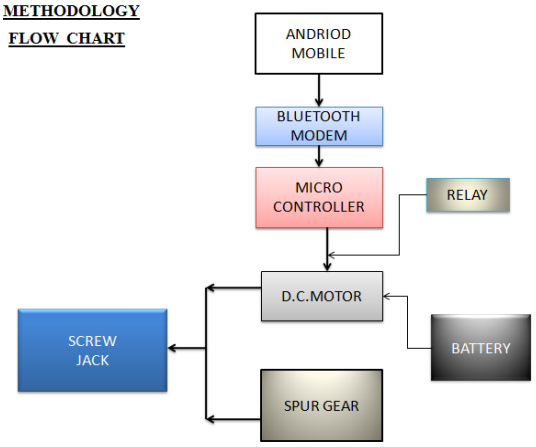


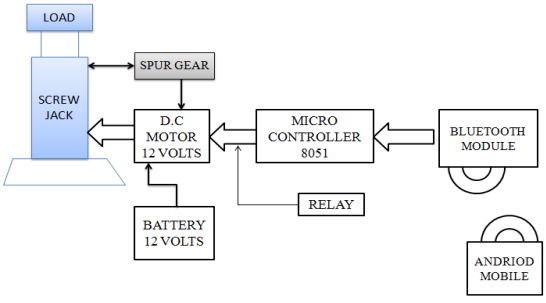
Fig : FLOW CHART

Automobile screw jack using smart plane it operates screw jack with the use of Bluetooth and the app. The system it consists mainly Bluetooth module, microcontroller, motor, Battery and jacks etc. The whole setup controls with the Smartphone while using the Bluetooth.

Screw jack consists of a screw and nut. The nut is fixed in a cast iron frame and remains stationary. The rotation of nut inside the frame is prevented by pressing a set screw against it. The spur are turned according to the outer size of the round flange nut, the other gear meshes which is connected to the drive motor, microcontroller and Battery. Screw is rotated in the nut by means of a D.C motor coupled to the spur gears. The head carries a platform, which supports the load and remains stationary while the screw is being rotated. A washer is fixed to the other end of the screw inside the frame, which prevents the screw to be completely turns out of the nut.

5. WORKING AND FABRICATION

An Android controlled automobile project that allows user to control a battery powered automobile wirelessly through an android application. The system uses a Bluetooth modem as a medium to transmit signals between the android based phone and to the Bluetooth jack. The commands are sent in the form of string variables by the android application through an active Bluetooth connection. These string variables are then received by Bluetooth modem and then forwarded to the Microcontroller. The microcontroller now processes the data sent by Bluetooth modem and checks for user commands. On recognizing direction commands sent by user (Forward/Backward), the microcontroller sends signals to appropriate driver IC's. The driver IC's now operate motors to achieve the desired movement of the automobile as sent by microcontroller. The lead-acid battery is used to drive the D.C motor. The D.C motor shaft is connected to the worm gear. If the power is given to the D.C motor, it will run so that the worm gear also runs to the slow speed of the D.C motor. The screw jack and moves the piston upward, so that the vehicle lifts from ground. The vehicle is lifted by using the lifting flat form in the top of the screw jack. The motor is drawn supply from the battery. The lifting and uplifting is done by changing the battery supply to the motor simply.



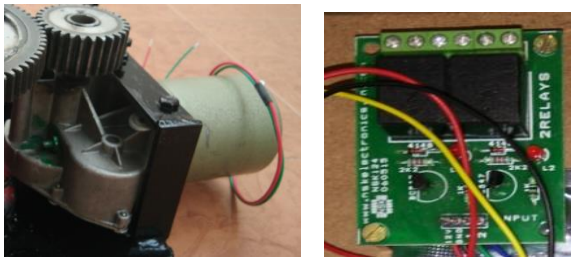
BLOCK DIAGRAM

5.1 Specifications

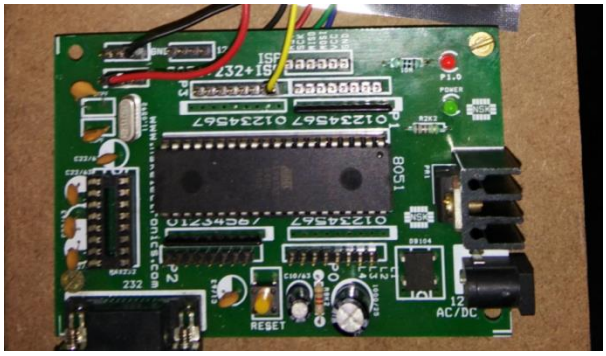
1. Screw Rod
   - Internal Thread : - 25mm , 40mm.
   - Screw rod capacity :- 1500 kgs
2. Battery :- DC 12 volts, 7 Ah
3. Motor :- 90 Watts, DC Motor
4. Microcontroller 8051: -at 89s52 AT-ATMEL, 89-Manufacture's series,S-silicon CMOS, 52- is the family of 8051, 8 bit, 4k ROM, 32 pin
5. Bluetooth :- 2.4 GHz Open band, 10 – 100 meter range, Up to 8 active devices can be in the same Pico, 1 Mbps gross rate.

5.2 PICTURES

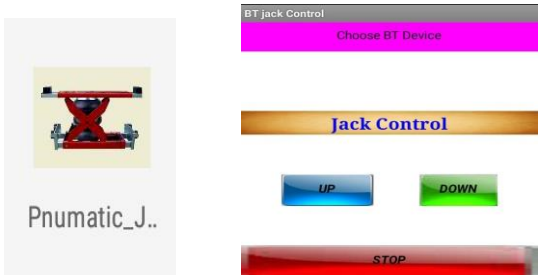
Screw jack Battery



DC Motor Relay switch



Microcontroller



Bluetooth APP

5.3 DESIGN OF SCREW JACK

DESIGN OF SCREW ROD

- Finding compressive stress , σ_c=F/A F= $\pi d^2/4$

- Factor of safety , FOS = σ_y/σ_c
- Helix Angle , tan α= P/πd_m
- μ= tan α
- Torque = Force ×perpendicular distance
  = F×R.tan($\theta + \alpha$)
  R= d_m/2
- Shear stress due to torque , τ = 16T/πd^3
- Direct stress , $\sigma_d = \sqrt{(\sigma_c^2+4\tau^2)}$

DESIGN OF NUT

Assuming stainless steel

- τ = (shear stress σ_y×0.6)

Number of internal threads for the load

- n = 4F/π ×(d^2-d_c^2)×P_b
- H = n×P

Tensile stress induced in nut

- σ_t = 4F/π ×(D_o^2-D_i^2)

Checking for buckling of screw

- Radius of gyration, k = d_c/4
- Slenderness Ratio = L/K

6. COST OF ESTIMATION

SL. NO.	NAME OF THE PART	QUANTITY	AMOUNT(RS)
1	Screw jack	1	4500 /-
2	Spur Gear	2	4500/-
3	Battery	1	1500/-
4	Micro-controller	1	350/-
5	D.C motor	1	1500/-
6	Relay Switch	2	150/-
7	APP Development		1000/-
8	Labor		1500/-
	TOTAL		15000/-

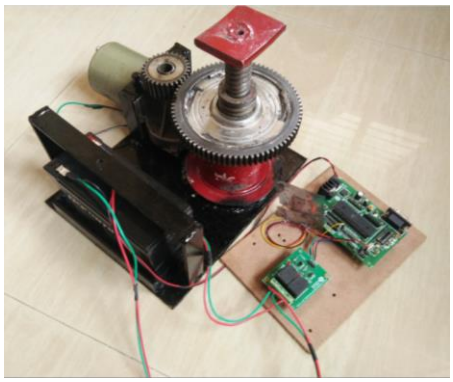
7. RESULT

We are tested the designed screw jack by using APP to lift the vehicles upto 1500 Kgs as per analytical and assumptions made by us and which is working safely.

8. CONCLUSION

The fabrication of automobile screw jack using smart phone was successfully completed as per the designed specifications.

The trial performance of this device provides to be successful, with case of operation and safety, Hence the results as given a clear indications of its commercial viability. The cost analysis has shown its economic feasibility and we are under the impression that it can be further reduced, when produced on a mass scale.



9. REFRENCES

[1]. Sonu yadav and M . L . Aggarwal, “Effect of Lifting Load on Solar Powered Jack Design In Automation Vehicles” , YMCA University of Sci and Technology, Faridabad- 121006 , India.

[2]. Ivan Sunit Rout, Dipti Ranjan Patra, Sidhartha Sankar Padhi, Jitrendra Narayan Biswal, Tushar Karti Panda, “Design and Fabrication of motorized automated object lifting jack”, C.V Raman College of Engineering, IOSR Journal of Engineering(ISORJEN) , ISSN(e) : 2250-3021, ISSN(p) :2278-8719, Vol 04, Issue (May-2014), PP 06-12

[3]. S.Anish Mathew, B.Bala Vignesh and N.S. Dinesh, “Engine Operated Screw jack” , Thiagarajar College of Engineering, Madurai , India.

[4]. Mohammed Abuzaid, Mohammed Hasnain, Shabaj Alam, Sohail Khan ‘”Inbuilt Hydraulic Jack in Automobile Vehicles”,Satyam Education and Social Welfare Society Group of Institutions, Bhopal, MP, India.

[5]. Design Data Hand book by K. Lingaiah. Vol. I and II

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

AQUA SILENCER FOR DIESEL ENGINE

Kiran S[1], Vinod Kumar N[2], Dr. K.S Badrinarayan [3], Sameera G[4], Dr. V.VijendraKumar[5]

[1]UG Student, Department of mechanical engineering, M S Engineering College,kiransangale970@gmail.com

[2] UG Student, Department of mechanical engineering, M S Engineering College,vinodkumarvinu1992@gmail.com

[3] Professor and Principal, M S Engineering College, principal@msec.ac.in

[4] Assistant Professor, Department of mechanical engineering, M S Engineering College,sameera2295@gmail.com

[5]Professor and H.O. D, Department of mechanical engineering, M S Engineering College, vijendravk@gmail.com

ABSTRACT

Global warming is increasing on our earth due to major increase in the pollution. Air pollution is very serious problem on our earth. The main component due to which the air pollution is increasing are (CO), (NoX) and lead which is get exposed from vehicles. The other sources such as big factories, electric power, generation plants, big industries etc. So it is required to solve these problems by taking various serious attempts. Aqua silencer is one of the attempt taken in reduce the air pollution. It is fitted to the exhaust pipe of engine or system. These Silences is used to reduce the noise and control the emission of dangerous gases. In aqua silencer the main component perforated tube which consists of number of different diameter holes. Generally these are 4 set of holes on perforated tube. Charcoal layer is pasted over that tube and it is used to convert high mass bubbles to low mass bubbles. The aqua silencer reduces emission noise because, the sound produced in aqua silencer under water having less amplitude than the sound produced in open atmosphere .These is happen because of in water molecules there are small sprockets which lowers amplitude of emission gases and lower the sound level. The charcoal layer which is pasted over perforated tube can control the emission using the activated charcoal so these layer having high absorption capacity

I. INTRODUCTION

It has been long observed that diesel engines play a crucial role in the transport industry, agriculture, mining and many other industries. Considering the available fuel resources and the present technological development, diesel fuel is evidently indispensable. In general, the consumption of fuel is an index for finding out the economic strength of any country. In spite of everything, we cannot ignore the harmful effects of the large mass of the burnt gases, which erodes the purity of our environment every day. An aqua silencer is used to control the noise and emission in IC engines. The reason why we opt for an aqua silencer is that, air pollution and noise pollution causes physical ill effects to human beings and also the environment.

The main contributor of air pollution is automobiles releasing gases like carbon dioxide, unburned hydrocarbons, etc. In order to cut down on emission of these gases, we can use an aqua silencer. It is fitted to the exhaust pipe of the engine. Sound produced under water is less audible than in

atmosphere. This is mainly due to presence of small sprockets in water molecules, which lowers its amplitude and thus, lowers the sound level. The emission can be controlled by using the activated charcoal layer and Lime water. Activated charcoal layer is highly porous and possess extra free valences so it has high absorption capacity and lime water chemically reacts with the exhaust gases from the engine and release much less polluted gases to the environment. The noise and smoke level is considerably less than the conventional silencer. There is no need of a catalytic converter and it is easy to install.

II. WORKING PRINCIPLE OF AQUA SILENCER

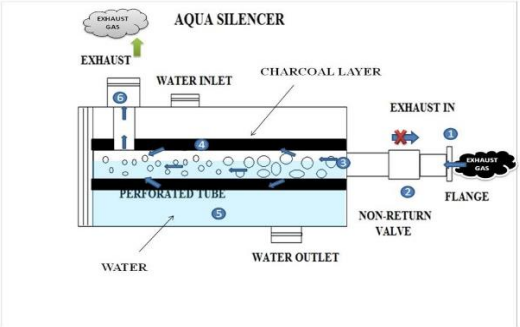


Fig. Aqua silencer

As the exhaust gases enter into the aqua silencer, the perforted tubeconverts high mass bubbles into low mass bubbes after that they psses through charcoal layer which again purify the gases. The activated charcoal layer has high absorption cpacity. After passing over the charcoal layer some of the gases may dissolved into the water and finally the exhaust gases escape through the opening into the atmosphere. Hence aqua silencer reduces pollution.

III. DESIGN CONSIDERATION

The design of exhaust gas manifold is very important in case of high speed diesel engines. In order to maintain the exhaust gas pressure within the required limits, the exhaust gas manifold is designed so that, the gases, which come out of the cylinder flows very smoothly, before it is let out into the atmosphere. This is absolutely essential in order to maintain the back pressure within safe limits, so that the engine can be kept at the optimum operating level. The back pressure, if it is allowed to exceed the pre-determined level, the effort on the part of the piston for scavenge is considerably increased and so power is lost in performing the above, so, the primary consideration when introducing any modification in exhaust system does not and shall not increase the back pressure which drastically affect the performance characteristics of an engine. To be more precise, the speed of the engine is affected for a given specific fuel consumption rate and so the combustion characteristics of an engine are all affected. As a net result of the combustion is not proper and complete which results in the increased impurities or unburnt gases. This principle against the purpose of introducing any system whose sole object is reducing the very toxic property of the exhaust gas. So, it is implied that the introduction of any system reduces the toxic property of the exhaust gas, shall not result in any effects in the opposite direction. So by introducing any component in the system the flow path length and the resistance to flow are indirectly increased. So the increase of back pressure is inevitable unless the increase in magnitude compensated in the design of the component itself. The exhaust gas has to pass through the water, which is filled in the scrubber tank. In any case, the outlet from the engine shall be kept below the water level in the scrubber tank for that the gas will pass through the water. The gas has no to push the water, in order to bubble through the water. The gas has to push the water, in order to bubble through the water in the scrubber tank. This may create chances to increase the backpressure. The baffles, which are provided to deflect the exhaust gases, also offer resistance to the flow and in turn increase the back, pressure. Due to the high temperature, the exhaust gas is let out from the engine, some of the water particles which come in contact, readily changes its phase from liquid state to gaseous state i.e., Steam Which increases the net mass of the exhaust gas flow per unit time. The resultant may increase the backpressure.

Fig. Diesel engine

IV. SECIFICATIONS OF SILENCER PARTS

Sl no.	Component	Size
1	M S Square hollow pipe (18 gauge)	1 inch square
2	M S hollow pipe	7 inch diameter, 15 inch length
3	Perforated tube	2.5 inch diameter, length 180mm
4	M S Plate for closing both side	8 inch diameter
5	Collar for Inlet and outlet valve	0.5 inch

V. CONCLUSION

An aqua silencer system has to be designed and fabricate for diesel engine silencer.

The main advantages of aqua silencer are -

No vibration when the engine is running. Start the engine easy. Control emission and in greater level. Carbon is precipitated.

For further work we will determine the amount of exhaust gas like hydrocarbons, nitrogen etc which is present in the single cylinder diesel engine without connecting Zero emission silencer. And then we will connect aqua silencer (without lime water) to the exhaust and determine the amount of exhaust gas by smoke analyser . At last we will connect silencer (with lime water) to exhaust pipe and readings will taken. So by results comparisons will be plot on graph.

REFERENCES

[1]. HsiehaWD, ChenRH, WUTL, LinTH. Engine performance and pollutant emission of an SI engine using ethanol–gasoline blended fuels. Atmos Environ 2002;36: 403–10.

[2]. Hasan MA. Effect of gasoline blends on engine performance and exhaust emission. Energy Convers Manage 2003;24:1547–61.

[3]. Hansen AC, Zhang Q, LynePWL. Ethanol–diesel fuel a review. Bioresour Technol 2005;96:277–85.

[4]. HeB, ShuaiS, WangJ, HeH. The effect of ethanol blended diesel fuels on emissions from a diesel engine Atmos Envir on 2003;37:4965–71.

[5]. ChenH, WangJ, ShuaiS, ChenW. Study of oxygenated biomass fuel blendson a diesel engine. Fuel 2008;87:3462–8.

[6]. Lapuerta M,ArmasO, Herreros JM.Emissions from a diesel–bioethanol blendinan automotive Diesel engine. Fuel 2008;87:25–31.

[7]. Yüksel F,Yüksel B. The use of ethanol–gasoline blendasa fuel in an SI engine. Renew Energy 2004; 29:1181–91.

[8]. H. Guo, Z. Liu, Y. Chen and R. Yao,"A Study of Magnetic effects on the Physicochemical Properties of Individual Hydrocarbons" Logistical Engineering College, Chongqing 400042, P.R China(1994), pp.216-220.

[9]. I. Pera, P. Pines, "Magnetizing Hydrocarbon Fuels and Other Fluids" U. S. Patent No.4716024, (1987).

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
Category: Mechanical

DUPLICATING WOOD CARVING MACHINE

Prashanth B[1], Akshay K N[1*],Amith G M[1], Shwethashree Hegde[1],Dr. K S Badarinarayan[1]
[1]Department of Mechanical Engineering, M S Engineering College Bengaluru
[*]akshay.akki.462@gmail.com

ABSTRACT
The present market is safety oriented and survival of any products/manufacturer is largely depends on cost, quality and performance of the product. Our design work is based on 4-bar Mechanism the comfort coupled with a safety and simplicity is what man strives for. Our project has been to bring about both the culmination of our effort has resulted in development of a new "DUPLICATING WOOD CARVING MACHINE". The project present a basic as well as very professional treatment of the subject in a very comprehensive, based on learning effort and understanding capability of today as per their levels. The device is simple and comfortable ,basic calculation, drawing, designing is included in the project. The salient features of our machine can be listed as the mechanism used as very simple, easy of operation, no skill is required to operate the machine.
Keywords— Motor, L angle, Shaft, Chuck, Spring, Fasteners, Wooden sheet.

I. INTRODUCTION

A new Duplicating Machine that will allow individuals to easily and accurately cut the material into various shapes that can be formed; like lettering, name plate etc and different type of materials can also be machined. The invention has a unique and rigid Duplicating mechanism having a stylus and motorized cutter mounted upon a rigid "U" -shaped frame, combined with a simple and accurate alignment system, in which the U-frame pivots upon a transverse bar which is aligned upon side rails in the manner of a T-square, enabling the duplicator to easily and accurately machine a material to a three-dimensional master. The duplicating machine of the invention is very simple to set up and operate. The average craftsman will be able to machine quickly and desired dimensions he can convert a work piece into a finished model as per the reference model. Only working skill is required to achieve the finished shape of the product.

My invention may be applied to machines, instruments or the like, in which the movements of an operating instrumentality are governed or controlled by a pattern following-mechanism. My invention is particularly applicable to apparatus for accurately and reliably cutting, welding, or carrying out other operations along a path corresponding to the contour of a given pattern or templet, and one application of my invention has been illustrated in the accompanying drawings *as applied.*

II. PROBLEM STATEMENT AND SOLUTION

Traditional engraving machine are bulky and are difficult to transfer from one place to another. This kind of machine has large workspace, high weight and good maneuverability; it is most important in field of wood or metal engraving. Here, we designed a pantograph for engraving letters on wood, on metal, for making thermo-cal patterns and plastic patterns which having easy handling, portable, low cost and low weight as compare with traditional engraving machine.

In a traditional engraving machine the tools are fixed because they can design only on wood but our process can be done on both soft and harder materials (wood and metal) by changing a necessary required hardness tool.

III. WHAT IS WOOD CARVING?

Is a form of working wood by means of a cutting tool in one hand or chisel by two hands or with one hand on a chisel and on other hand mallet, resulting in a wooden figure or figurine , or in a sculptural ornamentation of a wooden object.

The making of sculpture in wood has been extremely widely practiced but survives much less well than the other main materials such as stone and bronze, as it vulnerable to decay, insect damage, and fire. It therefore forms an important hidden element in the art history of many cultures.

Outdoor wood sculptures do not last long in most parts of the world. So that we have little idea how the totem pole tradition developed. Many of the most important sculptures of China and Japan in particular are in wood, and the great majority of sculptures are located in African and Oceania regions.

Wood is light and can take very fine detail so it is highly suitable for masks and other sculpture intended to be worn or carried. It is also much easier to work than stone carving.

Some of the finest extant examples of early European wood carving are from the middle ages in Germany, Russia, France where typical themes of this era is known as Christian iconography. In England, from 16th and 17th century where oak was the preferred medium.

1) To develop a device which can help in mass productionand help out in to increase productivity.
2) To develop a device this can make work simple.
3) To develop a device which can be used for multipurpose operations.
4) To develop a device which can work in many degree of freedom.
5) To develop a device which can run cost efficient.
6) To make a device which is suitable economical for small scale industries taking into consideration the cost factor ,this device is suitable for small scale as well as large scale industries.
7) Taking safety as prime consideration this device is safer in all aspects.

IV. LITERATURE REVIEW

WILLIAM D. COCKRELL - He is the assigner to general electric company a corporation of newyork in his invention the movements of operation instrumentality are governed or controlled by a pattern following mechanism. gas cutting apparatus embodying a pantograph.

Paul G. Gleason, Van Nuys, Calif he used the term modified pantograph to design 4 linkage and reduction in friction and total error trending to arise from any slight looseness in pivots. novel counter balance arrangement requering a minimum manipulating force for engraving operations.

A.Pecchioli the present invention relates to copy milling machine and more particularly to an interconnection system for tables of a pantograph milling machine. It says that including two movable tables one being a work piece supporting table and other being a template supporting table connection means for controlling horizontal movement of one of tables in direct response to a movement of other.

A. BOTTCHER ETAL a step

Feed device operate by an adjustable stop which is provided with a spindle screwed into a threaded sleeve and arranged foe displacement in casing . the sleeve is biased by spring at one end and during displacement of sleeve in casing a rotary control device engages sleeve so that it can turn in only a single direction with respect to a spindle.

Sean Michael Ragan matthias wandels woodgears.ca may be favorite personal maker website. its clean, well-organized, packed with resources, and every click brings new inspiration. its homemade 3D pantograph carving machine duplicator that im fixated on mechanical pattern copying machines like this of course are not new. theyre offten used in restoration work for instance to replace a damaged articultural detail by directly copying a surviving original.

Purvi Ajay Wankhede in study of theory of machine four bar mechanism is very important. Generally it is nothing but parallelogram used for copying profile.

It works on 5 links, and the stylus is at a single point only it is used for smaller sized model that's all.

V. DESIGNING

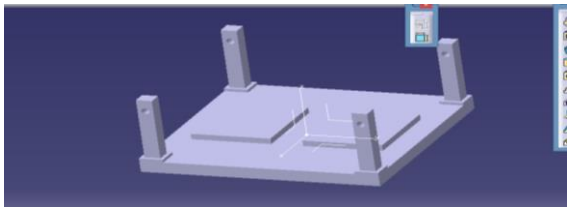


Fig 1: Base with supports

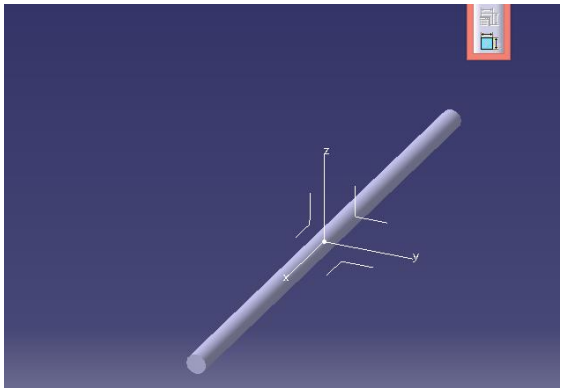


Fig 2: Guide rods

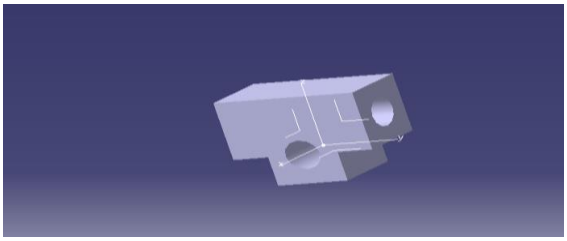


Fig 3: moving bar

VI. ASSEMBLING

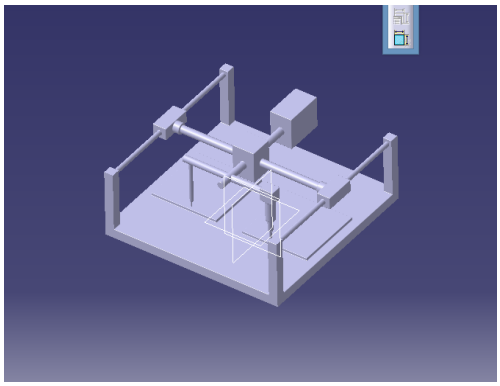


Fig 4:3D assembling

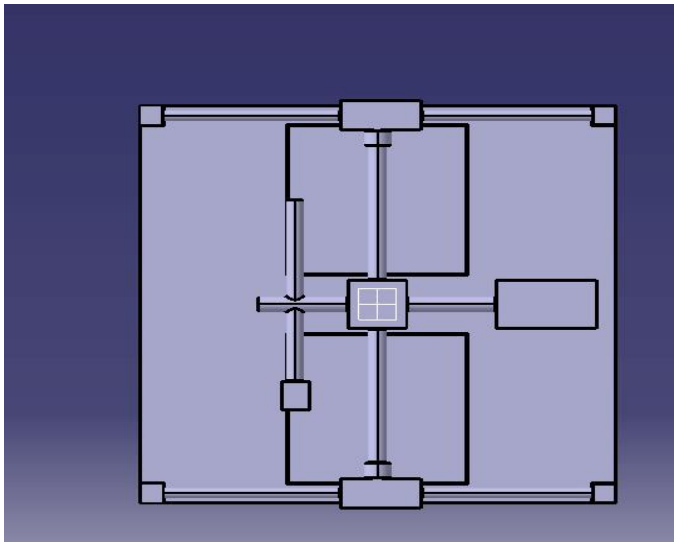
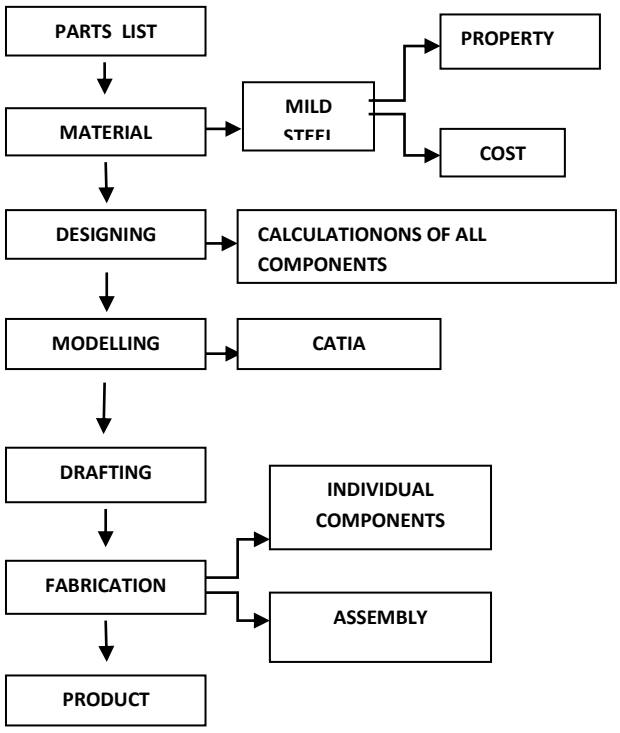


Fig 5:top view

VII. METHODOLOGY



VIII. CUTTERS

The cutter is the most vital single item on the engraving machine and must always have the best possible cutting edge. Relate it to a cook's knife, a carpenter's chisel, a hand graver. It must be sharp at all times, there is no substitute. Any engraving instruction should begin with the cutter, the most basic and essential piece of your equipment. I shall be emphasizing this over and over again.

Inexperienced engravers, for some reason have a terror of using a cutter grinding machine, imagining that they have to be an engineer before they can attempt to use such a device. Not so, in fact it's quite.

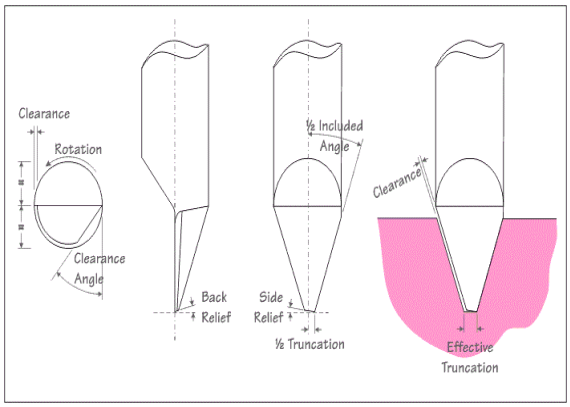


Fig. 6: Typical engraving cutter

IX. WOOD CARVING

Pantograph is a linkage constituting of five link connected with pin joints to form revolute pairs. It is connected in a manner based on parallelograms so that the movement of one point, in tracing an image, produces identical movements by second point. A pantograph is used to reproduce to an enlarged or a reduced scale and as exactly as possible the path described by a given point. If a line drawing is traced by the first point, an identical, enlarged, or miniaturized copy will be drawn by a pen fixed to the other. One of the revolute pair is fixed into the base, so that we can move this mechanism with respect to fixed point. Because of their effectiveness at translating motion in a controlled fashion, pantographs have come to be used as a type of motion guide for objects large and small. The point which traces the profile can be in any form e.g. Simple pin having conical point, rod having a bearing mounted at its end. And the point which gives the output can be in forms like router, pen, drilling machine etc.

X. ADVANTAGES

Easy in operation. High initial cost operating cost is less. Simple construction. Adaptable. High accuracy. Time saving.

Easy to setup. Light weight. Easy maintenance. No skill worker required.

XI. DISADVANTAGES

Poewr supply. To machine a metal component only to must be changed. Wood patterns can be prepared. Metal patterns or work pieces can be prepared with various shapes. Plastic patterns can also be machined. Thermo cal patterns or shapes also can be prepared. Different lettering can also be carved.

XII. FUTURE SCOPE

Automatic CNC system can be incurred. Automatic path follower Stylus can be installed. By changing the tool only, various operations can be performed. Rigidity of the structure making can be increased for cutting on various materials.

XIII. CONCLUSION

Project model may be of old mechanism, but still in present days it has many beneficial uses. Pantograph is simple engraving purpose on material like wood and metals. Our model of wood carving machine is having low weight, portable and easy to handle for unskilled persons also than other complicated engraving machines. We designed such mechanism for engraving machine which is safe; hence there are no problems in manufacturing too.

REFERENCES

[1]. W.D.COCKRELL ,Nov 4-1941, Photoelectric contour follower, patent 2261644.

[2]. P.G.GLEASON ,March 17-1953, Engraving machine ,patent 2631375.

[3]. A.PECCHIOLI , Feb 11-1969 , Pantograph milling machine having a work pice supporting table and template supporting table is provided with connection,3426644.

[4]. A.BOTTCHER ETAL, Sept 21-1971, Automatic step feed device for duplicating milling machines,3606816.

[5]. Sean Michael Ragan, Matthias wandels carving machine, April19-2012.

[6]. Purvi ajay wankhede ,IJSRD Vol-4 , issue 01,2016 , ISSN-2321-0613.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

FABRICATION OF AUTOMATIC POLLUTION CONTROL SYSTEM

Anil Kumar K[1], Varun Singh[2], Shubam Chopra[2], Dr.V.Vijendra Kumar[3], Dr.K.S.Badarinarayan[4]

[1]Asst. Professor, Department of Mechanical Engineering, M.S.E.C
[2]Students, Department of Mechanical Engineering, M.S.E.C
[3]H.O.D, Department of Mechanical Engineering, M.S.E.C
[4]Principal, M.S.E.C, Bangalore

ABSTRACT

The rapid industrial expansion in the world has given rise to significant pressure on the environment. The industrial units have now become a major point source of pollution.The system proposed over here comprises of the microcontroller AT89S52, carbon dioxide sensor and relay. As the carbon dioxide content in the air goes beyond some predefined limit then the microcontroller will automatically put OFF the machine causing the pollution or electricity supply will be cut-off for the machine in the industry or factory. The carbon dioxide sensor has been interfaced with the microcontroller. It is used to monitor the amount of carbon dioxide in the air. It is digital in nature, so it has been set to some predefined threshold value. If the content of the carbon dioxide in the atmosphere exceeds that predefined value then microcontroller will turn ON the relay to switch OFF the machines causing pollution. The electricity supply will be pulled OFF so the machines will not be started.

1. INTRODUCTION

Air is considered to be polluted when it contains certain substances in concentrations high enough and for durations long enough to cause harm or undesirable effects. These include adverse effects on human health, property, and atmospheric visibility

Air pollution management aims at the elimination, or reduction to acceptable levels, of airborne gaseous pollutants, suspended particulate matter and physical and, to a certain extent, biological agents whose presence in the atmosphere can cause adverse effects on human health (e.g., irritation, increase of incidence or prevalence of respiratory diseases, morbidity, cancer, excess mortality) or welfare (e.g., sensory effects, reduction of visibility), deleterious effects on animal or plant life, damage to materials of economic value to society and damage to the environment (e.g., climatic modifications). The serious hazards associated with radioactive pollutants, as well as the special procedures required for their control and disposal, also deserve careful attention.

Air pollution management aims at the elimination, or reduction to acceptable levels, of airborne gaseous pollutants, suspended particulate matter and physical and, to a certain extent, biological agents whose presence in the atmosphere can cause adverse effects on human health (e.g., irritation, increase of incidence or prevalence of respiratory diseases, morbidity, cancer, excess mortality) or welfare (e.g., sensory effects, reduction of visibility), deleterious effects on animal or plant life, damage to materials of economic value to society and damage to the environment (e.g., climatic modifications). The serious hazards associated with radioactive pollutants, as well as the special procedures required for their control and disposal, also deserve careful attention.

2. LITERATURE REVIEW

A Global Concern the OECD (1999, p.3) points out that FDI has become one of the driving forces binding countries into closer economic interdependence, and it continues to expand. The rapid increase in FDI flows has generated considerable debate about its environmental implications, in particular the impacts on environmental quality in the investment of the host country. In the OECD's 1999 "Conference on FDI and the Environment" in Netherlands, its Secretary-General, Donald Johnston, said that the debates on the environmental and other consequences of investment have sometimes been highly polarized and problematic.

Some researchers are worried that countries will lower their environmental standards in order to attract foreign investment, thereby creating Literature Review - 30 - so-called "pollution havens." Others argue, to the contrary, that foreign investment could promote "pollution halos" by introducing modern, more efficient and less polluting technologies. Bradford Gentry (1999, p. 21) supported the polarized nature of the debates by discussing two opposite positions on the FDI-Environment linkage in his speech in the above conference: ¾ FDI is a bane of environmental protection given its direct use of land and other natural resources, as well as the increased consumption it encourages; or ¾ FDI is a boon for environmental protection given the new resources it brings for improving efficiency, transferring knowledge, and addressing existing pollution.

The FDI and environment linkage can vary across locations, sectors and investors:

Locations: (a) does the host country have a strong environmental regulatory framework in place (foreign direct investors in the US have contributed significant amounts to cleaning up contaminated sites owned by the companies they acquired); (b) is the investment in a new or an existing operation (improving the economic efficiency of existing operations can also reduce environmental loadings); or (c) is the investment in an urban or a rural setting (affecting the likelihood that sensitive sites are implicated);

Sectors: (a) is it an environmental investment (such as in improving water systems); (b) is it in services, such as banking or telecommunications (with their less direct environmental implications); or (c) if it is in manufacturing or resource extraction, is it to establish a base Literature Review - 31 - for exports (potentially exposing the company to greater environmental pressures from customers); and ¾ Investors: what level of environmental pressure do investors already face locally, globally and in their home countries (affecting their willingness to consider and address environmental issues as part of their investments).

3. REASON FOR SELECTING THE PROJECT

The rapid industrial expansion in whole over the world has given rise to significant pressure on the environment.

The industrial units have now become a major point source of pollution.

One of the major mandates of all the countries government, therefore, is to reduce industrial emission or effluent generation, and to control the quality of the same within safe limits.

So to save the mankind and the earth this kind of system can prove to be very useful. The system is proposed in such a way that once the level of pollution increases beyond some limit in the industry or factory, the machines will be made to shut down automatically.

4. OBJECTIVES

Taking into account the Millennium Development Goals (MDGs) and the Singapore Declaration on Climate Change, Energy and the Environment which was adopted at the Third East Asia Summit last November, the CAI will promote integrated efforts to achieve the following three policy objectives.

(1) Promote low-carbon/low-pollution society

(2) Promote Sound Material-Cycle society

(3) Promote societies in harmony with nature, while adapting to climate change

This will focus on the points given below:

- Strengthen partnerships to ensure support societies in harmony with nature

- Standardize and network of environmental monitoring and countermeasures
- Train and utilize human resources -Maintain mutually supportive relationship between environment and trade

4.1 OBJECTIVE 1 : Promote low carbon/low pollution society

Share a vision to accelerate the shift to a low-carbon society, which will lead towards the achievement of the long-term goal of halving the global emissions from the current level by 2050.In addition, packages of environmental policies, measurement technologies, regulation systems, human resources, etc.Will be disseminated and further developed based on our experience of successful pollution controls, thereby promoting measures that help to achieve a low-carbon/low-pollution society.

4.2 OBJECTIVE 2 : Promote sound material-cycle society

It will then facilitate the transboundary movement of circulative resources. Also promote development of final disposal sites and energy recovery from waste in accordance with each country's situation.

4.3 OBJECTIVE 3 : Promote societies in harmony with nature, while adapting to climate change

This will propose societies in harmony with nature where human beings and nature can coexist and benefit from biodiversity in Asia into the future. And also, promote the establishment of ecological networks connecting with biodiversity considerations. To respond in an early stage in areas subject to severe impacts from climate change, development of soft and hard infrastructure for adaptation will be essential. Making efforts to understand and predict the impacts and vulnerabilities through observations and research, in particular to establish biodiversity monitoring systems which include the monitoring of biodiversity's influence on climate change, as well as the improvement of preventive conservation measures.

5. SCOPE OF THE PROJECT

This project is proposed to control the pollution that is caused due to the industries or factories. If the air pollution done by the machineries at the factories go beyond some predefined limit then machineries will be made to shut down automatically. This kind of system can be very useful for the government authorities to control the air pollution caused due to the industries or factories.

So to save the mankind and the earth this kind of system can prove to be very useful. The system is proposed in such a way that once the level of pollution increases beyond some limit in the industry or factory, the machines will be made to shut down automatically.

6. WORKING PRINCIPLE

The system proposed over here comprises of the microcontroller AT89S52, carbon dioxide sensor and relay. As the carbon dioxide content in the air goes beyond some predefined limit then the microcontroller will automatically put OFF the machine causing the pollution or electricity supply will be cut-off for the machine in the industry or factory.

The carbon dioxide sensor has been interfaced with the microcontroller. It is used to monitor the amount of carbon dioxide in the air. It is digital in nature. So it has been set to some predefined threshold value. If the content of the carbon dioxide in the atmosphere exceeds that predefined value then microcontroller will turn ON the relay to switch OFF the machines causing pollution. The electricity supply will be pulled OFF so the machines will not be started again by the administrator of the factory.

6.1 Components

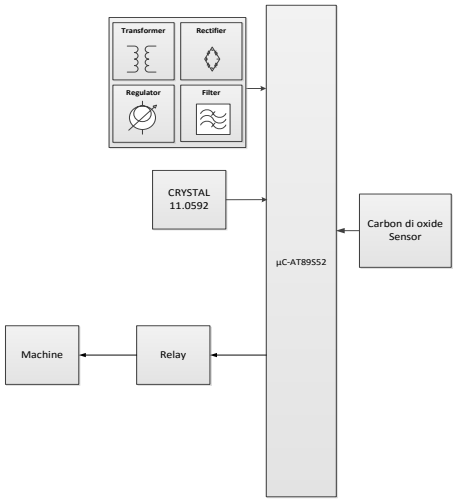
6.1.1 Hardware used

- Microcontroller: AT89S52
- Power supply
- Carbon di Oxide sensor
- Relay unit
- Fabrication Parts
- Piezo buzzer
- Fire sensor

6.1.2 Software used

- Embedded C
- KEIL IDE
- Willar Programmer

6.2 Block Diagram



7. DESIGN

7.1 Microcontroller

- Requires low power
- Gives high performance
- Compatible
- Cost effective
- Highly flexible
- Efficient

7.2 Gas Sensor

- High sensitivity to LPG,Natural gas and Town gas
- Small sensitivity to alcohol and smoke
- Fast response
- Stable and long life
- Simple drive circuit

7.3 Fire Sensor

- Allows your circuit to detect flames from upto 1m away
- Typical maximum range : 1m
- Calibration preset for range adjustment
- Indicator LED with 3 pins easy interface connector
- Input voltage +5V DC

7.4 Power Supply

- Output current in excess of 0.5A
- No external components
- Internal thermal overload protection
- Internal short circuit current-limiting
- Output transistor safe area compensation
- Available in TO-220, TO-39 and TO-252 PAK packages
- Output voltage of 5V,12V and 15V

7.5 Piezo Buzzer

- A piezo buzzer is driven by square waves
- The current is stably consumed under the regular operation. However it normally takes 3 times of current at the moment of starting to work
- A buzzer can sound on any frequencies
- Works well between -30C to 70C

8. FABRICATION

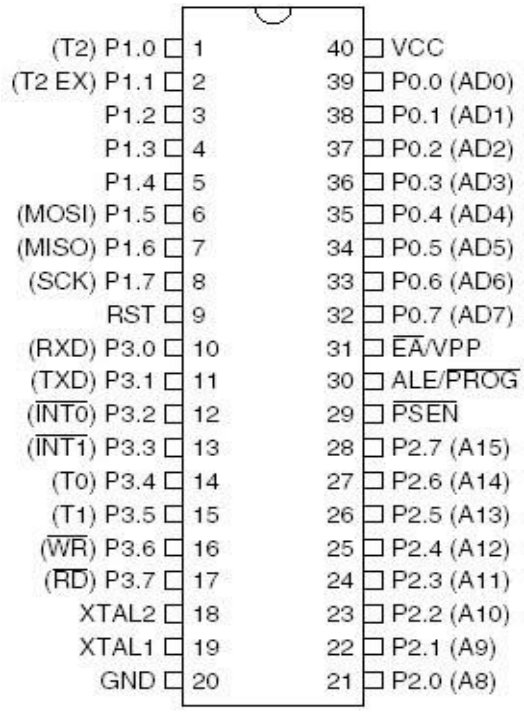
8.1 Microcontroller

8.1.1 Description of Microcontroller

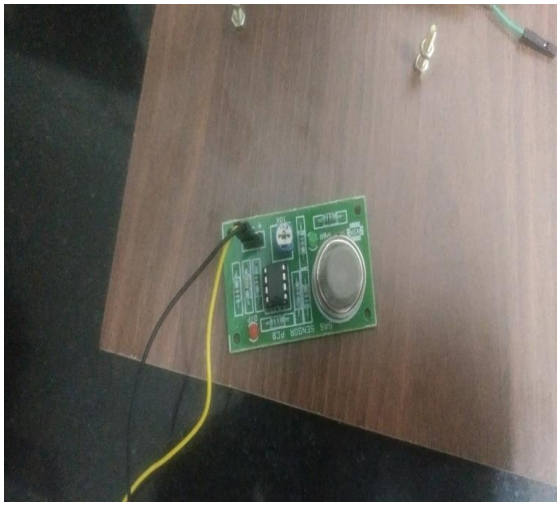
- The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory.
- The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout.
- The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.
- By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.
- The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM,

32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry.

8.1.2 Pin Configuration



8.2 Carbon Di Oxide Sensor



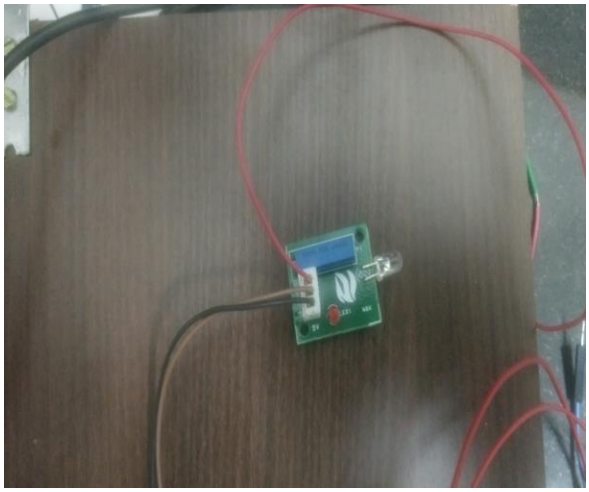
8.2.1 Description of Carbon Di Oxide Sensor

- A carbon dioxide sensor or CO2 sensor is an instrument for the measurement of carbon dioxide gas.
- The most common principles for CO2 sensors are infrared gas sensors (NDIR) and chemical gas sensors.
- Measuring carbon dioxide is important in monitoring indoor air quality.

8.2.2 Chemical CO_2 Sensors

- The basic principle of chemical based carbon dioxide sensors is based on the measurement of the pH change of the electrolyte solution caused by the hydrolysis of the CO_2.
- The sensor consist of a pair of electrodes, an oxide electrode and a reference electrode, bicarbonate based internal electrolyte solution, a gas permeable membrane at the bottom of the sensor.
- The CO_2 molecules present in the solution diffuse through this gas permeable membrane and enter into the internal electrolyte solution.
- Here the carbon dioxide molecules react with the water and form carbonic acid, which again breaks into bicarbonate and proton ions.
- $CO_2(aq) + H_2O \rightarrow H_2CO_3 + HCO_3^- + H+$

8.3 Fire Sensor

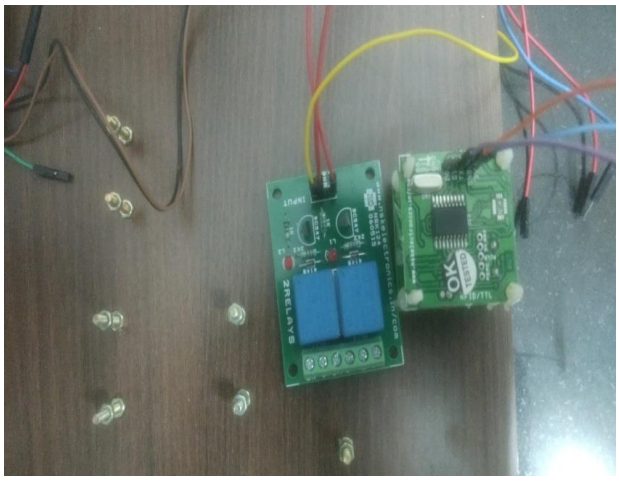


8.3.1 Description of Fire Sensor

- This fire sensor circuit exploits the temperature sensing property of an ordinary signal diode IN 34 to detect heat from fire. At the moment it senses heat, a loud alarm simulating that of Fire brigade will be produced. The circuit is too sensitive and can detect a rise in temperature of 10 degree or more in its vicinity. Ordinary signal diodes like IN 34 and OA 71 exhibits this property and the internal resistance of these devices will decrease when temperature rises.

- The fire sensor circuit is too sensitive and can detect a rise in temperature of 10 degree or more in its vicinity. Ordinary signal diodes like IN 34 and OA 71 exhibits this property and the internal resistance of these devices will decrease when temperature rises. In the reverse biased mode, this effect will be more significant. Typically the diode can generate around 600 milli volts at 5 degree centigrade. For each degree rise in temperature; the diode generates 2 mV output voltage. That is at 5 degree it is 10 mV and when the temperature rises to 50 degree, the diode will give 100 milli volts. This voltage is used to trigger the remaining circuit. Transistor T1 is a temperature controlled switch and its base voltage depends on the voltage from the diode and from VR and R1. Normally T1 conducts (due to the voltage set by VR) and LED glows. This indicates normal temperature.
- When T1 conducts, base pf T2 will be grounded and it remains off to inhibit the Alarm generator. IC UM 3561 is used in the circuit to give a Fire force siren. This ROM IC has an internal oscillator and can generate different tones based on its pin connections. Here pin 6 is shorted with the Vcc pin 5 to get a fire force siren. When the temperature near the diode increases above 50 degree, it conducts and ground the base of T1. This makes T1 off and T2 on. Alarm generator then gets current from the emitter of T2 which is regulated by ZD to 3.1 volt and buffered by C1.Resistor R4 (220K) determines the frequency of oscillation and the value 220K is a must for correct tone. To set the fire sensor circuit, keep a lighted candle near the diode and wait for 1 minute. Slowly adjust VR till the alarm sounds. Remove the heat .After one minute, alarm will turns off. VR can be used for further adjustments for particular temperature levels.

8.4 Relay



8.4.1 Description of Relays

- A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current.
- The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it).
- You can think of a relay as a kind of electric lever: switch it on with a tiny current and it switches on ("leverages") another appliance using a much bigger current.
- But often we need them to drive bigger pieces of apparatus that use bigger currents.
- Relays bridge the gap, making it possible for small currents to activate larger ones. That means relays can work either as switches (turning things on and off) or as amplifiers (converting small currents into larger ones).

9. ADVANTAGES, DISADVANTAGES & APPLICATIONS

- Automatic environment monitoring
- Easy to use
- Handy and smaller in size

9.1 Disadvantages

- Consumes heavy power
- Need a steady hand to use

9.2 Applications

- Industrial Use
- Domestic Use

CONCLUSION

As mentioned above we have prepared the design and fabrication of automatic pollution control system. From this we are expecting that we could control the pollution by monitoring the carbon dioxide level released from the industries or machines.

So our future work is to implement this fabricated model in practical environment where the pollution needs to be controlled in domestic as well as industrial areas.

REFERANCES

[1]. Richard S.J. Tol , On the optimal control of carbon dioxide emissions: an application of FUND, October 1997, Volume 2, Issue 3, pp 151–163.

[2]. Charles D. Keeling PhD, Industrial production of carbon dioxide from fossil fuels and limestone, Volume 25, 1973 - Issue 2.

[3]. Ernst Worrell, , Lynn Price, Nathan Martin, Energy efficiency and carbon dioxide emissions reduction opportunities in the US iron and steel sector, Volume 26, Issue 5, May 2001, Pages 513–536.

[4]. Dr. Elsje Alessandra Quadrelli, Prof. Gabriele Centi, Dr. Jean-Luc Duplan, Prof. Siglinda Perathoner, Carbon Dioxide Recycling: Emerging Large-Scale Technologies with Industrial Potential, Volume 4, Issue 9 September 19, 2011 Pages 1194–1215.

[5]. L Pricea, , , J Sintona, E Worrella, D Phylipsenb, H Xiulianc, L Jid, Energy use and carbon dioxide emissions from steel production in China, Volume 27, Issue 5, May 2002, Pages 429–446.

[6]. Gregg Marland, Ralph M. Rotty, Carbon dioxide emissions from fossil fuels: a procedure for estimation and results for 1950–1982, Volume 36B, Issue 4, September 1984, Pages 232–261.

[7]. http://www.wrfound.org.uk/articles.html

[8]. http://www.haat-india.com

[9]. http://www.nikaengg.com.html

[10]. http://www.igniss.pl/en/

[11]. https://www.nap.edu

[12]. http://www.greenpeace.org/international/en/campaigns

[13]. https://en.wikipedia.org

[14]. Library of IISM, JSS College, Mysore

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
Category: Mechanical

PNEUMATIC POWERED EXO SKELETON SUIT

VINOD Y B G[1], PYNROILANG KHYRIM G[2],NAVEEN KUMAR D[3], Dr. V.VIJENDRAKUMAR[4], Dr. K.S BADRINARAYAN[5]

[1]Student, department of mechanical engineering,vinodbhooti@gmail.com
[2]Student, department of mechanical engineering,roykean1990@gmail.com
[3]Professor, Department of mechanical engineering, M S Engineering College, dnaveenmech@gmail.com
[4]Professor and H.O.D, Department of mechanical engineering, M S Engineering College, vijendravk@gmail.com
[5]Professor and Principal, M S Engineering College, principal@msec.ac.in

ABSTRACT

The excelsior's prototype is a fully functional wearable exoskeleton arm that moves in sync with the operator's motion within 3 DOFs. Thanks to this device the user will no longer feel any fatigue in carrying heavy loads for long time period. Recyclable, light and enduring materials are used in this project in order to fulfill safety and environmental concern. Pnuematic muscles are placed cloning the human anatomy to provide absolute synchronization with ordinary human motion. Biceps triceps and deltoids are assisted by the device and limited according to their allowable angels of motion. The exoskeleton arm can specifically be used in physiotherapeutic treatment and to aid people with difficulties in mobility and also in the heavy industries.

1. INTRODUCTION

As human beings, we constantly use our bones and muscles to accomplish everyday tasks. To some, using their muscles is strictly for accomplishing necessary task. In some situation it is not possible to lift load about 100kg,in that situation we can use wearable exoskeleton. A powered exoskeleton (also known as powered armor, exoframe hardsuit, exosuit)is wearable mobile machine that is powered by a system of electric motors, pneumatic ,levers, hydraulics,or a combination of technologies that allow for limb movement with increased strength and endurance. Our project pneumatically powered exoskeleton by using compressed air actuates pneumatic cylinders. We can lift up to 100kg of weight but our design is only 40kg.it is simple in construction and cheaper cost..

2. OBJECTIVE

The product in general will allow users to lift weights outstanding the human ability. The exoskeleton arm can specifically be used in physiotherapeutic treatment and to aid those who have difficulties in mobility. Other useful uses are:-

1. Rescue mission
2. Heavy maintenance procedures.
3. Limited army applications.

3. SCOPE OF OUR PROJECT

In this present competitive world there is huge scarcity of man power, so there must be an alternative to reduce this problem. Even in industrial application it requires more human resources for daily work and load carrying process is more. All these above work can not done humans.

To overcome this situation pneumatic exo skeleton system is adopted to ease the work and minimise stress of humans. It also helps people who are physically disabled.

3. METHODOLOGY

Excelsior 's exoskeleton suit also known as powered exoskeleton exoframe,or exosuit,is a mobile

machine consisting primarily of an outer framework worn by a person, and a powered system of pneumatic artificial muscles (fluidic muscles) that delivers at least part of the energy for limb movement. Thanks to this device the user will longer feel any fatigue in carrying heavy load (up to 100kg) for long periods of time.recyclable,light and enduring materials and used in this project in order to fulfil safety and environmental concerns.

The main function of the exoskeleton suit is to assist the wearer by boosting their strength and endurance and durability. They are commonly designed for military use, to help soldiers carry loads both in and out combat. In civilian areas, similar exoskeleton could be used to help fire fighter and other rescuer workers survive dangerous environments. The medical field is another prime area for exoskeleton technology, where it can be used for enhanced precision during surgery or as an assist to allow nurses to move heavy patients.

Moving to the technical part, The exoskeleton suit structure is made mainly from a combination of steel and alluminium.The power system is delivered to set of fluidic muscles. In this prototype, 30mm diameter,230mm stroke length with radial, It can handle up to 100kg we can lift but our design is up to 40kg of load can lift. It consists of 4 cylinders operated by pneumatic pressure.

3. WORKING AND FABRICATION

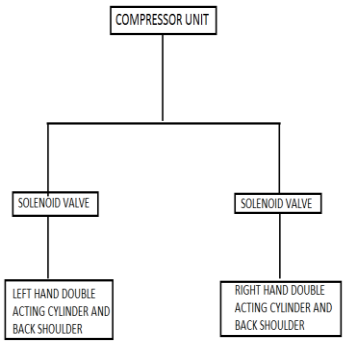


Fig: Block diagram of exo skeleton

The important parts of pneumatic exo-skeleton suit are:-

1. Compressor unit
2. Solenoid valve (direction control valve)
3. Double acting cylinders

1**. Compressor unit:-** It is one of the important part of exoskeleton suit. The capacity of compressor is 8-12 bars. It provides the necessary pressurized air required to operate the system. Our compressor has ability to lift up to 40-45 kgs load.

2**. Solenoid valve (direction control valve):-** It is used to control the direction of the pressurized air in this pneumatic system using 5/2 direction control valve. It requires two valves.

3. Double acting cylinders:- These cylinders are actuated by compressed air which can lift the load. This project requires four cylinders for operation (230mm stroke length).

3.1 Specifications

1. Compressor: 8-10 bars
2. Solenoid valve:

Quantity: 2
Type: 5/2
Outer diameter: 40mm
Inner diameter: 30mm
Stroke length : 230mm

Fig. Double acting cylinders

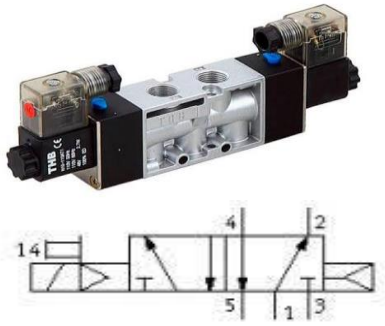


Fig. Solenoid valve

4. RESULT

This pneumatic powered exo skeleton gives quick response to human action and flexible

compared to hydraulic and electrical type exo skeleton. Our project designing is to lift load up to 40-50kgs and testing is in process.

5. CONCLUSION

The idea behind this project is to develop an inexpensive and user friendly system.This project shows that it is simple in construction, design and cheaper. It gives quick response and flexible compared to hydraulic and electrical type exo skeleton. This can be achieved while maintaining simplicity, ease of use, implementation and maintenance.

Our project is not only used to lifts weights but also is applicable in rescue operations, military, industries. It makes physically disabled people to carry weights in their daily life because the maximum load is carried by this pneumatic system.

6. REFRENCES

[1]. Gregory clark Henderson “pneumatically powered robotic exo skeleton”.(2012)
[2]. Alexansari,Christopher.g.atkeson,howiechoset,Mathew travers.
[3]. Yagin,Nicolas. “apparatus for facilitating walkng”(1890)
[4]. Vukobravic,miomir. “generation of exo skeleton”
[5]. Raytheon. “stronger second generation exo skeleton suit”
[6]. Joseph,antony. “robotic rex suit”(2013).

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

STUDIES ON MECHANICAL PROPERTIES OF E-GLASS FIBRE REINFORCED EPOXY COMPOSITES

ADIL AHMED S[1], PUNAR GOWDA G[2], RANJTH KUMAR B S[3], SANTHOSH GOWDA C D[4], SATHISH[5] DR.VIJENDRA KUMAR V[6], DR.BADRINARAYANA K S[7]

[1] Associate prof. Department of Mechanical Engineering, MSEC,Bengaluru,India, adilahmeds786@gmail.com

[2, 3, 4, 5] UG Student Department of Mechanical Engineering, MSEC,Bengaluru,India

[6] Professor& HOD, Department of Mechanical engineering,MSEC,Bengaluru,India,vijendravk@gmail.com

[7]Principal, MSEC, Bengaluru, India, bakesu@yahoo.co.in

ABSTRACT

Hybrid materials of any class are essential for current demands. This paper deals with the Hybrid effect of composites made of E-glass fibers which are fabricated by hand layup method using LY556 Epoxy resin and HY951 hardener. The properties of this Hybrid composite are determined by testing like Tensile, Bending and Hardness tests which are evaluated experimentally according to ASTM standards. The result of the test shows that hybrid composite of E-glass fiber has far better properties than that of Jute fiber composite.

I. INTRODUCTION

In today's scenario, the main disadvantage with existing mechanical components are of heavy weights which are indirectly affecting the efficiency of the machine. Hence the use of composite material is preferred.

Composite Materials : Composites are the materials made of two or more constituent materials with significantly different physical or chemical properties that, when combined produce a material with characteristics different from the individual composites. Typically engineered composite materials include [1] Natural composites [2] Metal Composites [3] Ceramic composites [4] Fiber-Reinforced Polymer composites

E-Glass : The electrical grade glass was originally developed for stand-off insulators for electrical wiring. It was later found to have excellent fiber forming capabilities and is now used almost exclusively as the reinforcing phase in the material commonly known as fiberglass. It is a material consisting of numerous strands of extremely fine fibers of glass. And has roughly comparable mechanical properties to other fibers such as polymer and carbon fiber. Although not as strong or as rigid as carbon fiber. It is much cheaper and significantly less brittle when used in composites. Glass fibers are therefore used as a reinforcing agent for many polymer products to form a very strong and relative lightweight fiber-reinforced polymer(FRP) composite material called Glass-reinforced polymer(GRP) also popularly known as fiberglass.

II. OBJECTIVES

1. To study the mechanical behavior of E-glass reinforced with epoxy composite material.
2. To reduce the overall weight of the component and to improve its load bearing capacity.
3. Preparing a composite which may find applications as structural material where

higher strength and cost considerations are important.

4. Hybridization of E-glass with Epoxy results in composites having a superior mechanical performance.
5. Preparing a light weight, strong and robust material with excellent properties for use in different industrial applications.

III. COMPOSITION

E-glass is a low alkali glass with a typical nominal composition of SiO2 54%wt, Al2O3 14%wt, CaO+MgO 22%wt, b2O3 10%wt and Na2O+K2O less than 2%wt. Some other materials may also be present at impurity levels.

IV.MATERIAL PROPERTIES

Properties that have made E-glass so popular in fiberglass and other glass fiber reinforced composite include:-

1. Low cost.
2. High production rates.
3. High strength.
4. High stiffness.
5. Relatively low density.
6. Non-flammable.
7. Resistant to heat.
8. Good chemical resistance.
9. Relatively insensitive to moisture.
10. Good electrical insulation.
11. Able to maintain strength properties over a wide range of conditions.

V. METHODOLOGY

The moulding experience of thousands of applications past 5 decades has enabled to develop a number of standard reinforcement additives combinations that are used for most of production needs. Most of the parts are made by compression moulding, contact moulding (Hand layup), Vaccum bag moulding and Filament moulding among these techniques. Hand layup technique is preferred for the current work because this method does not requires high end machinery. Hand layup refers to the manual method of laying or applying the reinforcement material into the mould. In the hand layup process, the reinforcement material is placed in the mould and then saturated with polyester resin using a brush or a two-component spray system.

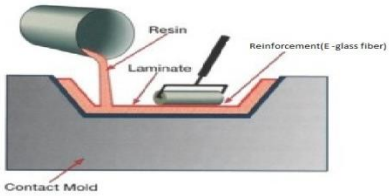


Fig 1 : Hand layup process

Fig 2 : Layed-up specimen

Steps Involved

1.	Procurement of raw materials
2.	Preparing E-glass fiber to standard size of 300 square millimetre .
3.	Mixing the Epoxy and Hardener in ratio 10:1
4.	Using wet Hand layup technique for the fabrication of material.
5.	Conduction of tests using Universal testing machine.

VI.MATERIAL SPECIFICATIONS FOR TESTING

1.Tensile test specimen

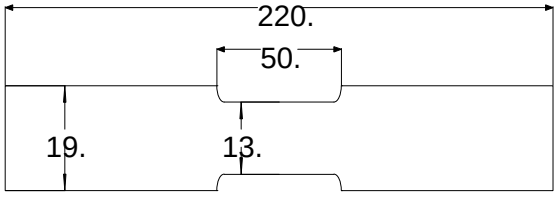


Fig 3 : 2D representation

Fig 4 : Tensile specimen

The tensile test is done by cutting the composite as per ASTM: D638 standard (sample dimension is 216x19x3mm). A universal testing machine (UTM) is used for testing with a maximum load rating of 100 KN.

2.Bending test specimen

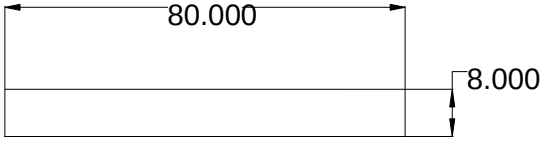


Fig 5 : 2D representation

Fig 6 : Bending test specimen

The flexural test is done in a three-point flexural setup as per ASTM: D790 standard (sample dimension is 80x8x3 mm). when a load is applied at the middle of the specimen, it becomes bends and fractures.

3.Hardness test specimen

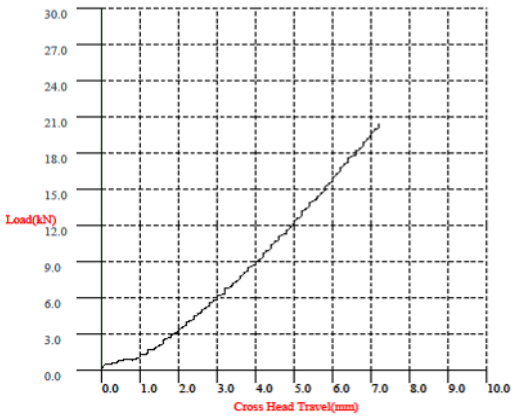
The hardness test is done on a sample of the specimen using Micro Vickers Hardness tester.

VII.RESULTS

1.Tensile test results

Yield stress acheieved : 243.68 N/mm2

Sample	Total elongation (%)	Tensile strength (N/mm2)	Breaking Load (kN)
1	0.80	268.79	20.36
2	0.96	252.36	19.76



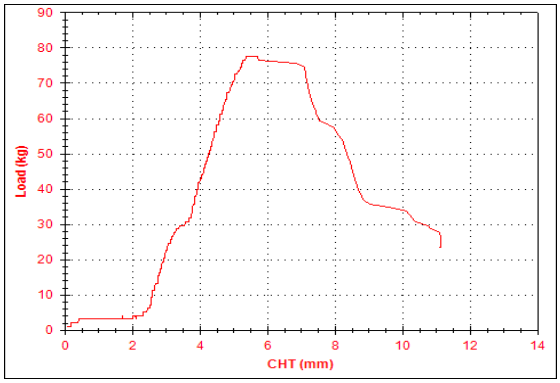
Graph

2.Bending test results

Sample 1 : E glass epoxy

Load at Peak : 77.502 kg

Component strength : 1.263 kg/mm2

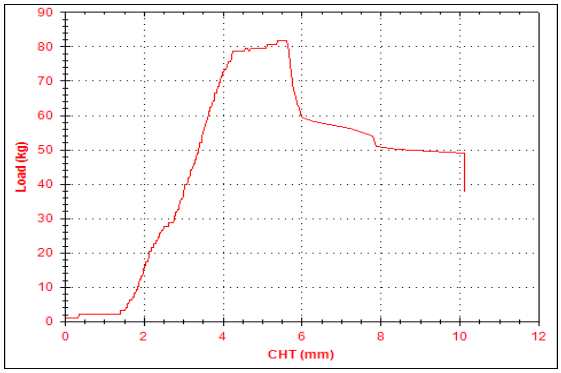


Sample 1 graph

Sample 2 : E glass epoxy

Load at Peak : 81.581 kg

Component strength : 1.390 kg/mm2



Sample 2 graph

3.Hardness Test results

Hardness HV 0.1

1	21
2	20
3	20

AVERAGE=20 HV 0.1

CONCLUSION

In this work the preparation of Glass fiber reinforcement polymer with hand layup technique is carried from the preparation of E-glass epoxy composite, it is shown that the glass fiber either commercial or prototypal are characterized by very similar mechanical properties in terms of tensile modulus and strength comparable to different types of fibers. Tests have been conducted in UTM.

REFERENCES

[1]. SusilB.Chopade, International Journal of Innovative research in Science, Engineering and technology Vol. 4, Issue 1 , January 2015.

[2]. Zhixiong Wu , Jingwen Li , 25th International Cryogenic Engineering conference and the international cryogenic material conference in 2014,ICEC 25-ICME 2014.

[3]. M R Sanjay , B Yogesha , Journal of mineral and materials characterization and engineering , 2016, 4, 15-25 published online January 2016 in SciRes.

[4]. Sudhir S Mathapati , Shivakumar S Mathapati, International Journal of research and innovation inscience and technology , January 2015.

[5]. K Devendra , T Rangaswamy , Journal of mineral and material characterization and engineering , 2013, 1,353-357 published online November 2013.

[6]. Mohammed Abdulqader Jalil Alsalihi ,University of Wisconsin Milwaukee UWM digital commons December 2014.

[7]. Mahmood M ,Shokreih , DavoodRezaei , Composites research laboratory , Iran university of science and technology , Narmik,Tehran 16844.

[8]. Rajendran S , Vijayarangan , PSG college of technology , Caimbotore-641004,India , received 13 august 1999; accepted 16 july 2000.

[9]. Sultan Erdemligunaslan , Abdulhalim Karasin , IJISET , Vol 1 Issue 9, November 2014.

[10]. PatilDeogonda, Vijaykumar N Chawla, International journal of scientific engineering and research , Vol 1 Issue 4 , December 2013.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in ISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

Category: Mechanical

DESIGN AND ANALYSIS OF SINGLE POINT CUTTING TOOL

PRASHANTH B[1] HARSHA S[1] NAGESH R[2] Dr.K S BADARINARAYAN[1]

[1]Department Mechanical Engineering, M.S.E.C, Bengaluru, Karnataka

[2]Department Mechanical Engineering, SVCE, Bengaluru, Karnataka

prashicena@gmail.com

ABSTRACT

Design of tool is an important aspect of tool engineering. In today's never ending competition to produce component at the cheapest cost, small and medium scale manufacturers. Hence a lot of emphasis is given to cycle time optimization. Usual component meant for manufacturing consists of outer diameter and a inner diameter to present in basic manner. And will require a minimum of 2 tools to machine the same. By the tool which we intend to make we want to minimize it to one tool. Machining processes involves analyzing the chip formation process. Years of research has conclusively shown that it a process involving plastic deformation in which large strains and strain rates are developed by localized shear deformation of work material immediately ahead of tool. Heat generated during the chip formation process as a result of plastic deformation and friction. The heat influences chip shape, tool wear, surface finish and cutting forces. The forces acting on the tool are an important aspect of machining. The knowledge of force is required for determination of power and also to design the various elements of machine tool, tool holders and fixtures. Here we used CATIA software for designing 3D model of single headed cutting tool and ANSYS 15 for structural analysis like Maximum deflection and maximum stress on the tool. Analytical method of calculating the deflection and von mises equivalent stress is also done.

1. INTRODUCTION

Cutting tool or cutter is any tool that is used to remove material from the work piece by means of shear deformation. An increase in productivity requires involvement of all production operations, technical possibility for full use or activation of all the available manufacturing facilities. In order to involve all the technological operations, optimum technological processes, optimum tool selection, suitable combination of tool-work piece material and determination of optimum cutting variables and tool geometry must be considered. Cutting tools have been used in metal machine shops since the late 19th century and manufacturers are continuing to evolve these mechanisms to become more efficient within the industry. What started off as tools that were tedious and strenuous to use, now have advanced themselves to high tech instruments that can be found in every tool box and machine shop. Cutting tools become into contact with the raw material, cutes, removes debris and chips from the material and helps to create the end piece. Cutting tools started off as tools made from high carbon steel, to high speed steel, cobalt, carbide and even diamond and ceramic.

Cutting may be accomplished by single point or multi point tools. Single point tools are used in turning shaping planning and similar operations and remove material by means of one cutting edge. Milling and drilling tools are often multipoint tool. Grinding tools are also multi point tools, each grain of abrasive function has a microscopic single point cutting edge and shears a tiny chip.

CUTTING TOOL MATERIALS

Cutting tools must be made of a material harder than the material which is to be cut and the tool

must be able to withstand the heat generated in the metal cutting process. Also the tool must have a specific geometry with clearance angles designed so that the cutting edge can contact the work piece without the rest of the tool dragging on the work piece surface. The angle of cutting face is also important as is the flute width, number of flutes, teeth and margin size. In order to have a long working life all of the above must be optimized, plus the speeds and feeds at which the tool is run.

Some of the parameters of a material that is to be considered while selecting the cutting tool material: the work holding support,

The starting and finished part shape,

The work piece hardness ,

The material's tensile strength,

The material's abrasiveness.

Different machining applications require different cutting tool materials. The ideal cutting tool material should have all of the following characteristics:

- Harder than the work it is cutting
- High temperature stability
- Resists wear and thermal shock
- Impact resistant
- Chemically inert to the work material and cutting fluid.

There are many types of cutting process done in different conditions. In such conditions along with the general requirements of the cutting tool, they need some unique properties. To achieve this properties the cutting tools are made up of different material. The material chosen for a particular application depends on the material to be machined, type of machining, quantity and quality of production.

According to the material used the tools are classified into

Carbon tool steel

High speed steel tool (HSS)

Cemented carbide

Ceramics tool

Cubic boron nitride Tool (CBN)

Diamond tool

CARBON TOOL STEEL

Carbon tool steel is an inexpensive cutting tool used for the low-speed machining operation. These plain carbon steels have the composition of 0.6-1.5% carbon and very small amount of (less than 0.5 %) Mn, Si. Other metal like Cr, V are added to change the hardness and grain size. High carbon steels are abrasion resistant and have the ability to maintain sharp cutting edge. Carbon tool steels possess good machinability. This material loses their hardness rapidly at a temperature about 250°C. Therefore, it can't use high-temperature application. It does not prefer in a modern machining operation.

Carbon steel tool is used in twist drills, milling cutters, turning and forming tools, used for soft material such as brass, aluminum magnesium, etc.

Temperature - 450°C

Hardness – up to HRC 65.

HIGH SPEED STEEL

This is a high carbon steel with a significant amount of alloying element, such as tungsten, molybdenum, chromium, etc. to improve hardenability, toughness and wear resistance. It gives a higher metal removal rate. It loses its hardness at a moderate temperature about 650°C. Therefore, a coolant should be used to increase tool life. It can use many times by re-sharpening. Some surface treatment is done on the HSS to improve its property.

Surface treatment used in the HSS

Super finishing - Reduce friction

Chromium electroplating - Reduce friction

Oxidation - Reduce friction

High-speed steel tools are used in drills, milling cutters, single point lathe tools, broaches.

Cutting speed range - 30-50 m/min

Fig 1: High speed steel tool

CEMENTED CARBIDE TOOL AND CERMET

The carbide tools are produced by powder metallurgy technique. It consists of tungsten, tantalum and titanium carbide with cobalt as a binder (when the binder is nickel or molybdenum, then it is called cermet). Cemented carbide tools are extremely hard; they can withstand very high-speed cutting operation. Carbide tool does not lose their hardness up to 1000° C. A high cobalt tool is used for a rough cut while low cobalt tool used for finishing operations.

Cutting speed range - 60-200m/min

Temperature - 1000°C

Hardness – up to HRC 90

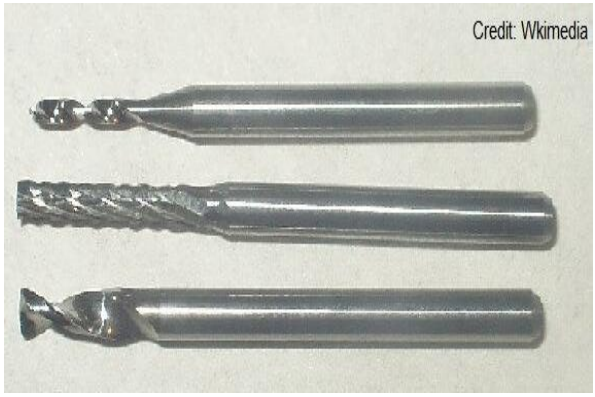


Fig 2: Carbide tools.

CERAMICS

Most common ceramic materials are aluminum oxide and silicon nitride. Powder of ceramic material Compacted in insert shape, then sintered at high temperature. Ceramic tools are chemically inert and possess resistance to corrosion. They have high compressive strength. They are stable up to temperature 1800°C. They are ten times faster than HSS. The friction between the tool face and chip are very low and possess low heat conductivity, usually no coolant is required. They provide the very excellent surface finish.

Cutting speed 300-600m/min

Temperature - 1200°C**,** Hardness – up to HRC 93.

DIAMOND

It is the hardest material known and it is also expensive. It possesses very high thermal conductivity and melting point. Diamond offers excellent abrasion resistance, low friction coefficient and low thermal expansion. It is used in machining very hard material such as carbides, nitrides, glass, etc. Diamond tools give a good surface finish and dimensional accuracy. They are not recommended for machining steel.

Fig 3: Glass cutting tool.

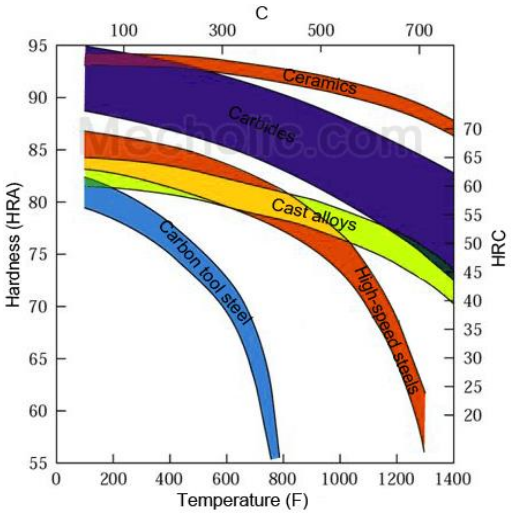


Fig 4: Hot hardness of cutting tool materials.

CUTTING TOOLS WITH INSERTS

Cutting tools are often design with inserts or replaceable tips. In these the cutting edge consist of a separate piece of materials either brazed, welded or clamped on the too body. Common materials for tips includes cemented carbide, polycrystalline diamond and cubic boron nitride.

Cutting tools include tool bits and broaches. Rotary cutting tool included drills bits, counter sink, and counter bores, taps and dies, milling cutters, reamers and cold saw blades.

Fig 5: Different types of inserts.

INSERT SHAPE

Turning inserts are manufactured in a variety of shapes, sizes and thicknesses. The shape can be round to maximize edge strength, diamond-shaped to allow a sharp point to cut fine features, square, or even octagonal to increase the number of separate edges that can be applied as one edge after another wears out.

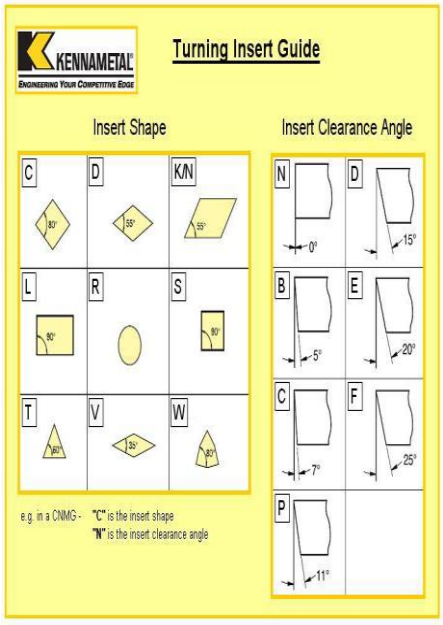


Fig 6: Inserts guide.

C and W type turning inserts are often used for rough machining due to their larger point angle, which makes them more rigid. Inserts with a smaller point angle, such as D and V, are often used for finish machining. Although they have less strength, the smaller angle can reach more part details.

Large point angle:

Stronger cutting edge

Higher feed rates

Increased cutting forces

Increased vibration

Small point angle:

Weaker cutting edge

Increased access to part details and Decreased cutting forces .

INSERT MATERIALS

Insert material is typically carbide, though ceramic, cermet or diamond inserts can be applied to more demanding applications. A variety of protective coatings also help these insert materials cut faster and last longer.

Insert Material	Characteristics
Cemented carbide (HW, HC) HW: Uncoated HC: Coated	The most common material used in the industry today. It is offered in several "grades" containing different proportions of tungsten carbide and binder (usually cobalt). High resistance to abrasion.
Cermets (HT, HC) Cermet containing primarily titanium carbides (TiC) or titanium nitrides (TiN) or both HT: Uncoated HC: Coated	Another cemented material, based on titanium carbide (TiC). Binder is usually nickel. It provides higher abrasion resistance compared to tungsten carbide at the expense of some toughness. Extremely high resistance to abrasion.
Ceramics (CA, CM, CN, CC) CA Oxide ceramics containing primarily aluminum oxide (Al2O3) CM Mixed ceramics containing primarily aluminum oxide (Al2O3) but containing components other than oxides CN Nitride ceramics containing primarily silicon nitride (Si3N4) CC Nitride ceramics containing primarily silicon nitride (Si3N4), but coated	Chemically inert and extremely resistant to heat, ceramics are usually desirable in high speed applications, the only drawback being their high fragility. The most common ceramic materials are based on alumina (aluminium oxide), silicon nitride and silicon carbide

TOOL HOLDERS

It is essential that the insert be supported in a strong, rigid manner to minimize deflection and possible vibration. Consequently, turning tools are supported in various types of heavy, forged steel tool holders.

TOOL OPERATIONS

TURNING:

Turning is a machining process in which a cutting tool, typically a non-rotary tool bit, describes a helix tool path by moving more or less linearly while the work piece rotates. The tool's axes of movement may be literally a straight line, or they may be along some set of curves or angles, but they are essentially linear (in the non mathematical sense). Usually the term "turning" is reserved for the generation of external surfaces by this cutting action.

Turning can be done manually, in a traditional form of lathe, which frequently requires continuous supervision by the operator, or by using an automated lathe which does not. Today the most common type of such automation is computer numerical control, better known as CNC. (CNC is also commonly used with many other types of machining besides turning.).

Fig 7: turning operation.

FACING

In machining, facing is the act of cutting a face, which is a planar surface, onto the workpiece. Within this broadest sense there are various specific types of facing, with the two most common being facing in the course of turning and boring work (facing planes perpendicular to the rotating axis of the workpiece) and facing in the course of milling work (for example, face milling). Other types of machining also cut faces (for example, planing, shaping, and grinding), although the term "facing" may not always be employed there.

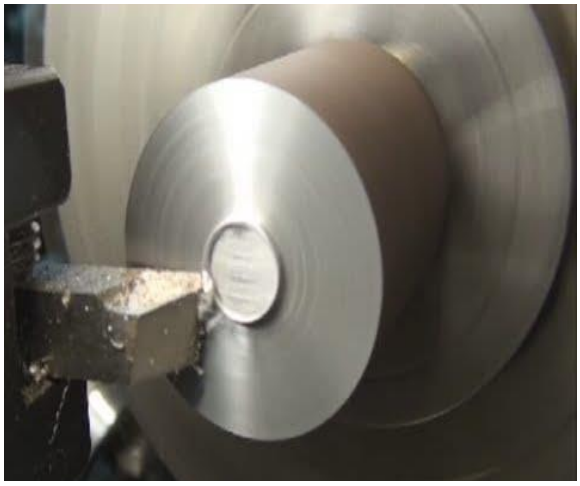


Fig 8: facing operation.

LITERATURE SURVEY

From journal “International Journal of Innovative Research in Advanced Engineering” by Maheshwari N Patil and Shreepad Sarange we got to know about the effect of von mises stress and depth of cut on the cutting tool.

In this paper, an advanced FEM simulation technique is utilized to investigate the physical cutting process for predicting von mises stresses and deformation of tip of single point cutting tool. There has been a great deal of research on single point cutting tool analysis and large body of literature on single point cutting tool has been published. FEM based simulation of machining processes has been providing a better understanding for heat generation in cutting zones, and resulting stress and temperature fields. The premise of the numerical models is to be able to lead predictions in machinability, tool wear, tool failure, and surface integrity on the machined surfaces. Success and reliability of numerical models is basically dependent upon work material flow stress models in function of strain, strain rate and temperatures, also on friction parameters between the tool and work material interfaces. There has been a considerable amount of research devoted to analyze the effect of machining variables such as speed, depth of cut,

temperature, and cutting forces on the tool by using modeling and analysis software ANSYS.

SL NO	PARAMETER	VALUES
1	BACK RAKE ANGLE	8 DEGREE
2	SIDE RAKE ANGLE	10 DEGREE
3	SIDE RELIEF ANGLE	7-9 DEGREE
4	END RELIEF ANGLE	6-8 DEGREE
5	TOOL LENGTH DEPENDING ON CS	100 TO 500mm
6	NOSE RADIUS	1.2 TO 1.6 mm

Finite Element Analysis of Single Point Cutting Tool by Using ANSYS

1) At this the model is designed in Master Modeler. First, half the framework is created and then it is completed using Revolve command. Then the tool piece is made on the work piece. Then the cross section command is used followed by Build section command. Then both the parts are extruded using the Extrude command, then we put away the parts to bin using Filter and Fictroxity section command. Then only frame work is then kept and surface by boundary command is used. After that the Join command is used to join the parts perfectly.

2) Now we come to Boundary conditions and use Create FEA Model command to name the existing part as a new part.

3) Now we go to meshing and apply the command Define Shell Mesh, then we use the Mesh Preview icon and use the keep mesh icon to form mesh. Now we return to boundary Condition and select the end of the work piece. Then we specify the Restraint and keep the x-direction as free. After then we create sets end apply force in x, y, & z direction respectively in a combined manner. Then we also apply temperature at three different areas namely Chip-Tool interface, Tip of tool and on the work piece. Then we go to boundary condition and turn on Restraint set command and temperature set-1 which we have created earlier.

4) Now we go to model solution for creating a solution set of the model and then it is solved using the Solve icon.

5) Lastly we entered in Post Processing and use the Display command and select the Stress condition to get required Result. Then it can be utilized and animated to get desired combinations. Also we can use the select Result icons to obtain various combinations of this model.

CONCLUSION FROM THE PAPER

1)It is observed that as depth of cut increases, the von-mises stresses developed in the tool increases which are the main reason of tool failure.

2) From the experimental set up, it is clear observed that as depth of cut increases, the temperature generated in the tool at the tool tip also increases.

3) It is also observed that, as the depth of cut increases, deformation of the tool tip is also increases. It is main reason of tool failure.

4)Analyze the residual stresses developed in the too.

From journal “International Journal of Advances in Engineering, 2015” we got to know that,

The effect of cutting is to reduce wear and tear of tool tip point as well as more heat dissipation to surrounding hence the increase in tool life and surface finish of the product to be machine.

With increase in depth of cut the surface roughness is increased. Here experimental results shows by selecting the proper cutting parameters the coated tools are suitable to produce fine surface finished components

OBJECTIVE OF THE PROJECT

a. This project particularly focuses on designing of a single point cutting tool and analyzes the model and give the best suited material for the tool.

b. The software’s which we used to design the tool is CATIA v5 and in order to analyze the Model ANSYS v15 is used.

PROBLEM STATEMENT

In today’s never ending competition to produce component at the cheapest cost small and medium scale manufacturers. Hence a lot of emphasis is given to cycle time optimization.

By the tool which we intend to make we want to minimize it to one tool

As a immediate benefit.

1. Cycle time reduces as the tool index time is being saved.
2. More number of operations done in a single holder.
3. Double the space to include more tool holders.
4. Increased configuration of operations possible.

2 PROBLEM STATEMENT

In today's never ending competition to produce component at the cheapest cost small and medium scale manufacturers. Hence a lot of emphasis is given to cycle time optimization.

By the tool which we intend to make we want to minimize it to one tool

As a immediate benefit.

1. Cycle time reduces as the tool index time is being saved.
2. More number of operations done in a single holder.
3. Double the space to include more tool holders.
4. Increased configuration of operations possible.

3. INTRODUCTION TO CAD

- Computer-aided design (CAD), also known as computer-aided design and drafting (CADD), is the use of computer technology for the process of design and design-documentation. Computer Aided Drafting describes the process of drafting with a computer. CADD software, or environments, provide the user with input-tools for the purpose of streamlining design processes; drafting, documentation, and manufacturing processes. CADD output is often in the form of electronic files for print or machining operations. The development of CADD-based software is in direct correlation with the processes it seeks to economize; industry-based software (construction, manufacturing, etc.) typically uses vector-based (linear) environments whereas graphic-based software utilizes raster-based (pixelated) environments.
- CADD environments often involve more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.
- CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) objects.
- CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.
- The design of geometric models for object shapes, in particular, is often called *computer-aided geometric design* (*CAGD*).
- Current computer-aided design software packages range from 2D vector-based drafting systems to 3D solid and surface modellers. Modern CAD packages can also frequently allow rotations in three dimensions, allowing viewing of a designed object from any desired angle, even from the inside looking out. Some CAD software is capable of dynamic mathematic modeling, in which case it may be marketed as CADD — *computer-aided design and drafting*.
- CAD is used in the design of tools and machinery and in the drafting and design of all types of buildings, from small residential types (houses) to the largest commercial and industrial structures (hospitals and factories).

CAD is mainly used for detailed engineering of 3D models and/or 2D drawings of physical components, but it is also used throughout the engineering process from conceptual design and layout of products, through strength and dynamic analysis of assemblies to definition of manufacturing methods of components. It can also be used to design objects.

- CAD has become an especially important

technology within the scope of computer-aided technologies, with benefits such as lower product development costs and a greatly shortened design cycle. CAD enables designers to lay out and develop work on screen, print it out and save it for future editing, saving time on their drawings.

- Types of CAD Software

2D CAD

Two-dimensional, or 2D, CAD is used to create flat drawings of products and structures. Objects created in 2D CAD are made up of lines, circles, ovals, slots and curves. 2D CAD programs usually include a library of geometric images; the ability to create Bezier curves, splines and polylines; the ability to define hatching patterns; and the ability to provide a bill of materials generation. Among the most popular 2D CAD programs are AutoCAD, CAD key, CADDS 5, and Medusa.

3D CAD

Three-dimensional (3D) CAD programs come in a wide variety of types, intended for different applications and levels of detail. Overall, 3D CAD programs create a realistic model of what the design object will look like, allowing designers to solve potential problems earlier and with lower production costs. Some 3D CAD programs include Autodesk Inventor, Co Create Solid Designer, Pro/Engineer Solid Edge, SolidWorks, Uni graphics NX and VX CAD, CATIA V5.

3D Wireframe and Surface Modeling

CAD programs that feature 3D wireframe and surface modeling create a skeleton-like inner structure of the object being modeled. A surface is added on later. These types of CAD models are difficult to translate into other software and are therefore rarely used anymore.

Solid Modeling

Solid modeling in general is useful because the program is often able to calculate the dimensions of the object it is creating. Many sub-types of this exist. Constructive Solid Geometry (CSG) CAD uses the same basic logic as 2D CAD, that is, it uses prepared solid geometric objects to create an object. However, these types of CAD software often cannot be adjusted once they are created. Boundary Representation (Brep) solid modeling takes CSG images and links them together. Hybrid systems mix CSG and Brep to achieve desired designs

3.1 CATIA V5

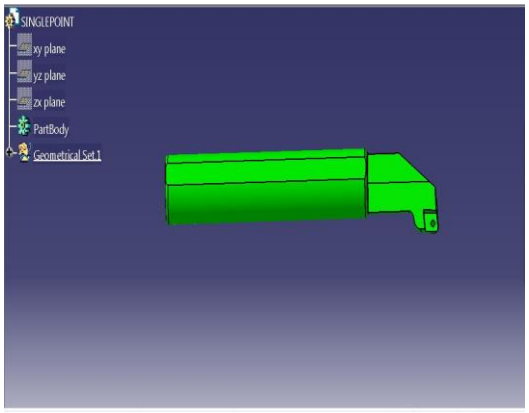
CATIA (Computer Aided Three-dimensional Interactive Application) (in English usually pronounced) is a multi-platform CAD/CAM/CAE commercial software suite developed by the French company Dassault Systems. CATIA is the cornerstone of the Dassault Systems product lifestyle management software suite. CATIA competes in the high-end CAD/CAM/CAE market with Creo Elements/Pro and NX (Unigraphics).

Commonly referred to as a 3DProduct Lifestyle Management software suite, CATIA supports multiple stages of product development (CAx), including conceptualization, design (CAD), manufacturing (CAM). And engineering (CAE). CATIA facilitates collaborative engineering across disciplines, including surfacing and shape design, mechanical engineering, and equipment and systems engineering.

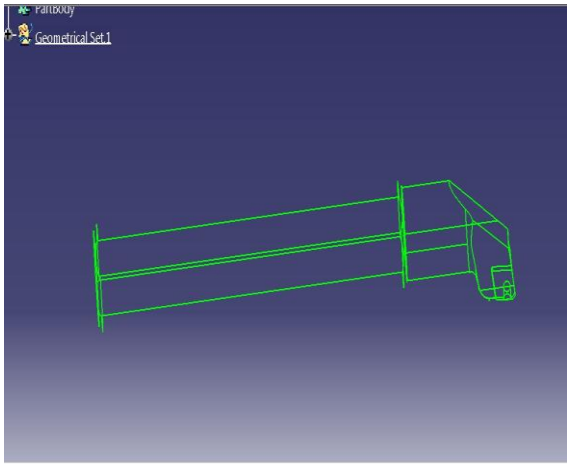
CATIA provides a suite of surfacing, reverse engineering, and visualization solutions to create, modify, and validate complex innovative shapes, from subdivision, styling, and Class A surfaces to mechanical functional surfaces.

It enables the creation of 3D parts, from 3D sketches, sheet metal, composites, molded, forged or tooling parts up to the definition of mechanical assemblies. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. It facilitates the design of electronic, electrical, and distributed systems such as fluid and HVAC systems, all the way to the production of documentation for manufacturing.

CATIA offers a solution to model complex and intelligent products through the systems engineering approach. It covers the requirements definition, the systems architecture, the behavior modeling and the virtual product or embedded software generation. CATIA can be customized via application programming interfaces (API). CATIA V5 and V6 can be adapted.



CATIA 3D MODEL



WIREFRAME MODEL

3.2 **INTRODUCTION TO FEA**

Finite Element Analysis (FEA) was first developed in 1943 by R. Courant, who utilized the Ritz method of numerical analysis and minimization of variational calculus to obtain approximate solutions to vibration systems. Shortly thereafter, a paper published in 1956 by M. J. Turner, R. W. Clough, H. C. Martin, and L. J. Topp established a broader definition of numerical analysis. The paper centered on the "stiffness and deflection of complex structures".

FEA consists of a computer model of a material or design that is stressed and analyzed for specific results. It is used in new product design, and existing product refinement. A company is able to verify a proposed design will be able to perform to the client's specifications prior to manufacturing or construction. Modifying an existing product or structure is utilized to qualify the product or structure for a new service condition. In case of structural failure, FEA may be used to help determine the design modifications to meet the new condition.

There are generally two types of analysis that are used in industry: 2-D modeling, and 3-D modeling. While 2-D modeling conserves simplicity and allows the analysis to be run on a relatively normal computer, it tends to yield less accurate results. 3-D modeling, however, produces more accurate results while sacrificing the ability to run on all but the fastest computers effectively. Within each of these modeling schemes, the programmer can insert numerous algorithms (functions) which may make the system behave linearly or non-linearly. Linear systems are far less complex and generally do not take into account plastic deformation. Non-linear systems do account for plastic deformation, and many also are capable of testing a material all the way to fracture.

FEA uses a complex system of points called nodes which make a grid called a mesh. This mesh is programmed to contain the material and structural properties which define how the structure will react to certain loading conditions. Nodes are assigned at a certain density throughout the material depending on the anticipated stress levels of a particular area. Regions which will receive large amounts of stress usually have a higher node density than those which experience little or no stress. Points of interest may consist of: fracture point of previously tested material, fillets, corners, complex detail, and high stress areas. The mesh acts like a spider web in that from each node, there extends a mesh element to each of the adjacent nodes. This web of vectors is what carries the material properties to the object, creating many elements.

A wide range of objective functions (variables within the system) are available for minimization or maximization:

- Mass, volume, temperature
- Strain energy, stress strain
- Force, displacement, velocity, acceleration
- Synthetic (User defined)

There are multiple loading conditions which may be applied to a system. Some examples are shown:

- Point, pressure, thermal, gravity, and

centrifugal static loads

- Thermal loads from solution of heat transfer analysis
- Enforced displacements
- Heat flux and convection
- Point, pressure and gravity dynamic loads

Each FEA program may come with an element library, or one is constructed over time. Some sample elements are:

- Rod elements
- Beam elements
- Plate/Shell/Composite elements
- Shear panel
- Solid elements
- Spring elements
- Mass elements
- Rigid elements
- Viscous damping elements

Types of Engineering Analysis

Structural analysis consists of linear and non-linear models. Linear models use simple parameters and assume that the material is not plastically deformed. Non-linear models consist of stressing the material past its elastic capabilities. The stresses in the material then vary with the amount of deformation as in.

Vibrational analysis is used to test a material against random vibrations, shock, and impact. Each of these incidences may act on the natural vibrational frequency of the material which, in turn, may cause resonance and subsequent failure.

Fatigue analysis helps designers to predict the life of a material or structure by showing the effects of cyclic loading on the specimen. Such analysis can show the areas where crack propagation is most likely to occur. Failure due to fatigue may also show the damage tolerance of the material.

Heat Transfer analysis models the conductivity or thermal fluid dynamics of the material or structure. This may consist of a steady-state or transient transfer. Steady-state transfer refers to constant thermo properties in the material that yield linear heat diffusion.

Results of Finite Element Analysis

FEA has become a solution to the task of predicting failure due to unknown stresses by showing problem areas in a material and allowing designers to see all of the theoretical stresses within. This method of product design and testing is far superior to the manufacturing costs which would accrue if each sample was actually built and tested.
In practice, a finite element analysis usually consists of three principal steps:

1. **Preprocessing**: The user constructs a model of the part to be analyzed in which the geometry is divided into a number of discrete sub regions, or elements," connected at discrete points called nodes." Certain of these nodes will have fixed displacements, and others will have prescribed loads. These models can be extremely time consuming to prepare, and commercial codes vie with one another to have the most user-friendly graphical “preprocessor" to assist in this rather tedious chore. Some of these preprocessors can overlay a mesh on a preexisting CAD file, so that finite element analysis can be done conveniently as part of the computerized drafting-and-design process.
2. **Analysis**: The dataset prepared by the preprocessor is used as input to the finite element itself, which constructs and solves a system of linear or nonlinear algebraic equations

Ki[j] u[j] = f[i]

where u and f are the displacements and externally applied forces at the nodal points. The formation of the K matrix is dependent on the type of problem being attacked, and this module will outline the approach for truss and linear elastic stress analyses. Commercial codes may have very large element libraries, with elements appropriate to a wide range of problem types. One of FEA's principal advantages is that many problem types can be addressed with the same code, merely by specifying the appropriate element types from the library.

3. **Postprocessing**: In the earlier days of finite element analysis, the user would pore through reams of numbers generated by the code, listing

displacements and stresses at discrete positions within the model. It is easy to miss important trends and hot spots this way, and modern codes use graphical displays to assist in visualizing the results. A typical postprocessor display overlays colored contours representing stress levels on the model, showing a full field picture similar to that of photo elastic or moiré experimental results.

3.3 **ANSYS R15**

ANSYS is an engineering simulation software (computer-aided engineering, or CAE) developer headquartered south of Pittsburgh in the Southpointe business park in Cecil Township, Pennsylvania, United States.

The company was founded in 1970. by Dr. John A. Swanson as *Swanson Analysis Systems, Inc* (SASI). Its primary purpose was to develop and market finite element analysis software for structural physics that could simulate static (stationary), dynamic (moving) and thermal (heat transfer) problems. SASI developed its business in parallel with the growth in computer technology and engineering needs. The company grew by 10 percent to 20 percent each year, and in 1994 it was sold to TA Associates. The new owners took SASI's leading software, called ANSYS®, as their flagship product and designated ANSYS, Inc. as the new company name.

This project is analyzed in static structure

3.4 **STRUCTURAL STATIC ANALYSIS**

A static analysis calculates the effects of *steady* loading conditions on a structure, while ignoring inertia and damping effects, such as those caused by time-varying loads. A static analysis can, however, include *steady* inertia loads (such as gravity and rotational velocity), and time-varying loads that can be approximated as static equivalent loads (such as the static equivalent wind and seismic loads commonly defined in many building codes).

Loads in a Static Analysis

Static analysis is used to determine the displacements, stresses, strains, and forces in structures or components caused by loads that do not induce significant inertia and damping effects. Steady loading and response conditions are assumed; that is, the loads and the structure's response are assumed to vary slowly with respect to time. The kinds of loading that can be applied in a static analysis include:

- Externally applied forces and pressures
- Steady-state inertial forces (such as gravity or rotational velocity)
- Imposed (non-zero) displacements
- Temperatures (for thermal strain)
- Fluencies (for nuclear swelling)

3.5 **COMMANDS USED IN A STATIC ANALYSIS**

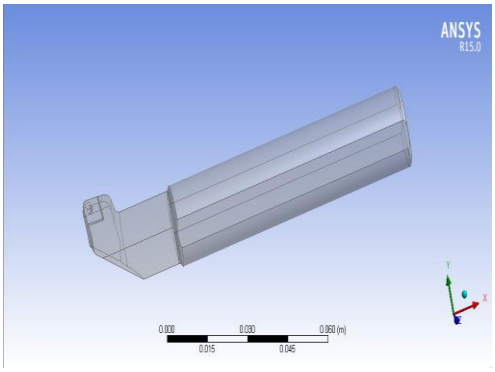
We use the same set of commands to build a model and perform a static analysis that you use to do any other type of finite element analysis. Likewise, you choose similar options from the graphical user interface (GUI) to build and solve models no matter what type of analysis you are doing.

➢ "A Sample Static Analysis (Command or Batch Method)," shows you the sequence of commands you would issue (either manually or while running ANSYS as a batch job) to perform an example static analysis. "A Sample Static Analysis (GUI Method)," shows you how to execute the same sample analysis using menu choices from the ANSYS GUI. (To learn how to use the commands and GUI selections for building models, read the ANSYS Modeling and Meshing Guide.)

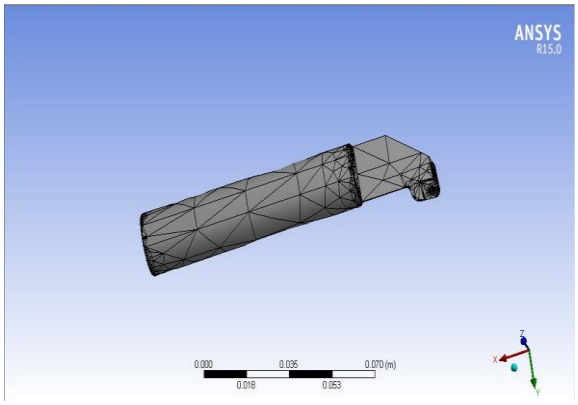
➢ **Overview of steps in a static analysis**

The procedure for a static analysis consists of three main steps:

➢ 1. Build the model.
➢ 2. Apply loads and obtain the solution.
➢ 3. Review the results.



IMPORTED MODEL IN ANSYS



MESHED MODEL IN ANSYS

CALCULATIONS

In any metal cutting operation in a lathe there acts a force 'R' on the tool.

This Force 'R' can be resolved into three components.

Py = in the horizontal plane, perpendicular to the direction of the feed;

Px = in horizontal plane against the direction of feed;

Pz = in vertical plane, perpendicular to both Py and Px

Empirical formula determining the Pz can be expressed as under

Pz= Cp*tx*Sy*K

Where, Cp= coefficient, characterized by the work material and condition of working Such as tool, coolant.

t = depth of cut

S = feed in mm/revolution

K = overall correlation, consisting of actual condition of working and tool angles, which varies from 0.9 to 1.0

K= Kc*Kf*Kσ*Km

Where,

Kc = Correction coefficient for coolant.

Kf = Correction coefficient depending upon the entering angle.

Kσ = correction coefficient depending upon the back rack angle.

Km = correction coefficient depending upon the material.

For Depth of cut = 0.2 mm

Feed = 0.286 mm/revolution

Cp= 225

x = 1.00

y = 0.75

Pz = Cp*tx*Sy* K= 225*0.21.00*0.2860.75*0.935

Pz =16.44 N

The components approximately connected by the following expression

Px / Pz = 0.3

Px = 0.3*Pz =0.3*16.45=4.932

and Py /Pz = 0.2

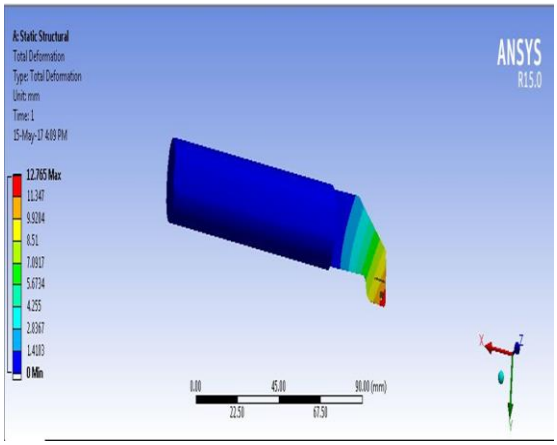
Py=0.2 *16.45 = 3.28

- **5.3 MATERIAL DATA**
- **MATERIAL: HSS**
- DENSITY: 8600Kg\mm
- YOUNG'S MODULUS: 30*10^6 N\mm^3
- POISON'S RATIO: 0.29
- **MATERIAL: EN24**
- DENSITY: 7.85kg/dm^3
- YOUNG'S MODULUS: 210*10^3 N\mm^2
- POISON'S RATIO: 0.30

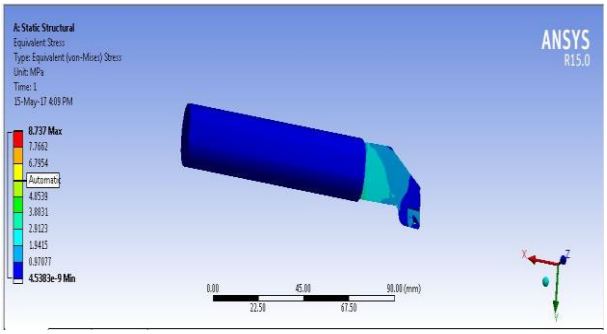
Cutting force (N)	Depth of Cut (mm)				
	0.2	0.5	1.0	2.0	2.5
Px	4.932	12.33	24.66	49.32	61.65
Py	3.28	8.22	16.44	32.88	41.10
Pz	16.44	41.10	82.20	164.4	205.5

ANALYSIS AND RESULTS

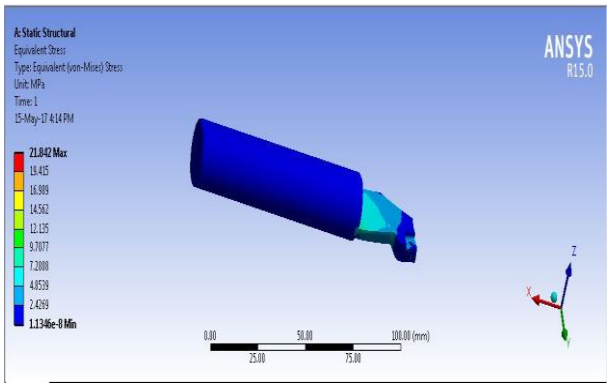
- **HSS**



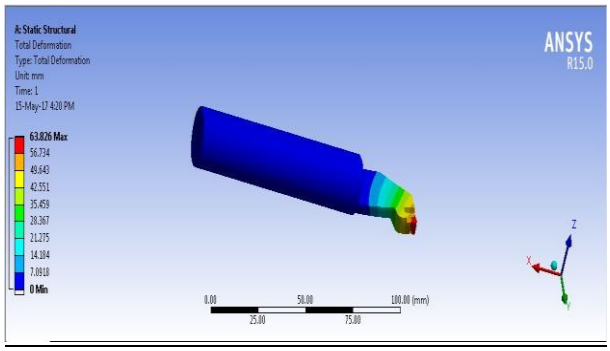
TOTAL DEFORMATION OF 0.2MM



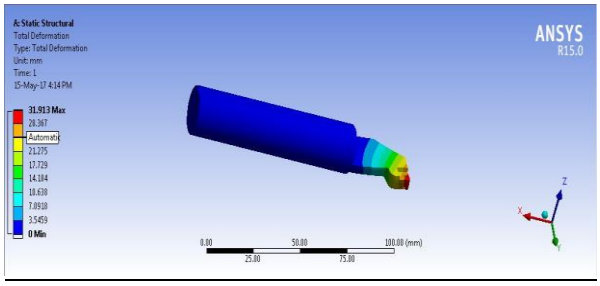
VON-MISES STRESS 0.2 MM



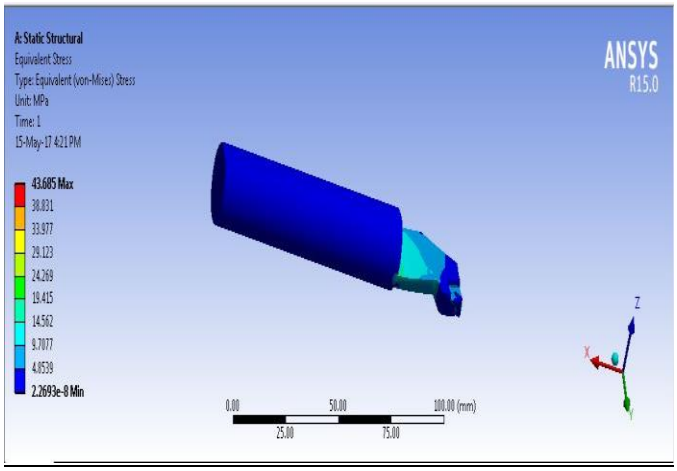
VON-MISES STRESS 0.5 MM



TOTAL DEFORMATION OF 1.0 MM



TOTAL DEFORMATION OF 0.5MM



VON-MISES STRESS 1.0 MM

Cutting force (N)	Depth of Cut (mm)				
	0.2	0.5	1.0	2.0	2.5
Px	4.932	12.33	24.66	49.32	61.65
Py	3.28	8.22	16.44	32.88	41.10
Pz	16.44	41.10	82.20	164.4	205.5

Conclusion

From the experimental result and software result following conclusion is made

1) It is observed that as depth of cut increases, the von-mises stresses developed in the tool increases which are the main reason of tool failure.

2) From the experimental, it is clearly observed that as depth of cut increases, the temperature Generated in the tool at the tool tip also increases.

3) From the experimental, it is clearly observed that as Speed of Spindle increases, the temperature generated in the tool at the tool tip also increases.

6. **SCOPE OF FUTURE WORK**

VIBRATIONAL ANALYSIS CAN BE CARRIED OUT.

REFERENCES

[1]. S. Sundaram, P. Senthilkumar, A. Kumaravel and N. Manoharan, "Study Of Flank Wear In Single Point Cutting Tool Using Acoustic Emission Sensor Techniques", ARPN Journal of Engineering and Applied Sciences, VOL. 3, NO. 4, AUGUST 2008.

[2]. K. Kadirgama, K. A. Abou-El-Hossein, B. Mohammad, M. M. Noor and S. M. Sapuan, "Prediction of tool life by statistic method in

end-milling operation", Scientific Research and Essay, Vol. 3 (5), pp. 180-186, May, 2008.

[3]. S. Dolinsek, J. Kopac, "Mechanism and types of tool wear; particularities in advanced cutting materials", Journal of Achievements in Materials and Manufacturing Engineering, VOLUME 19, ISSUE 1, November 2006.

[4]. W.S. Lin, "The reliability analysis of cutting tools in the HSM processes", Archives of Materials Science and Engineering, Volume 30, Issue 2, April 2008, Pages 97-100.

[5]. "Workshop Technology (Volume – II) Machine Tools," by S. K. Hajra Choudhary, A. K. Hajra Choudhary, and Nirjhar Roy. 2007. Media Promoters & Publishers Pvt. Ltd., Mumbai.

[6]. "Manufacturing Technology (Volume – II) Metal Cutting & Machine Tools," by P. N. Roy, 2008. Tata McGraw Hill Publications, New Delhi.

[7]. "Design Data Book for Machine Elements," PSG Tech. Publications.

[8]. "Design Data for Machine Elements," by B. D. Shiwalkar, 2005, Central Techno Publications, Nagpur

[9]. "A Text Book of Machine Design,", by R. S. Khurmi & J. K. Gupta, 1997, S. Chand & Company Ltd., New Delhi.