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BASIC WORKING SIMULATION OF AUTOMOBILE ENGINE AND THERMAL ANALYSIS OF PISTON

B.Vishal Naik[1], U. Rangaswami[2], G. Santosh[3], R. Mohan[4]

[1]B.Vishal Naik, [2] U. Rangaswami, [3] G.Santosh B.Tech, [4]R. Mohan

[1, 2, 3] Student, [4] Head of Mechanical Department

Visvesvaraya College Of Engineering& Technology, M.P. Patelguda,Bonguloor Xroads, Ibrahimpatnam Hyderabad, (India)

ABSTRACT

An Internal combustion engine is characterized as associate engine within which the energy discharged within the engine is directly reborn to mechanical work, rather than associate external combustion engine within which a unique combustor is used to burn the fuel. There area unit variety of parts within the engine that area unit necessary for the effective functioning of associate Engine. during this project we tend to style some main parts of a four cylinder I.C Engine and conjointly try is finished to review static analysis on a rotating shaft from one cylinder IC Engine. The modeling of engine parts is finished in CATIA V5 R20 computer code. Finite element Analysis (FEA) is performed to ascertain the strain variations at crucial locations exploitation the ANSYS fifteen.0 computer code on rotating shaft by applying the boundary conditions. Static analysis is performed on the rotating shaft to understand the strain variations on that and it's performed by considering the 3 completely different alloys of steel.conjointly to style a true engine, having under consideration all necessary calculations regarding with mechanics, dynamics and strength calculation of basic details. Another purpose of the project is to outline the correct materials for every half. Next thereto i will be able to create second and 3D drawings on CATIA and animation of operating combustion Engine.

I. INTRODUCTION

An engine or motor may be a machine designed to convert one type of energy into another energy. Heat engines, as well as combustion engines and external combustion engines (such as steam engines) burn a fuel to make heat, that then creates a force. the inner combustion engine was formed and developed within the late 1800s. it's had a major impact on society, and is taken into account one in all the foremost vital inventions of the last century. the inner combustion engine has been the muse for the fortunate development of the many business technologies. as an example, contemplate however this sort of engine has remodelled the transportation business, permitting the invention and improvement of cars, trucks, airplanes and trains.

1.1 Types of Engines

There square measure 2 major cycles employed in combustion engines: Otto and Diesel. The Otto cycle is called when Nikolaus Otto (1832 – 1891) WHO developed a ICE in 1876. it's conjointly known as a spark ignition (SI)

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engine, since a spark is required to ignite the fuel-air mixture. The Diesel cycle engine is additionally known as a compression ignition (CI) engine, since the fuel can auto-ignite once injected into the combustion chamber. The Otto and Diesel cycles treat either a four- or two-stroke cycle. Since the invention of the inner combustion engine several pistons-cylinder geometries are designed. The selection of given arrangement depends on variety of things and constraints, like engine equalisation and accessible volume:

1.2 In Line

The inline-four engine or straight-four engine is an indoor combustion engine with each one of the four cylinders mounted in a very line, or plane on the housing. the one bank of cylinders could be set in either a vertical or a slanted plane with each one of the cylinders driving a typical rotating shaft. wherever it's slanted, it's in some cases known as AN inclination four. in a very specific graph or once a compression is used, AN inline-four engine is recorded either as I4 or L4

1.2 Horizontally Opposed

A horizontally opposed engine is AN engine within which the 2 cylinder heads area unit on opposite facet of the rotating shaft, leading to a flat profile. Subaru and Porsche area unit 2 automakers that use horizontally opposed engine in their vehicles. Horizontally opposed engines provide a coffee centre of gravity and thereby might a drive configuration with higher stability and management. they're additionally wider than different engine configurations, presenting complications with the piece of furniture of the engine at intervals the engine bay of a front engine automotive. this type of engine is wide unfold within the craft production.

1.3 Radial Engine

The radial engine may be a responding type burning engine arrangement within which the cylinders purpose outward from a central shaft like the spokes on a wheel. This arrangement was usually used as a region of huge craft engines before most substantial plane began utilizing rotary engine engines.

in a very ICE, the pistons square measure related to the shaft with a master-and-articulating-rod assembly. One piston encompasses a master rod with an immediate association to the shaft. The remaining pistons pin their connecting rods` association to rings round the fringe of the master rod. Four-stroke radials forever have odd range cylinders for every line, in order that a gradual every-other-piston firing order are often maintained, giving sleek operation.

1.4 V Engine

V engine or V motor may be a typical arrangement for an inside combustion engine. The pistons and cylinders square measure adjusted in 2 separate planes or "banks", is that they appear, by all accounts, to be in a very "V" once seen on the axis of the shaft. The V style usually decreases overall engine length, height and weight compared with the proportional inline arrangement. Different cylinder bank angles of Vee square measure used as a region of assorted engines relying upon the amount of the cylinders; there can be angles that employment superior to something others for stability. Veryskinny points of V consolidate a share of the advantages of the straight and V engine

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1.5 Main Parts of the Engine

1.5.1 Piston

Piston is one in all the most elements within the engine. Its purpose is to transfer force from increasing gas within the cylinder to the rotating shaft via a rod. Since the piston is that the main reciprocator a part of associate degree engine, its movement creates associate degree imbalance. This imbalance usually manifests itself as a vibration, that causes the engine to be perceivably harsh. The friction between the walls of the cylinder and also the piston rings eventually ends up in wear, reducing the effective lifetime of the mechanism.

1.5.2 Connecting Rod

The rod could be a major link within a combustion engine. It connects the piston to the rotating shaft and is answerable for transferring power from the piston to the rotating shaft and causing it to the transmission. There are different kinds of materials and production ways employed in the creation of connecting rods. the foremost common varieties of connecting rods are steel and metallic element. the foremost common sort of producing processes is casting, formation and pulverised science.

1.5.3 Crankshaft

The rotating shaft is that the a part of associate degree engine that interprets reciprocatory linear piston motion into rotation. To convert the reciprocator motion into rotation, the rotating shaft has crankpins, extra bearing surfaces whose axis is offset from that of the crank, to that the “big ends” of the rod from every cylinder attach.

1.5.4 Camshaft

Camshaft is often referred to as “brain” of the engine. this is often therefore as a result of its job is to open and closed at simply the proper time throughout engine rotation, so the utmost power and economical cleanout of exhaust to be obtained. The shaft drives the distributor to electrically synchronize spark ignition. Camshafts do their run through eccentric "lobes" that actuate the parts of the valve train.

1.5.5 Piston Rings

The piston rings are used to decrease the friction between the piston and also the cylinder. The piston rings scale back the contact surface between the piston and cylinder as result friction losses are reduced.

1.6 Introduction to CATIA

CATIA is a fully automation software which relates with the mechanical field. It is graphical user interface which is easy to learn and also the software is feature based and parametric solid modelling. We can draw 2D and 3D models of a part and accordingly the assembly of the parts can be done in it.

The shape or geometry of the model or assembly is dependent upon the values which are referred as constraints. Modules such as sketcher module used to design 2D drawings, part design module is used to design the 3D models of geometry, and Assembly work design is used to assemble the different parts which are drawn in the part design module. Kinematics is used to give the simulation or motion to the part bodies which are designed and assembled in part and assembly design modules.

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1.7 Different modules used in CATIA

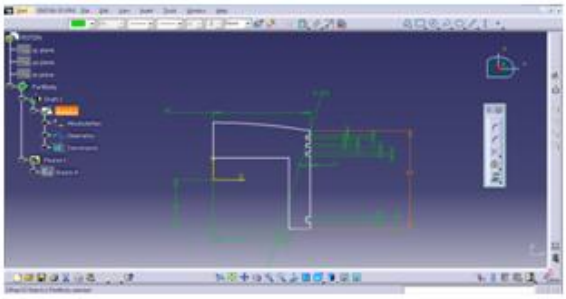
- Sketcher
- Part Design
- Assembly Design
- Kinematics

By Using the CATIA software the part designs were designed and assembly is made because compared to other software's CATIA is easy to design.

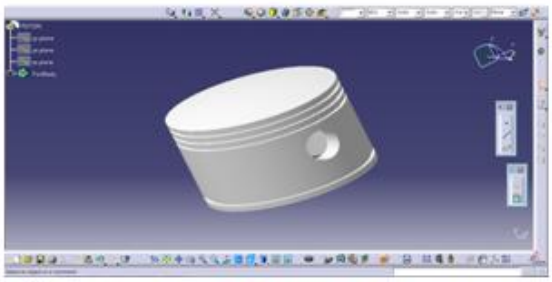
1.8 Design of Engine components

1.8.1 Piston

Outline diagram

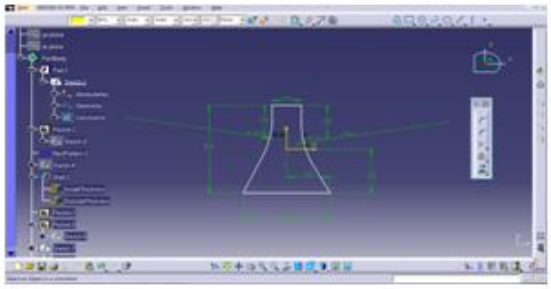


Completed view:



1.8.2 Cylinder Head

Outline diagram



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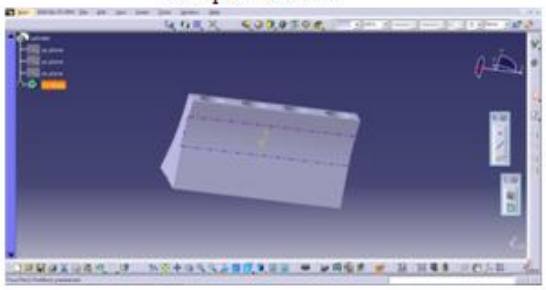
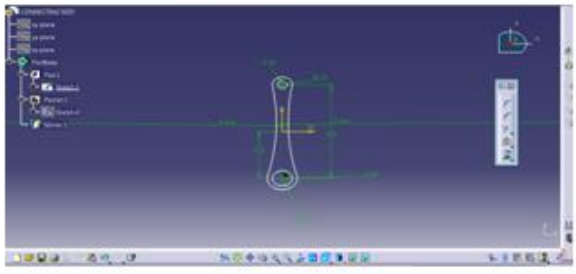


1.8.3 Connecting Rod

Outline view:



Completed view:

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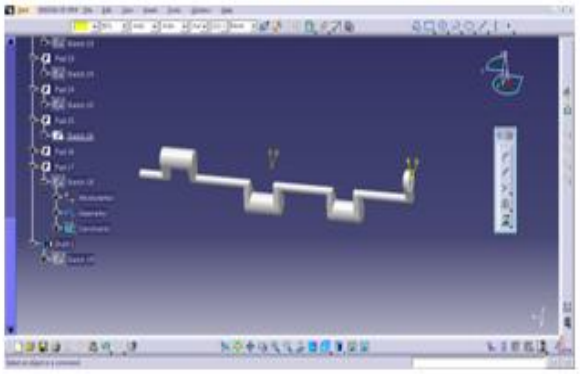
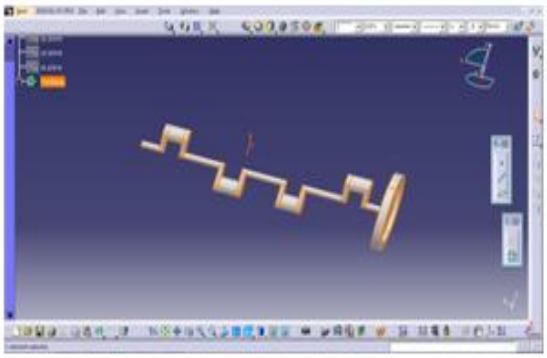
1.8.4 Crankshaft

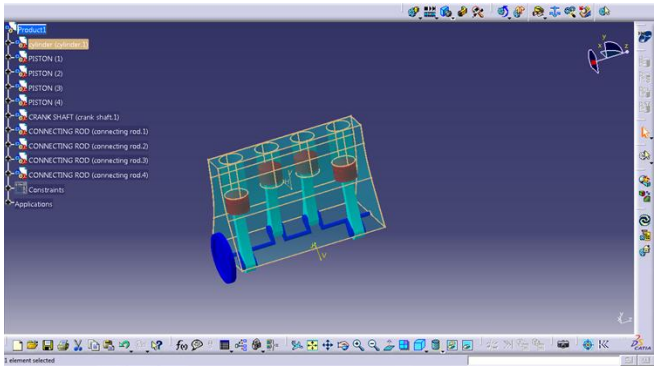
Outline view:



Completed view:



Assembled view:



II. FINITE ELEMENT ANALYSIS (FEA)

The fundamental idea in FEA is that the body or structure may be separated into littler components of finite measurements called “Finite Elements”. The original body or the structure is then considered as an array of these components associated at a limited number of joints called “hubs”. Straightforward capacities are approximated the removals over each limited component. Such accepted capacities are called “shape capacities”. This will signify the movement within the components as far as the relocation at the hubs of the components.

The Finite Element method is a scientific tool for resolving ordinary and partial differential comparison in light of the fact it is a numerical tool, it can take care of the complex issue that can be signified in differential mathematical statement from. The use of FEM is limitless as respects the arrangement of down to earth design issues. Because of high cost of processing power of years passed by, FEM has a history of being utilized to take care of complex and expense critical difficulties.

III. RESULTES AND DISCUSSION

Thermal analysis on piston

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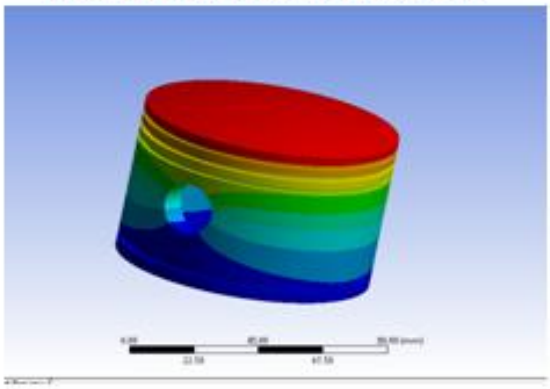
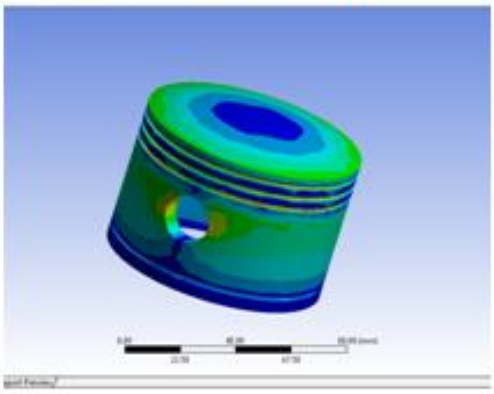
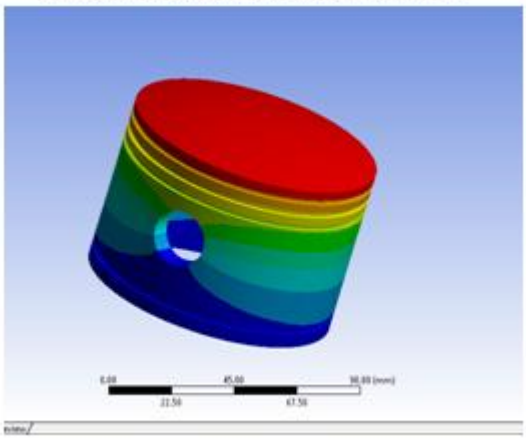
Temperature distribution for copper alloy



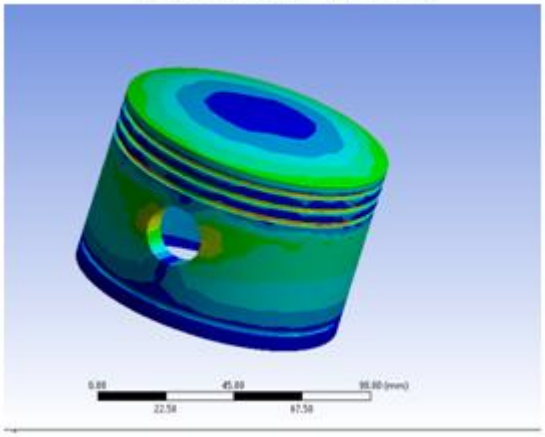
Total heat flux for copper alloy



Temperature distribution for aluminum alloy



Total heat flux for copper alloy



3.1 Numerical Values Obtained During Analysis

The results were drawn from the analysis test on piston by ANSYS ,

S.no	Material	Total temperature	Heat flux
1	Copper alloy	799.43	0.082264
2	Aluminum alloy	798.71	0.081735

IV. CONCLUSION

In this project we have designed the part diagrams of the engine components like piston, cylinder, and crankshaft and made the assembly of these components. We have designed the part design in 2D and 3D models and assembled it in the assembly design workbench.

Thermal analysis has been performed on the piston to find the defects in the formation of piston. Analysis was done by considering the two different materials copper alloy and aluminum alloy has found to be having less heat flux while compared to others. Copper alloy is better then the aluminum alloy

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AUTHOR DETAILS

[1] B.VISHAL NAIK,B.TECH FROM VISVESVARAYA COLLEGE OF ENGINEERING& TECHNOLOGY, M.P. PATELGUDA,BONGULOOR XROADS, IBRAHIMPATNAM HYDERABAD

[2] U.rangaswami,B.Tech from Visvesvaraya college of engineering& technology, m.p. patelguda,bonguloor xroads, ibrahimpatnam Hyderabad

[3] G.santoshB.Tech from Visvesvaraya college of engineering& technology, m.p. patelguda,bonguloor xroads, ibrahimpatnam Hyderabad

[4] R.mohan, working as head of mechanical department from Visvesvaraya college of engineering& technology, m.p. patelguda,bonguloor xroads, ibrahimpatnam Hyderabad