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MODELING AND STATIC STRUCTURAL ANALYSYS OF CONNECTING ROD BY USING DIFFERENT MATERIALS

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ABSTRACT

The connecting rod is the intermediate member between the piston and the Crankshaft. Its primary function is to transmit the push and pull from the piston pin to the crank pin, thus converting the reciprocating motion of the piston into rotary motion of the crank. Existing connecting rod is manufactured by using Carbon steel. Composite materials are now a day widely used in the engineering field. The general characteristics possessed by the composite materials are found to be the reason for using it in the automotive applications. The objective of the project is to design and Static Thermal analysis of connecting rod using metal matrix composite (MMC) with different materials (Al 6061-1.5%B4c-1.5%Sic MMC Material, Al 360 Material, 6092 Sic/25 P-T6 Al MMC Material, Steel C45) The connecting rods are commonly used in the internal combustion engines and are subjected to millions of varying stress impacted. While the Composite connecting rods are lighter and may offer better compressive strength, stiffness and fatigue resistance than conventional connecting rod their design still represents a major technical challenge. In this project both the standard material and composite connecting rods are modeled and analyzed using catia v5 and ANSYS WORKBENCH 16.2. software respectively. A comparative study was undertaken to predict the structural and thermal behavior of connecting rods using three dimensional finite element analysis model, and to determine the most cost effective modeling and analysis approach. The finite element results verify that the performance is same as that of standard steel connecting rod. The stress and static Thermal analysis of the composite

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connecting rods is found to be better than that of the standard connecting rod. Finally concluded the suitable material of connecting rod based on the stresses, strains, deformations, shear stress, temperature distribution, heat flux values.

INTRODUCTION

Internal Combustion engine has many parts like cylinder, piston, connecting rod, crank and crank shaft. The connecting rod is very important part of an engine. Working of the connecting rod is to transmit power of piston to crank pin. Connecting rod has two ends one is pin end and other is crank end. Pin end is attached with piston. The big end (crank end) is attached to the crank pin by a crankshaft. The function of crank shaft is to transmit the reciprocating motion o f piston into rotary motion. The connecting rod should be such that it can sustain the maximum load without any failure during high cycle fatigue. The connecting rod has generally three parts; pin end, crank end, and long shank. Design of shank can be different type like rectangular, tubular, circular, I-section and H-section. Circular section is generally used for low speed engines. I-section is used for high speed engines.

ABOUT CONNECTING ROD

Connecting rod is among large volume production component in the internal combustion engine, which connects the piston to the crankshaft

and is responsible for transferring power from the piston to the crankshaft and sending it in to transmission. Hence, these rods must have lowest weight to achieve the highest possible rigidity.

LITERATURE REVIEW

K.Sudershan kumar, [1] described modeling and analysis of Connecting rod. In his project carbon steel connecting rod is replaced by aluminum boron carbide connecting rod. Aluminium boron carbide is found to have working factory of safety is nearer to theoretical factory of safety, to increase the stiffness by 48.55%andtoreducestress by 10.35%.

Vivek. C. Pathade, [2] he dealt

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with the stress analysis of connecting rod by finite element method using pro-e wild fire 4.0 and ansys work bench 11.0 software. And concluded that the stress induced in the small end of the connecting rod are greater than the stresses induced at the bigger end, therefore the chances of failure of the connecting rod may be at the fillet section of both end.

Pushpendra Kumar Sharma, [3] performed the static FEA of the connecting rod using the software and said optimization was performed to reduce weight. Weight can be reduced by changing the material of the current forged steel connecting rod to crack able forged steel (C70). And the software gives a view of stress distribution in the whole connecting rod which gives the information that which parts are to be hardened or given attention during manufacturing stage.

Ram Bansal, [4] in his paper a dynamic simulation was conducted on a connecting rod made of aluminum alloy using FEA. In this analysis of connecting rod were performed under dynamic load for stress analysis and optimization. Dynamic load analysis was performed to determine the in service loading of the connecting rod and FEA was conducted to find the stress at critical locations.

PROBLEM STATEMENT

Improper material leads to the failure Connecting rod undergoes repetitive loads during it service life, fatigue performance and durability of this component has to be considered in the Design Process. generally using material (structural steel) of connecting rod replaced with developed Aluminum Metal matrix materials. with different material (Al 6061-1.5%B4c-1.5%Sic MMC Material, Al 360 Material, 6092 Sic/25 P-T6 Al MMC Material, Steel C45) and its behavior study by FEM analysis. . The model of connecting rod was created in CATIA V5 and imported in ansys 14.5 workbench for static and thermal analysis. After analysis a comparison is made between an existing steel connecting rod finally concluded the which material is the suitable for the connecting rod

OBJECTIVES OF THE PROJECT:

The following are the main objectives of the present work:

1. To design connecting rod by using catia work bench with gemotery given below data
2. To determine von-misses

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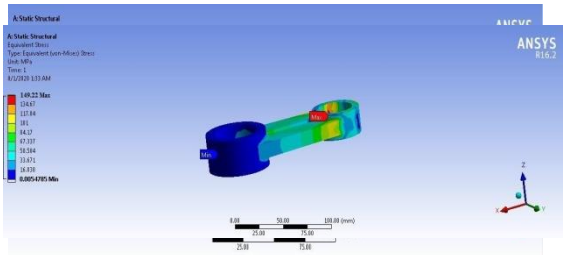
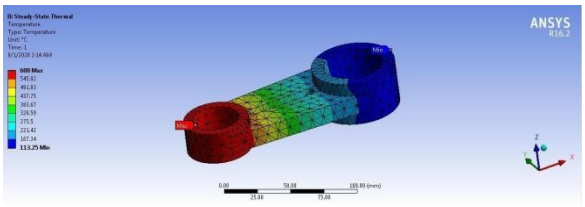


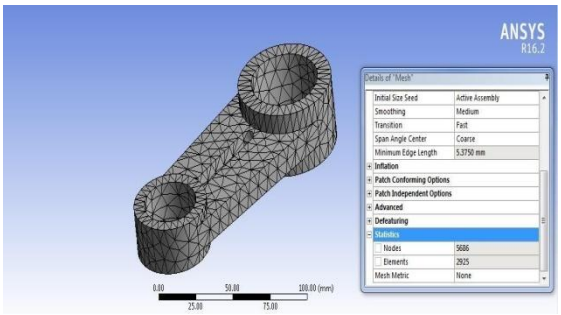


stresses, shear stresses, strain, Total deformation, Temperature distribution and heat flux

3. To identify suitable Metal matrix material for the fabrication of connecting rod based on results obtained from finite element analysis

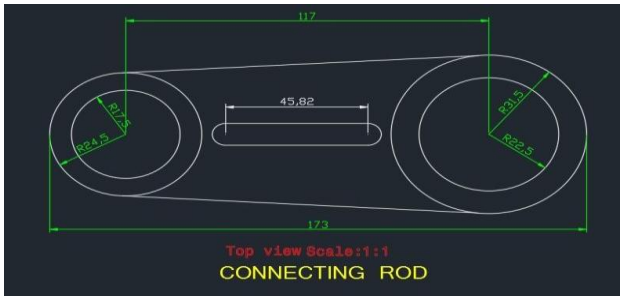
DIMENSIONS OF THE CONNECTING ROD:

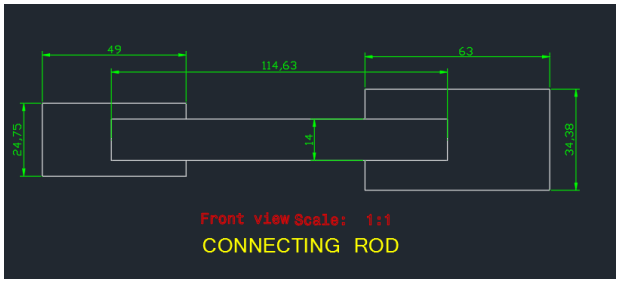
ANSYS ON CRANKSHAFT



CONCLUSION

IN THIS PAPER, In a reciprocating engine,





the connecting rod connects the piston to the crank or crankshaft. In modern automotive

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internal combustion engines, the connecting rods are most usually made of steel for production engines, but can be made of aluminum (for lightness and the ability to absorb high impact at the expense of durability) or B4C (for a combination of strength and lightness at the expense of affordability) for high performance engines. The aluminum composite connecting rod has light weight about 1/3 of steel .Connecting rod plays an important role in ic engine ,Design and static thermal analysis done with different materials(Al 6061-1.5%B4c- 1.5%Sic MMC Material, Al 360 Material, 6092 Sic/25 P-T6 Al MMC Material, Steel C45). In this present work, connecting rod created in software CATIA we are taking specifications pulsar 150cc dimensions apply theoretical value loads different materials, finally find out the stress, strains, deformation, shear stress, Temperature distribution, Heat flux in all cases Al 6061- 1.5%B4c-1.5%Sic MMC Material is the best material because of Light weight, high strength, non corrosion material, better heat transfer, fuel consumption will be reduced.

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