

A COMPARATIVE ANALYSIS OF DESIGN OF CONNECTING ROD OF AN IC ENGINE WITH FEA: A REVIEW

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ABSTRACT

In an internal combustion engine connecting rod has a vital role and it is a high volume production, critical Connecting rod is the link between the piston and the crank. We know that the aim of the connecting rod is to transfer the reciprocating motion of the piston into rotary motion of the crankshaft. & transmitting the thrust of the piston to the crankshaft. Each vehicle that uses an internal combustion engine. They require at least one connecting rod & more connecting rod depending upon the number of cylinders in the engine. Connecting rods are mainly manufactured by forging from either wrought steel or powdered metal. They could also be cast. Anyhow, castings could have blow holes which are detrimental from durability and fatigue points of view. The fact of forgings, it's produce blow-hole-free and better rods gives them an advantage over cast rods. The main objective of the present work is to modify the existing design with thehelp of FEA analysis. Modification is being done by changing in material composition. Material uses in this study are Aluminum, Aluminum alloy, Aluminum alloy . Different materials and their alloys are being tested and compared to generate the final result to design connecting rod with upgraded material and enhance mechanical properties.

KEY WORDS : Connecting rod , crank , thrust, Internal combustion engine , blow-hole-free.

I.INTRODUCTION

The connecting rod is the link between the piston and the crank shaft. Its main function is to transmit the to and fro motion from the piston pin to the crank pin because it is rigid, and thus convert the reciprocating motion of the piston into rotary movement of the crank. It consists of a long shank, a small end and a big end. The cross section of the shank may be rectangular, circular, tubular, I-section or H section. Generally circular section is used for low speed engines while I-section is preferred for high speed engines. The valves on top represent suction and exhaust valves necessary for the intake of an airfuel mixture and exhaust of chamber residuals. In a petrol engines, a spark plug is required to transfer an



electrical discharge to ignite the mixture. Some of the important components of the internal combustion engine are Cylinder, piston, piston rings, Connecting rod, crankshaft etc.

The connecting rod forms an integral part of an internal combustion engine. It acts as a linkage between piston and crank shaft. The small end of connecting rod attaches to the piston pin, gudgeon pin (the usual British term) or wrist pin, which is currently most often press fit into the connecting rod but can swivel in the piston. The other end, the bigger end being connected to the crankshaft. The main function of connecting rod is to transmit the translational motion of piston to rotational motion of crank shaft. The function of the connecting rod also involves transmitting the thrust of the piston to the connecting rod.[6] The connecting rods subjected to a complex state of loading. It undergoes high cyclic load of order 108 to 109 cycles, that is why it comes under the influence of different types of loads in operation. Fatigue loading is one of the prime causes contributing to its failure. The maximum stress occurs in the connecting rod near the piston end due to thrust of the piston. The tensile and compressive stresses are produced due to the gas pressure, and bending stresses are produced due to centrifugal effect. Due to these factors, the connecting rod has been the topic of research for different aspects such as production technology, materials, performance simulation, fatigue parameter etc. There are different types of materials and production methods used in the creation of connecting rods. The most common materials which are being used for Connecting rods are steel and aluminium. The most common types of manufacturing processes are casting, forging and powdered metallurgy.



Figure 1 Connecting Rod

II. Material used for connecting rod

Connecting rods are fabricated mainly by two methods drop forging operation and molding operations. The steel forging process fabricates a light weight but more costly connecting rods. Malleable or spheroidal-graphite iron casting or sinter forgings process are being used to produce small to medium sized IC engines. Steel connecting-rod uses a bronze or brass small-end bush with a detachable large-end shell bearing is of white metal. The problem face in using steel is that they are extremely heavy and as a result consume more power result in more stresses. Aluminum alloy is also employed for connecting-rods as they are lighter in weight and both small-end and big-end bearings can be directly bored into the parent metal of rod and need not be disjoined. Babbitt lining bearing are used for gas engine of small, light duty purpose and bearing with copper-lead lining is used in compression Ignition engines.

III. Literature Survey:

Different exploration papers are examined to track down the new strategy and new area of study that expands the effectiveness, execution and life of interfacing bar. So different plan are contemplated to arrive at the proper resolution;

Mr. Shubham Chougale "In this paper author worked et.al, "a connecting rod for two wheeler is designed by analytical method": On the basis of that design a physical model is created in CATIA V5. Structural system of connecting rod has been analyzed using FEA. With the use of FEA various stresses are calculated for a particular loading conditions using FEA software ANSYS WORKBENCH 14.5. The same work is carried out for different material. Also the thermal analysis of the connecting rod is performed. The obtained results are compared on the basis of various performances with considerable reduction in weight.

Achyut Chauhan1, Heval Saxena1, Niraj Mehta "A Review on FEA of Connecting Rod of I.C Engine: In this investigation an attempt is made to find the best material of connecting rod & optimization of connecting rod for reduce weight, Stress, Strain, Displacement while increasing or maintaining strength of Connecting rod. Analysis of the connecting rod is one of the method in which complete structure as well as working performance of the connecting rod has been done respectively. We will be doing various analysis like static analysis and thermal analysis by using FEA method.



Afzal, A. and A. Fatemi,. "A comparative study of fatigue behavior and life predictions of forged steel and PM connecting rods This study investigates and compares fatigue behavior of forged steel and powder metal connecting rods. The experiments included strain-controlled specimen testing, with specimens obtained from the connecting rods, as well as load-controlled connecting rod bench testing. Monotonic and cyclic deformation behaviors, as well as strain-controlled fatigue properties of the two materials are evaluated and compared. Experimental S-N curves of the two connecting rods from the bench tests obtained under R = -1.25 constant amplitude loading conditions are also evaluated and compared. Fatigue properties obtained from specimen testing are then used in life predictions of the connecting rods, using the S-N approach. The predicted lives are compared with bench test results and include the effects of stress concentration, surface finish, and mean stress. The stress concentration factors were obtained from FEA, and the modified Goodman equation was used to account for the mean stress effect. Fractography of the connecting fracture surfaces were also conducted to investigate the failure mechanisms. A discussion of manufacturing cost comparison and recent developments in "crackable" forged steel connecting rods are also included.

K. Sudershan Kumar et al. "Modelling and Analysis of Two Wheeler Connecting Rod," In this paper connecting rod material is replaced by Aluminium coated with Boron carbide. A model is design by using PRO-E software and analysis is done on ANSYS software.

G. M. Sayeed Ahmed worked on "Design Fabrication and Analysis of a Connecting Rod with Aluminium Alloys and Carbon Fibre" he replaced a forged steel connecting rod with Aluminium alloy and Carbon fibre. The Connecting Rod is modelled on Pro/E. Connecting rod of materials aluminium 6061, aluminium 7075, aluminium 2014 and carbon fibre 280 GSM are used and analysis is done.

Sushant, Victor Gambhir al ,In this paper, a connecting rod for two wheelers was designed by analytical method. With the use of FEA von-mises stress, shear stress, strain and bending stress were calculated for a particular loading conditions with help of ANSYS workbench. After analysis they find final result & in result they see Aluminium 7068 connecting rod was better than Carbon 70 steel connecting rod in terms of von-mises stress, shear stress, and bending stress, with considerable reduction in mass.

Puran Singh, DebashisPramanik, Ran Vijay Singh al ,This analysis shows the importance of the solution of the connecting rod big end distortions in view of the changes in the bearing clearance at the



most important variants of the stress This variant is frequently overlooked & show the design status of connecting rod rather is safe or not.

IV. CONCLUSION

From referred the above literature reviews we have concluded that the basic study and research work is done in improving in material of connecting rod. We will not be changing dimensions of connecting rod but change the material or find new liter material for improve efficiency of the I.C engine. then after conclude various analysis in ANSYS software & found out how many stress develop in connecting rod when applied load & they also found that there is possibility of further reduction in mass of connecting rod and also connecting rod have been analysed which is use modern days & select I section connecting rod for design.

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