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Finite Element Analysis of Connecting Rodof ICE by using Aluminum 360

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A B S T R A C T

The present work aims at the Static Structural Analysis of connecting rodforged steel through Finite Element Modelling (FEM) Method using Ansys Workbench v16.1. One most critical component among in this is connecting rod. In the internal combustion engine, connecting rod play very important role in it. The role of connecting rod in internal combustion engine is the performance and efficiency of connecting rod depends upon the design and it material. In this work, Aluminum 360 has been used to develop the connecting rode. 3 D model has been developed by using the solid work softwareIn the boundary condition during the finite element analysis, bigger end has been kept constant/fixed and force applied on the small end in both direction tensile and compressive simultaneously

Keywords: Aluminum 360, wind tower, finite element analysis

1.Introduction

Connecting rod is one of the vital and basic parts utilized in Internal Combustion Engine of any car, truck, and bus vehicle. In every automobile vehicle one and more connecting rod is required to transmit the force toward the crank shaft. Mainly the no of connecting rod depends upon the no of cylinder is there. The role of the connecting rod is to transmit the power which has been generated in the cylinder due to combustion of the inert fuel. Crank shaft avail the rotatory motion to run a vehicle. It is the intermediate part between the piston and crankshaft. It a element which is used to convert the piston reciprocating motion in to the rotary gesture. So there is both motion rotary and interchange. Ends of the connecting rod are look like as eyes say upper end and big end of the rod which is connected. Small end of the connecting rod is devoted to the piston using a gudgeon pin, while the big end is linked to the crankshaft by crank pin.

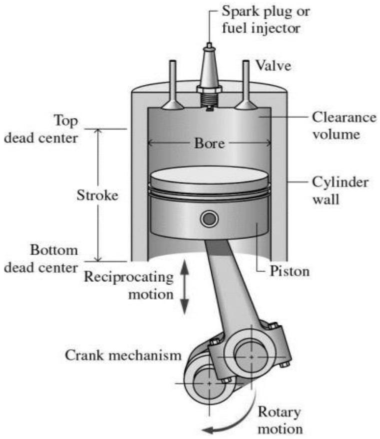
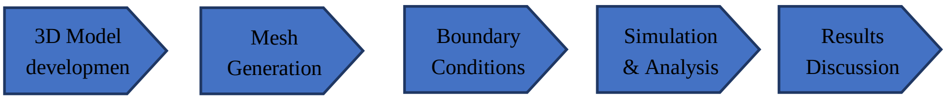


Fig.1 Assembly of Connecting RodFig. 2 Connecting Rod for Engine

In this chapter, the critical literature review has been mentioned regarding the connecting rod along with different type of material with their simulation results Nuha H et al In this work authors determined stress analysis at various individual tensile and compressive loads acting on connecting rod at different speed was done. Simulation was performed by using Cero PTC software to obtain stress distribution in the connecting rod at static condition. Generally two different type of steels are used for manufacturing of connecting rode first one is AISI 4340 Cr-Mo-Ni steel and other one is AISI 1040. They performed the Simulation of connecting rod. Their results shown that maximum pressure force is 28842.13 (N) and it occurs at 3000 RPM rotational along with maximum tensile force is 173.373 N.R Bansal [3] in the research of R Bansal, aluminum alloy has been used for dynamic analysis using finite element method. Catia software has been used to develop 3 dimensional connecting rode model. Ansys software was used for dynamic analysis, stress analysis and strain. Stress analysis tool to determine the maximum deformation, maximum stress point and dangerous areas are found in the rod by applying different method.D.Gopinath et al (4) et al they used three different type of materials to reduce the weight of connecting rod and its optimization. Authors has applied the static structural module for the analysis. In this work initially first static analysis has been performed by using all different type of materials and then Vonmises stresses and shear stresses was applied and compared and then optimize the weight of forged steel connecting rod. They used CATIA software to develop the 3D model of connecting rod. Furthermore they used hyper mesh for finite element method.The aim of the present work is to develop FEM 3D model for the forged steel connecting rod

2. Development of the 3D model

The design parameters of connecting rod is taken from the Figure 3.1 shown below. It shows various parts and dimensions of connecting rod.3 Dimensional Connecting rod model is produced using Catia V5 software. Dimensions for the size and shape of the connecting rod are captured from previous published article. For finite Element analysis it is essential to have a model of detailed product then on model can accomplish different analysis and can predict the result and its behavior. The geometry of connecting rod used for finite element analysis



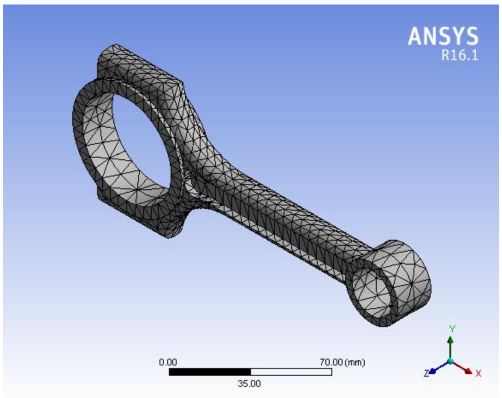


Figure 3 Process chart of simulation

Fig 4 Mesh generation in connecting rod

Aluminum alloy 360 and A 360 are die casting alloy having good strength, good corrosion resistance and excellent cast ability. Alloy A360 is a purer form of alloy 360 having lower impurity maximums.

Table 1 Material properties of AL 360

Material Properties	**Al-360**
Young's Modulus,(E)	2.1 × 105 MPa
Poisson's Ratio	0.33
Tensile Ultimate strength	317 MPa
Tensile Yield strength	280 MPa
Density	2770 kg/ m^3
Behaviour	Isotropic

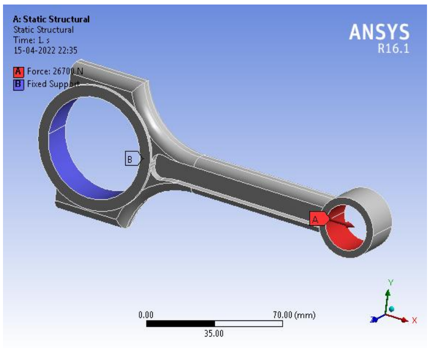


Fig 5 Tensile load applied at piston end

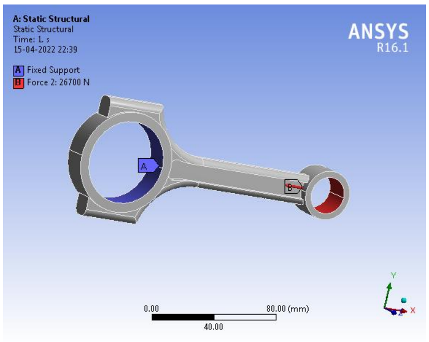


Fig 6 Compressive load applied at piston end

3. Results and Discussion

The static analysis of connecting rod has been investigated with respect to forged steel properties and boundary conditions as mentioned in material specifications Table 1. The force of 26700 N has applied on the small end as shown in Figure 5. The maximum deformation at the small end side has been observed. The displacements of the connecting rod has been recorded in all three possible direction such as in x-direction, y-direction, z-direction and also find out the total displacement. Figure 7 shown the deformation of the connecting rod. The maximum total deformation 0.19225 mm has been observed. The equivalent stress in the connecting rod has been shown in Figure 8The maximum 889 N/mm^2 stress has been observed as shown in Figure 8. The equivalent strain in the connecting rod has been shown in Figure 4.5. The maximum 0.004263 N/mm^2strain has been observed as shown in Figure 9.

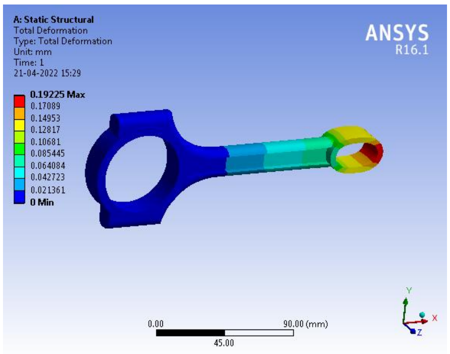


Figure 7 Total deformation of the connecting rod of aluminum 360

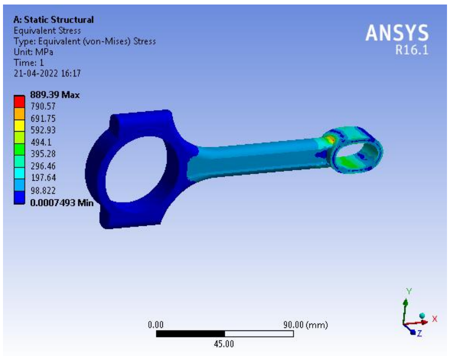


Figure 8 Total equivalent stress of the connecting rod of aluminum 360

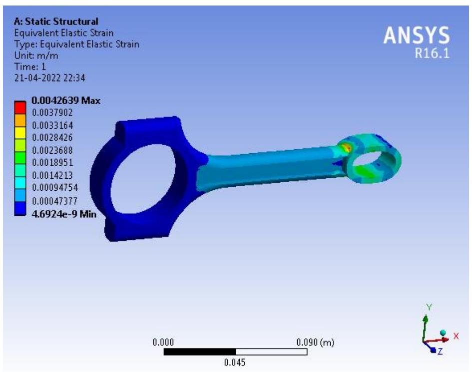


Figure 8 Total equivalent strainof the connecting rod of aluminum 360

4. Conclusions

The In this study, the forged steel connecting rode has been used to develop 3D model. First deformation, equivalent stress and strain analysis is performed by using aluminum 360 material for the internal combustion engine connecting rod. The maximum total deformation 0.19225 mm has been observed. The maximum 889 N/mm2 stress has been observed. The maximum 0.004263 N/mm2 strain has been observed

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