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Finite Element Analysis of Connecting Rodof ICE by using Forged Steel

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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, forged steel 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: Forged steel, wind tower, finite element analysis

1 Introduction

Connecting rod is exposed to high-cyclic loads because of two kinds of power including gas powers due to fuel burning happens in the chamber and inertial powers due to weight of rod and cylinder. The connecting rod has more strength and obstinacy to plug different roles like to bear the outside stacking, furnishes an unbending association with cylinder utilizing gudgeon pin and with driving rod utilizing the wrench pin. Simultaneously it must be light in weight with the goal that it can limit the inertial powers as a result of its movement. The connecting rod is a piece of 4 bar connect component working inside the I. C. motor. The moderate part is called knife between enormous end and little end having the cross segment of it is possible that "I Section" or "H Section" and by the same token "round area" or "a rectangular sort". Plan of area relies upon prerequisite and the application where it will be utilized. It is enhanced in light of the heaps bearing and the space accessibility for it.

Figure 1 Connecting Rod of Internal Combustion Engine

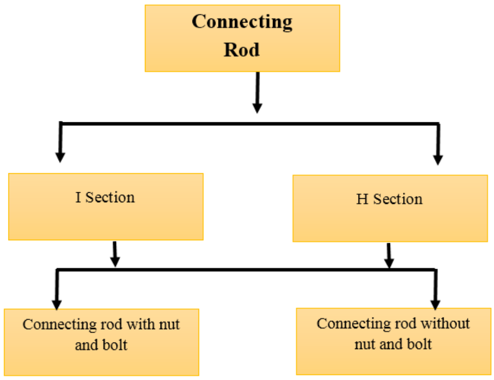

Figure 2 Different type of connecting rod

In this chapter, the critical literature review has been mentioned regarding the connecting rod along with different type of material with their simulation results B.K.Roy [1] optimized the design parameters of connecting rod by using the ansys and catia V5. It has been establish out that the study obtainable here has come up with enhanced results along with safe design of connecting rod below allowable limits of The maximum deformation, maximum stress point and dangerous areas are found by the stress analysis of ConnectingRodmany factors and safe stresses.J.P. Fuertes et al [5] et al author's worked on AA1050 and AA5083 aluminum alloys which were earlier deal with by severe plastic deformation process by ECAP process (Equal Channel Angular Pressing) were used to make the connecting rod by the isothermal forging process and it detailed analysis of mechanical properties and its sub micrometric structure were investigated. In this study, the design and the experimentation process were done. It is observed that there is an improvement in the mechanical properties when the starting material is ECAP-processed before carrying out the isothermal forging. This improvement consists in an increase of 20% in the hardness of the final connecting rod which also possesses a microstructure grain size of 500 nm. Results obtained were compared with conventionally manufactured connecting rod which shows that mechanical properties of mechanical components which were manufactured by isothermal forging from ECAP-processed material were high, as well as it has better flow of the material and at a lower forging temperature. In spite of the fact that the material under study (AA1050) presents a low level of strain hardening, a significant improvement in hardness is obtained in the case of the connecting rods manufactured from ultra-fine grained material. The increase in hardness is about 20%.

M.N. ilman et al [6] et al One of the reason of failure of connecting rod is fatigue occur at the rounded fillet of the big connecting rod end. Various factors affecting fatigue failure including structural design, material types and dynamic loads. A analysis was done though chemical composition analysis, microstructural examination using optical microscopy, hardness and tensile tests, scanning electron microscopy (SEM) fractography and stress analysis and fatigue crack growth rate (FCGR) test was performed using a sinusoidal load with a constant load amplitude. Results showed region near fillet radius is subjected to low cycle fatigue and the initial crack formation started in this region because of high stress concentration. Connecting rod was made of cast steel, not forged steel, with a considerable number of non metallic inclusions such as Al_2O_3, SiO_2 and FeO. These inclusions which were present near the surface of the rounded fillet seemed to act as stress raiser and they were responsible for crack initiation. And these inclusions results increase in fatigue crack growth rate. The aim of the present work is to develp FEM 3D model for the forged steel connecting rod

2. Boundary condition to develop 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. This section comprises conversation about connecting rod geometry regarding the simulation analysis, mesh development and also discussed on the accuracy of developed model. Load distribution on the connecting rod and amount of resultant force is used to analyze pressure constant, significance of restraint and finite element method model. The condition of load that is use to determine structural behavior of connecting rod is static load condition. Finite element method is use to determine this structure

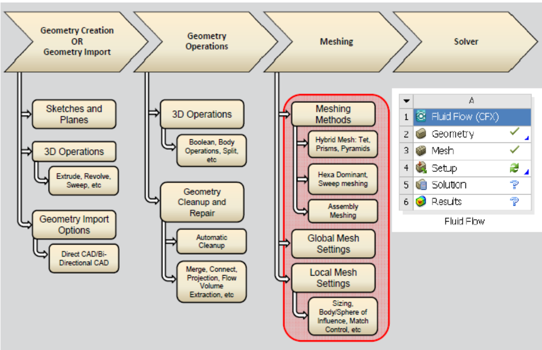

Fig 3 Flow process in ANSYS

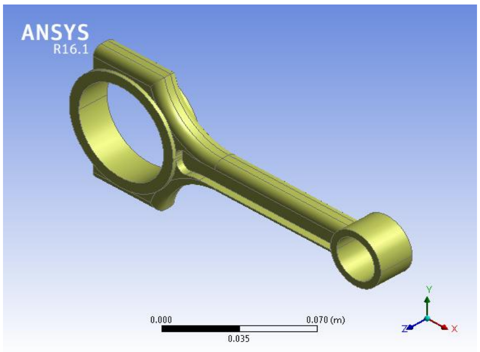

Fig 4 Model of connecting rod used in ANSYS

Forged steel having good strength, good corrosion resistance and excellent cast ability and also having lower impurity maximums

Table 1 Material properties of Forged Steel

Material Properties	**Forged steel**
Young's Modulus,(E)	190-210 GPa
Poisson's Ratio	0.27-0.30
Tensile Ultimate strength	530 Mpa
Tensile Yield strength	385 Mpa
Density	7.87[g/cm3]
Behaviour	Isotropic

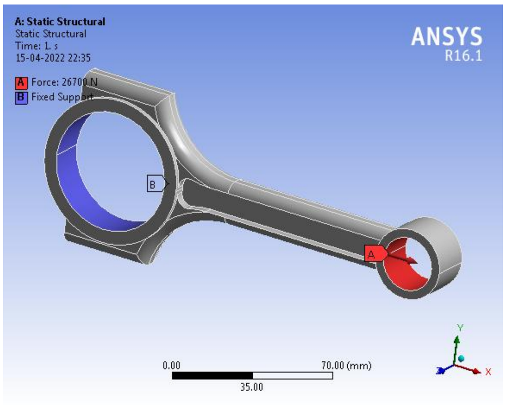

Fig 5 Tensile load applied at piston end

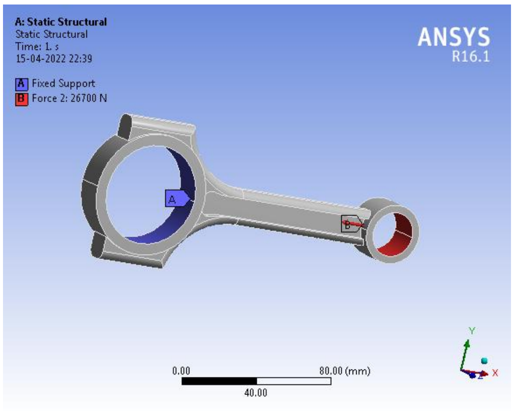

Fig 6 Compressive load applied at piston end

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 0.19300 mm has been observed. The equivalent stress in the connecting rod has been shown in Figure 8The maximum 901 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 0.0043242 N/mm^{2}strain has been observed as shown in Figure 9.

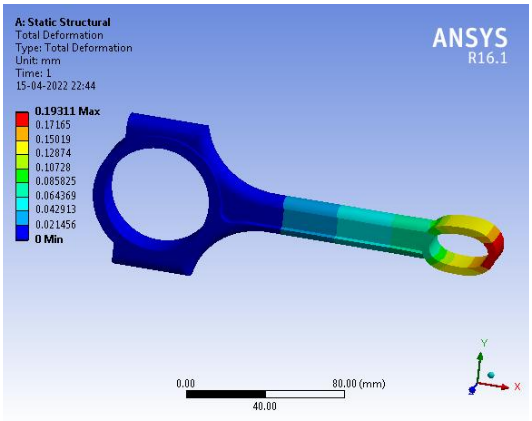

Figure 7 Total deformation of the connecting rod of forged steel

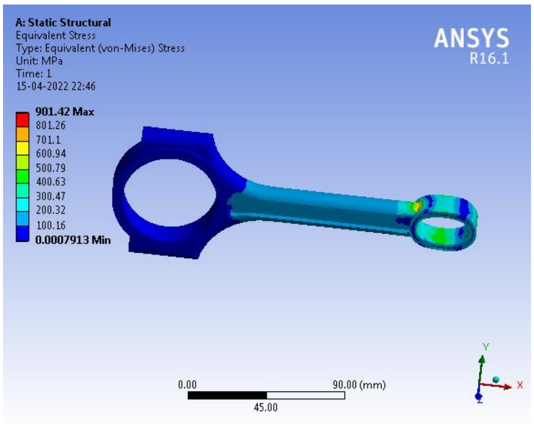

Figure 8 Equivalent stress of the connecting rod of forged steel

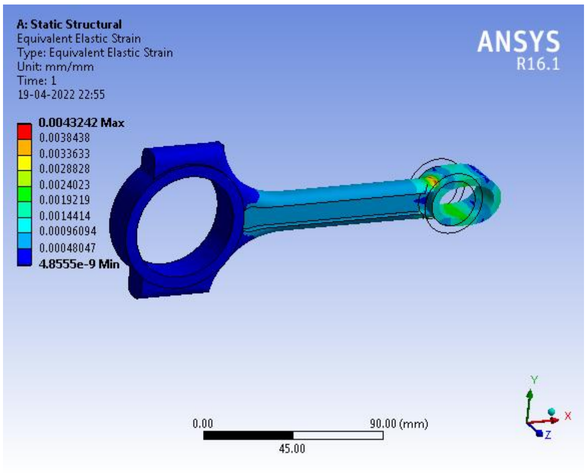

Figure 9 equivalent elastic strain of the connecting rod of forged steel

4. Conclusions

TheIn 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 forged steel material for the internal combustion engine connecting rod. The maximum total deformation 0.19300 mm has been observed. The maximum 901 N/mm^2 stress has been observed. The maximum 0.0043242 N/mm2 strain has been observed

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