STATIC ANALYSIS OF AUTOMOBLE CONNECTING ROD USING ANSYS

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ABSTRACT

Connecting rod is a moving part which is connected between piston and crank. It is subjected to tension, compression, and inertia loads. So it plays a vital role in power transmission in the engine. Lighter connecting rods help to decrease lead caused by inertia force in engine as it does not require more balancing weight on crankshaft Here two materials called Al-7068 and C-70 is selected for performing the static analysis. From the analysis it conclude that carbon steel has better performance compared to the aluminum alloy

1 INTRODUCTION

1.1 INTRODUCTION TO CONNECTING ROD

An IC engine is the one in which the heat transfer occurs to the working fluid occurs within the engine by the ignition of fuel. Connecting rod works a important role and it is the intermediate link between the piston and the crank. Connecting rod in engine should be stronger and lighter, should more fuel efficient and at the same time they should provide safety and comfort to passengers. This makes vehicle construction led to the invention and implementation of quite new materials which are light and stronger to meet design requirements.

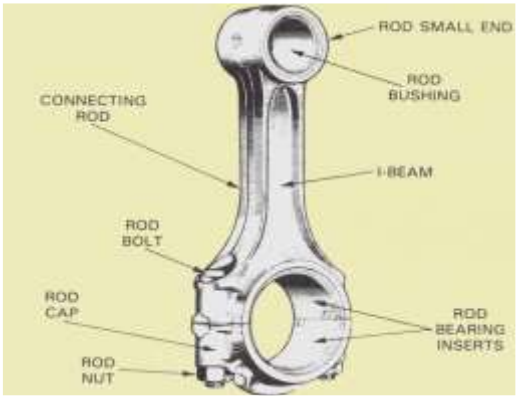

Fig 1 Connecting Rod

1.2 Overall Objectives

In this study two comparatively material called carbon steel C-70 and aluminum alloy Al-7068 is selected and is used for the static analysis

1.2.1 Modeling of the Steering Knuckle

Modeling of the connecting rod a 3D modeling software with its standard dimensions

1.2.2 Analysis

Perform load analysis

2. PROBLEM DEFINITION

Vehicle construction led to the invention and implementation of quite new materials which are light and stronger to meet design requirements. Lighter connecting rods help to decrease lead caused by inertia force in engine as it does not require more balancing weight on crankshaft. Normally the connecting rods are most usually manufactured by steel for production engines, but can be made of T6-2024 and T651-7075 aluminum alloys (for lightness and the ability to absorb high impact at the expense of durability).An application of an metal matrix composite helps in safety increase and leads to effective use of fuel consumption to obtain the high engine power. Honda Company

had already started the manufacturing of aluminum connecting rods reinforced with steel continuous fibers. By carrying out these modifications in engine elements will helps in effective reduction of weight, increase of durability of particular part, which lead to decrease of overall engine weight, improvement in its traction parameters, economy and ecological conditions such as reduction in fuel consumption and emission of harmful substances into atmosphere. Connecting rods are subjected to both compressive and tensile forces during the 720 degrees of the four-stroke combustion cycle.

3. DESIGN METHODOLOGY

3.1 Steps Involved in Methodology

Step 1: Modeling of connecting rod using 3D modeling software.
Step 2: Finite element modeling of the connecting rod
Step 3: Analysis of connecting rod using ANSYS software.

i. Element selection
ii. Discretization
iii. Mesh generation.

Step 4: Finite element static analysis.

4 LOADS IN A STATIC ANALYSIS

Static analysis is performed to determine the stresses, strains, and forces in structures or components caused by operating loads and inertia loads

- Externally applied forces
- Steady-state inertial forces (such as gravity and rotational velocity)
- Imposed (non-zero) displacements

Procedure for a Analysis

The overall equilibrium equations for linear structural static analysis are:

- Build the model
- Apply loads and obtain the solution
- Review the results

$$[K]\{u\} = \{F\}$$

Here mean stress theory called Gerber's theory is used, since this theory is only prescribed for ductile materials.

5. FINITE ELEMENT ANALYSIS OF THE CONNECTING ROD

5.1 METHODOLOGY

Following are the process by which the analyzing processes of connecting rod is done.

- Modeling using solidworks
- Importing to ANSYS Workbench
- Generating Meshing
- Applying material properties
- Plotting the result

5.2 Modeling of the connecting rod

The modeling is done using solidworks with the help of standard dimensions that we got through the careful review.

Fig 2 Model of the connecting rod

5.3MESH DETAILS

The meshing details of the elements were given below

Element size	1mm
Minimum edge length	0.01mm
Nodes	395031
Elements	232137

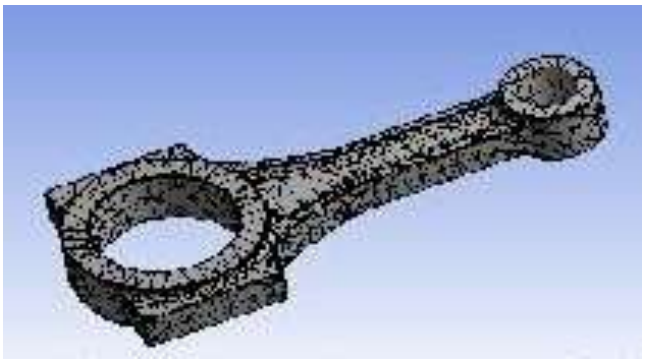

Fig 3 Meshed Solid Model

5.4 MATERIAL PROPERTIES

The material called **Carbon steel and Al Alloy** is taken, and their properties were given below

Properties	Carbon steel	Al Alloy
Density	7850 kg/m^3	2770 kg/m^3
Poisson's ratio	0.30	0.33
Yield Strength	573.11Mpa	750 Mpa
Young's modulus	211Gpa	73.1 Gpa
Tensile Strength	965.5 Mpa	280 Mpa

6 STATIC ANALYSIS RESULTS

6.1 EQUIVALENT STRESS

The equivalent stress of carbon steel and Al alloy is shown below

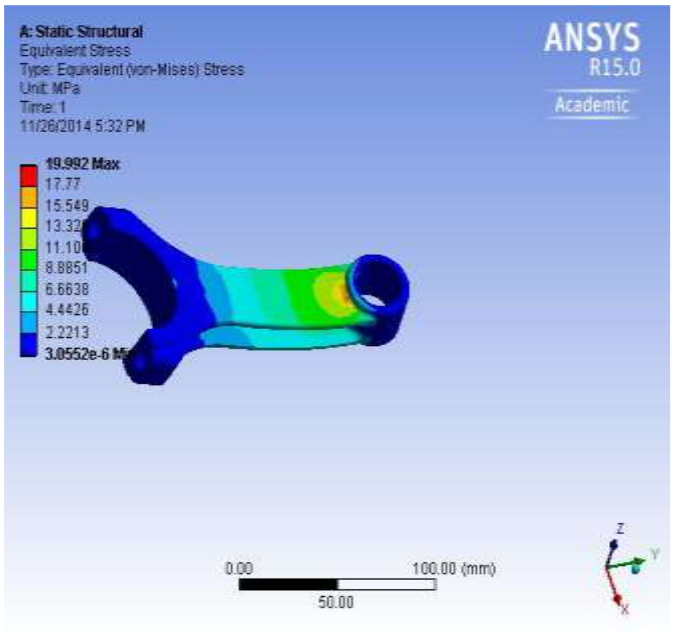

Fig 4 Equivalent Stress of Carbon steel

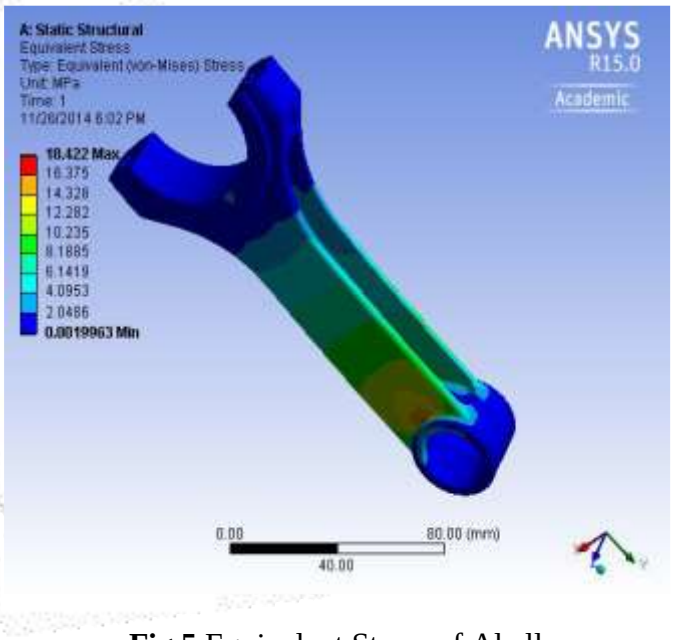

Fig 5 Equivalent Stress of Al alloy

6.2 EQUIVALENT STRAIN

The equivalent strain of carbon steel and Al alloy is shown below

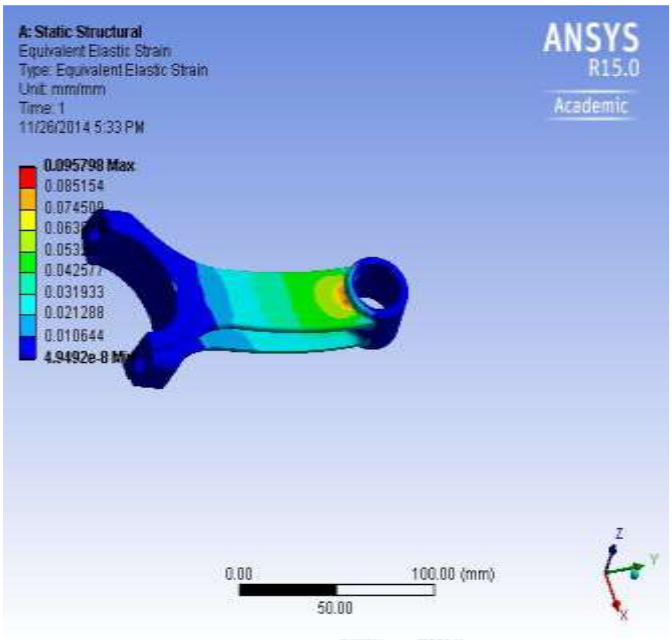

Fig 6 Equivalent Stress of Carbon steel

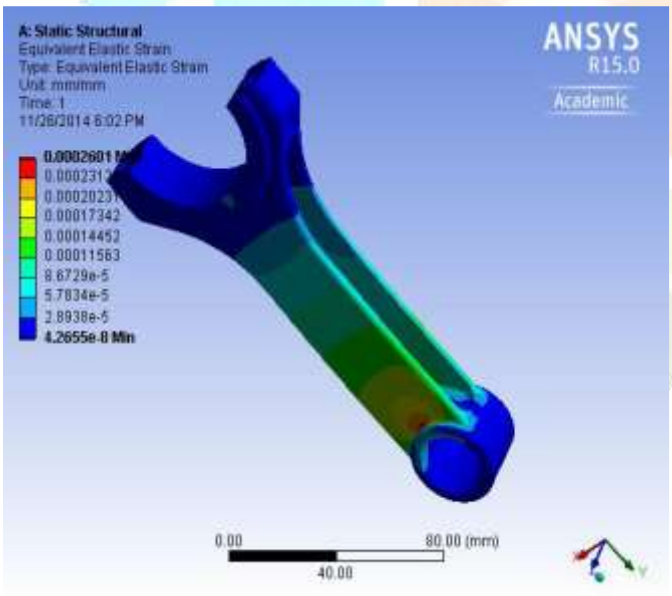

Fig 7 Equivalent Strain of Al alloy

Material	Equivalent Stress	Equivalent Strain
Carbon steel	19.82Mpa	0.095
Al alloy	18.22Mpa	0.002

7 CONCULSION

The connecting rod has been modeled and analyzed using ANSYS WORKBENCH.

The Corresponding stress and strain of the material is given below which states that carbon steel material stands for the maximum stress and strain and had the better property compared to the aluminum alloy steel.

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