

Experimental & Analysis of Connecting Rod Optimization for Weight Reduction

Prof. N. D. Patil
Assistant Professor
PVPIT Budhgaon

Prof. P. P. Awate
Assistant Professor
PVPIT Budhgaon

Prof. S. P. Shinde
Assistant Professor
PVPIT Budhgaon

Abstract

Connecting rods are widely used in a variety of engines such as in-line engines, V-engines, opposed cylinder engines, radial engines, and oppose-piston engines and in compressors. The connecting rod is an integral component of internal combustion engine and compressor. It acts as a linkage between piston and crankshaft. The connecting rod has some numbers of zones, namely, the small end (also called piston pin end), the central shank (I-cross-section) and the big end (also called as crank pin end). The connecting rod is a pin is jointed in which more weight is concentrated towards the big end. To study this property, the location of the center of gravity point of connecting rod lies more towards the big end. The connecting rod can be make either by casting, powder metallurgy or forging. The connecting rods are widely manufactured of forged steel, but can be made of aluminum for lightness and the ability to absorb high impact at the expense of durability or titanium for a combination of strength and lightness at the expense of affordability for high performance of engines, or of cast iron.

Keywords: Analysis of Connecting Rod Optimization, Connecting Rod Optimization for Weight Reduction

I. INTRODUCTION

A. Objectives

- Modeling current connecting rod.
- Analyzing for stresses and deformation.
- Topological optimization for the model.
- Results from topological optimization will be implemented on existing model.
- Analyzing for stresses and deformation on optimized model.
- Machining the existing connecting rod as per optimization result.
- Finding high strain portion from CAE software.
- Mounting strain gauge on same portion.
- Preparing fixtures to hold connecting rod for experimental testing.
- To conduct test on Universal Testing Machine to find stress and deflection of existing connecting rod.
- Correlating results of both CAE and experimental.

B. Connecting Rod

Forces existing on the connecting rod, the various forces acting on the connecting rod are as follows:

- Force on the piston due to gas pressure and inertia of the reciprocating parts.
- Force due to inertia of the connecting rod or inertia bending forces.
- Force due to friction of the piston rings and of the piston.
- Force due to friction of the piston pin bearing and the crankpin bearing. In designing a connecting rod, the following Dimensions are required to be determined.
- Dimensions of cross-section of the connecting rod.
- Dimensions of the crankpin at the big end and the piston pin at the small end.
- Size of bolts for securing the big end cap.
- Thickness of the big end cap.

B. CAD Geometry of a exiting model in CATIYA

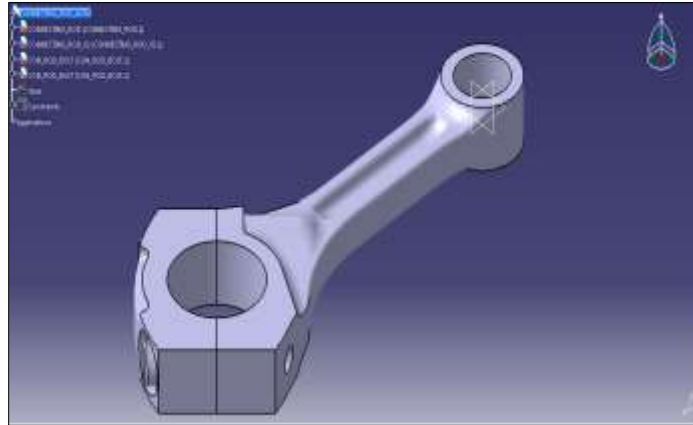


Fig. 3: CAD Model of Connecting Rod

C. CAD Geometry of an exiting model in ANSYS

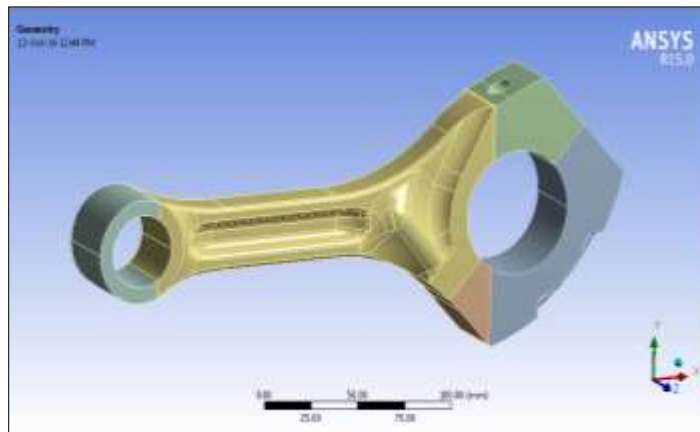


Fig. 4: CAD Geometry of an existing model

Table - 2

Properties of Mild Steel

Material	Mild Steel
Young's Modulus	200 GPa
Poisons Ratio	0.3
Density	7850 kg/m ³
Yield Strength	250 MPa

D. Meshing for exiting model in ANSYS

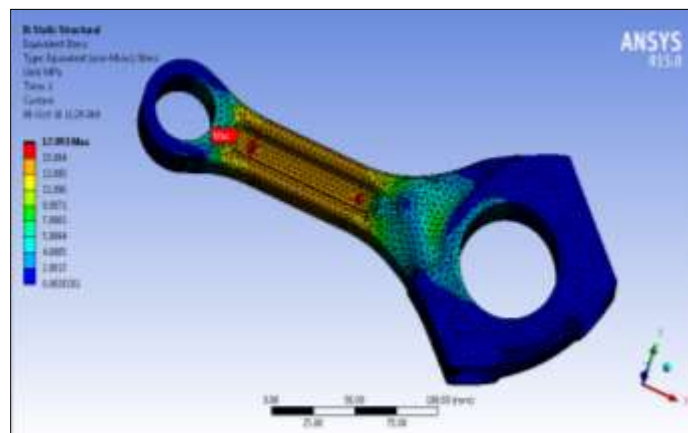


Fig. 5: Meshing Existing Model

Table – 3
Meshing Existing Model Element & Nodes

<i>Element type</i>	<i>Wedge</i>
<i>No. of Elements</i>	<i>82105</i>
<i>No. of Nodes</i>	<i>52748</i>

III. CONCLUSION

The modeling of connecting rod and FE Analysis has been presented. Topology optimization were analyzed to the connecting rod and according to the results, it can be concluded that the weight of optimized design is 11% lighter The results clearly indicate that the new design much lighter .Material optimization approach will be considered for future research.

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