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Comparative Design & Analysis of Combustion chamber of Two Stroke petrol Engine

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Abstract— The objective of the present study focusses on the design and analysis of the piston based on the structural and thermal considerations. The use of computational fluid dynamics and generation of a combustion model, has limited application in this analysis.

Index Terms— 3D CAD model, Ansys Analysis, Comparing Results, Piston Designs

1 INTRODUCTION

A piston is a component of reciprocating IC engines. It is the moving component with in a cylinder and is made of gas-tight by piston rings. In an engine, piston is used to transfer force from expanding gas in the cylinder to the crankshaft via a piston rod. Piston endures the cyclic gas pressure and the inertial forces at work, and this working condition may cause the fatigue damage of the piston, such as piston side wear, piston head cracks and so on. So there is a need to optimize the design of piston by considering various parameters in this project the parameters
selected are analysis of piston by applying pressure force acting at the top of the piston and thermal analysis of piston at various temperatures at the top of the piston in various strokes. This analysis could be useful for design engineers for modification of piston at the time of design.

Piston, a component of reciprocating engines, reciprocating pumps, gas compressors and pneumatic cylinders, is the moving component that is contained by a cylinder. In an Internal Combustion (IC) engine, it is acted upon by the pressure of the expanding combustion gases in the combustion chamber and the motion is transmitted to through the piston-connecting rod assembly to the crankshaft. A piston is a major component in an IC engine and its design/analysis is based on structural and thermal considerations. The use of the Computer Aided Modelling software CATIA and SOLIDWORKS is also attributed to the design of an IC engine component viz. According to them, by altering the design parameter e.g. thickness or design of the crown, an optimal solution to the existing design could be obtained.

The objective of the present study focusses on the design and analysis of the piston based on the structural and thermal considerations. The use of computational fluid dynamics and generation of a combustion model, has limited application in this analysis.

2 Methodology

Initially, we have gone through the literature and read some articles available online related to piston design and analysis than after discussing with the project guide we have confirm the project. Firstly, we created the piston model with flat surface with the help of CATIA and SOLIDWORKS and imported the model to the ANSYS software for analysis and get the final results.

Same as for the second design, we prepared the model and import it to the ANSYS for analysis. After the analysis we get the final report, than after getting both the reports we compared the results of both the piston models and make the final report.

2.1 Proposed Method

1. **Analysis of literature and review some articles.**
2. **After discussion with guide we have confirm the project.**
3. **Create CAD design 1 of piston.**
4. **Import the design 1 to the Ansys .**
5. **Analys the final result of design 1.**
6. **Create CAD design 2 of piston.**
7. **Import the design 2 to the Ansys .**
8. **Analys the final result of design 2.**
9. **Compare the result of both the models and make final report.**

3 GEOMETRIES

3.1 CAD Model 1

CAD model 1 preparation in SOLIDWORKS software

Dimension of piston, top radius 189mm, bottom line 9.5 mm upper vertical 5 mm then horizontal 4 mm then vertical 2 mm horizontal 4mm.

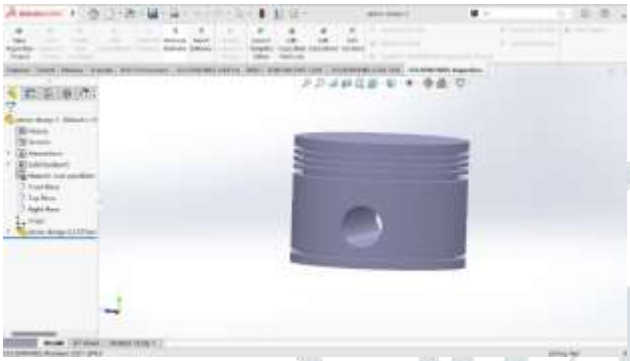

Fig 1

3.2 CAD Model 2

CAD model 1 preparation in SOLIDWORKS software: -

Dimension of piston, top radius 189mm, bottom line 9.5 mm upper vertical 5 mm then horizontal 4 mm then vertical 2 mm horizontal 4mm and piston crown concave shape of 0.5 mm

Fig 2

4. Importing to Ansys

Importing the model 2 to the ANSYS software for analysis and performed different operation on the design with the help of static structural method i.e.,

- Total Deformation
- Maximum Shear Elastic strain
- Minimum Principle Elastic Strain
- Maximum Principle Stress

4.1. Model 1 :

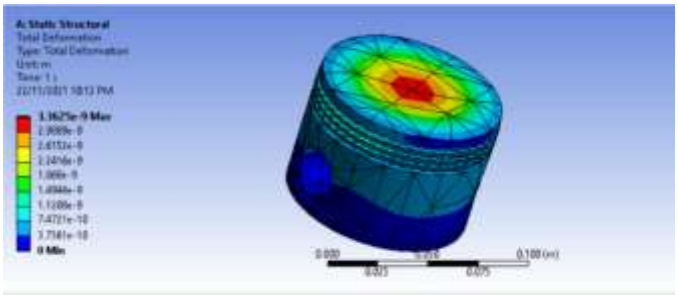

Fig 1.1

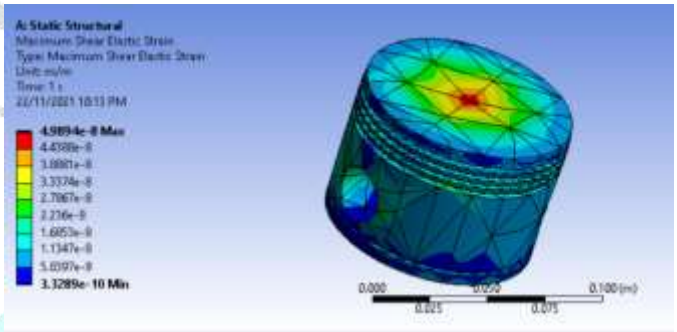

Fig 1.3

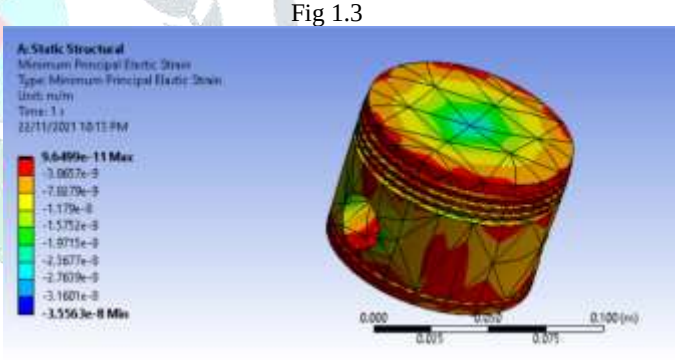

Fig 1.2

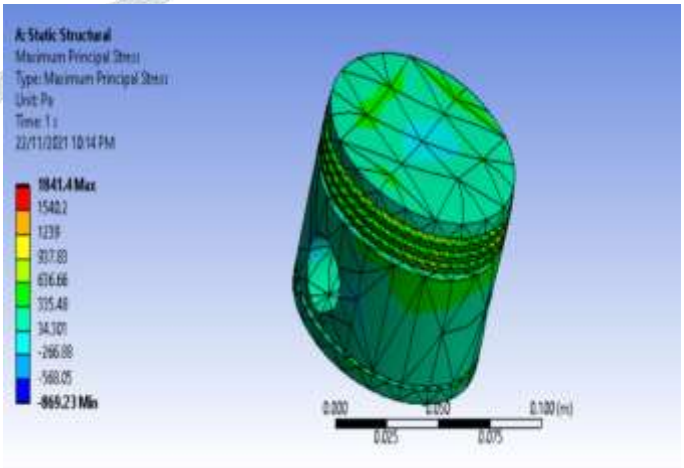

Fig 1.4

4.2. Model 2 :

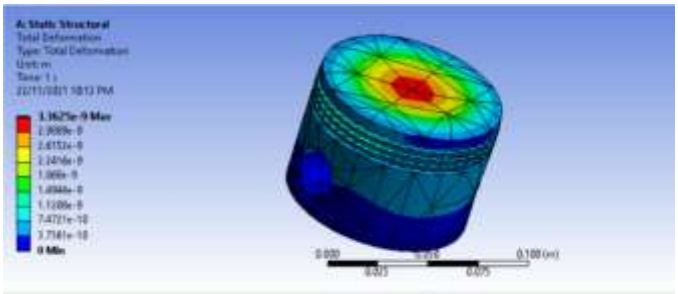

Fig 2.1

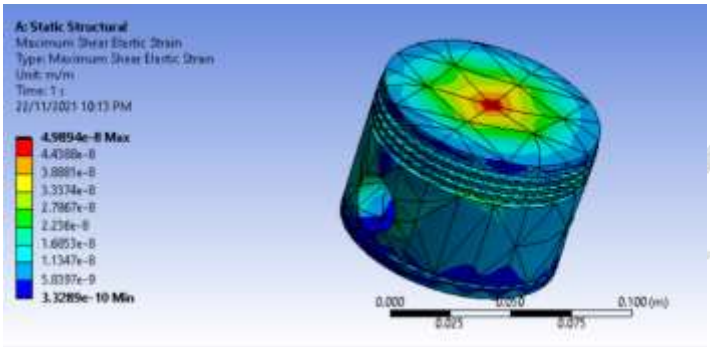

Fig 2.2

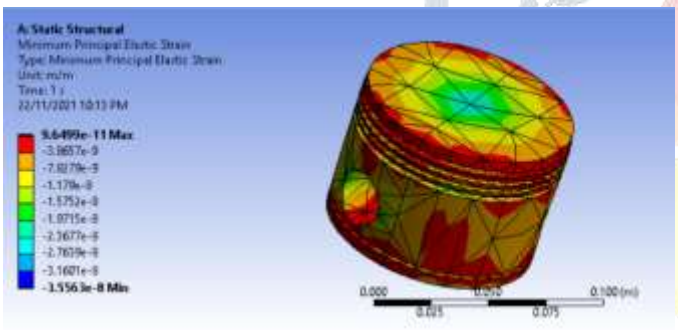

Fig 2.3

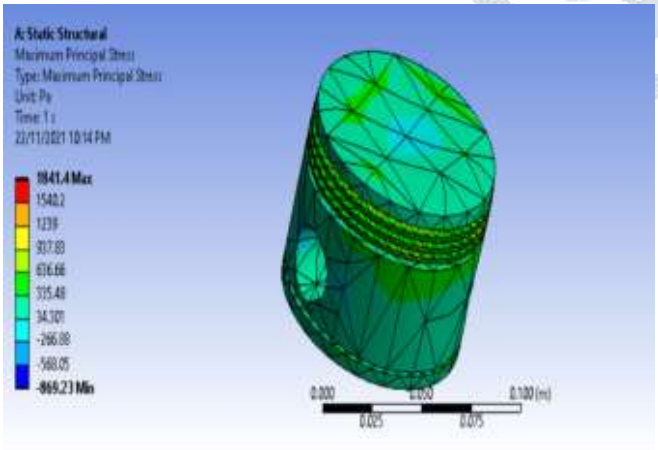

Fig 2.4

5. Result Comparison

Result_1

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
6.904e+010	0.33	6.7686e+010	2.5955e+010	23

Result 2

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
7.904e+010	0.33	7.7686e+010	2.5955e+010	23

With the comparison we can see that the model 2 performance is better than the model 1 and gives better results than the model 1 in different tests performed in ANSYS

6. CONCLUSIONS

Comparing the results of First design and second designs it is concluded that by modifying the piston crown region performance of the piston could be
improved without a major change in structural performance. Piston deformation could be reduced up to a limit, beyond which a further reduction would result in distortion of the piston. However, of the two designs. It is possible to further improve the analysis results by simulating the actual conditions using a combustion model of the engine.

• These is confirmed by the analysis that the change in the design of the piston crown can make the piston performance better and increase the life span of the piston.

• The new model also works longer with no maintenance and gives good service.

With the help of additive manufacturing process, the manufacturing of the product become very easy, cost effective and reliable. And the size of the tools is very good i.e. it takes less space and become easy to use.

7. ACKNOWLEDGMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and we are extremely fortunate to have got this all along the completion of our project work. Whatever we have done is only due to such guidance and assistance and we would not forget to thank them.

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