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STATIC STRUCTURAL ANALYSIS OF BIMETALLIC PISTON USING DIFFERENT MATERIAL COMBINATIONS

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ABSTRACT- In today's world scenario, there is tremendous development in the field of automobile and every day, there is a new invention to do better out transport facility. Also company may concentrated on very important fact, service after sale it is consider spinal code in the field of automobile. Most of the company may spend their 50% of their income on research and development to make their vehicle better. Previously this task is very expensive in absence of recent technology, for testing and design like CAD/CAM and the analysis software like Ansys software, the prediction is very difficult about any product. Also CFD play major role for the aerodynamic designing for the automobile. Using Different CAD/CAM software one can design the product as per the requirement, and can also manufacture easily on CNC machine. This project work is based on bi-metallic component used in automobile; there are lots of bimetallic components used in automobile application. In this case, we are studying the scope of different material combinations for manufacturing bimetallic pistons. In these study two different models of pistons – Regular and Bi-Metallic are studied under engine operating conditions with different material combinations, for model Development we use Catia V5 and for Analysis we use Ansys 15.0
Key words – Bimetallic Materials, Automobile, ansy

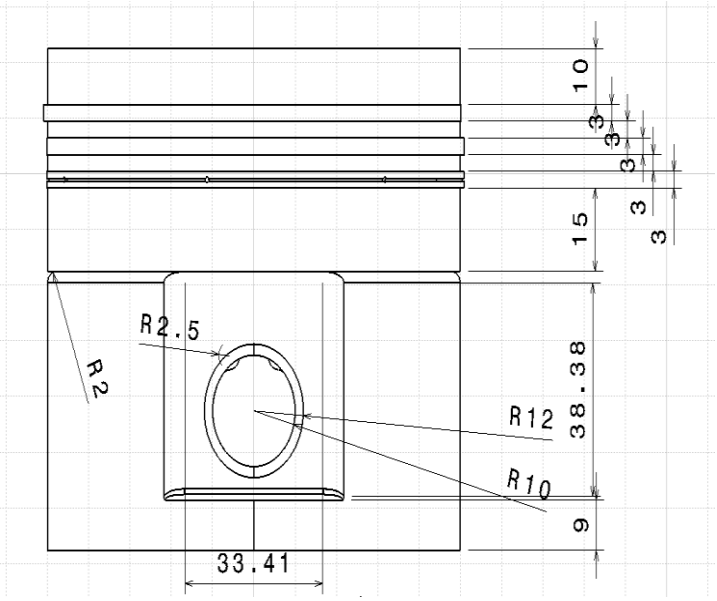
INTRODUCTION

Internal Combustion Engine

The internal combustion engine is an engine in which the burning of a fuel occurs in a confined space called a combustion chamber. This exothermic reaction of a fuel with an oxidizer creates gases of high temperature and pressure, which are permitted to expand. The defining feature of an internal combustion engine is that useful work is performed by the expanding hot gases acting directly to cause movement, for example by acting on pistons, rotors, or even by pressing on and moving the entire engine itself.

Piston

Pistons are usually equipped with piston rings. These are circular metal rings that fit into grooves in the piston walls and



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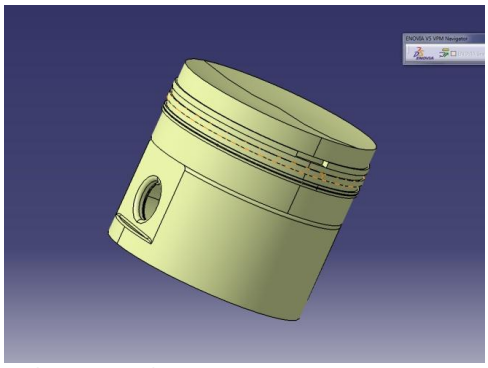
assure a snug fit of the piston inside the cylinder. They help provide a seal to prevent leakage of compressed gases around the piston and to prevent lubricating oil from entering the combustion chamber.

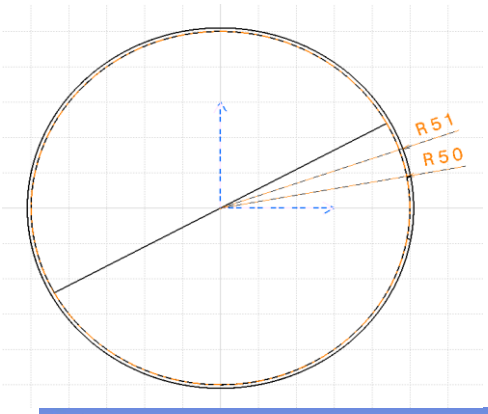
Bimetals

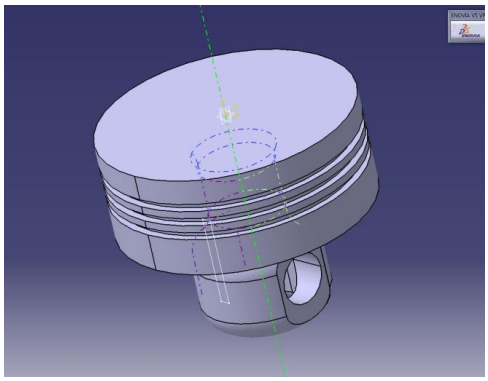
Bimetal refers to an object that is composed of two separate metals joined together. Instead of being a mixture of two or more metals, like alloys, bimetallic objects consist of layers of different metals. Tri-metal and tetra-metal refer to objects composed of three and four separate metals respectively.

Drafting



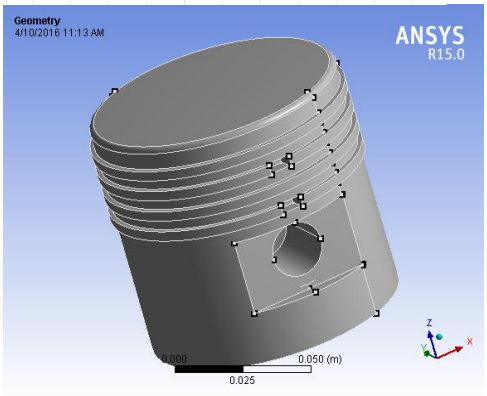
MODELLING



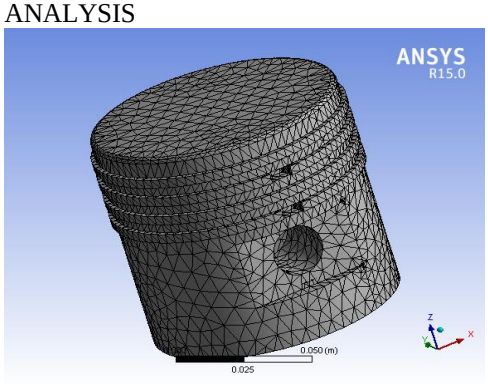


3D Model of Piston

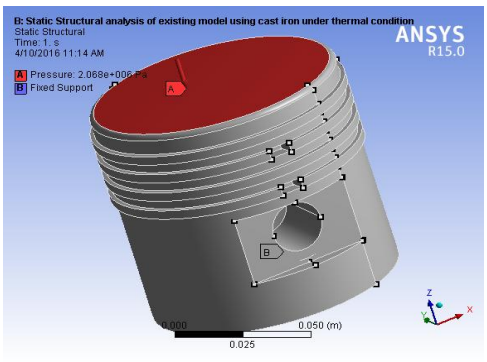
ANALYSIS



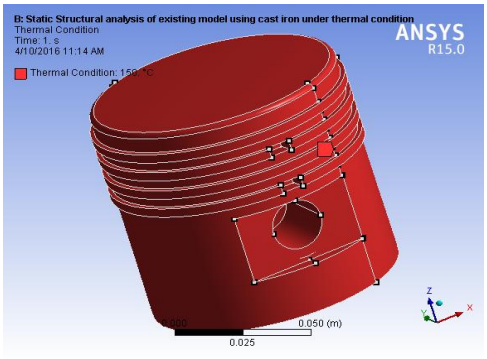
GEOMETRY



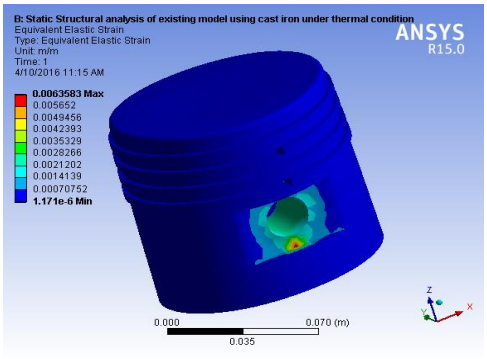
MESHED MODEL



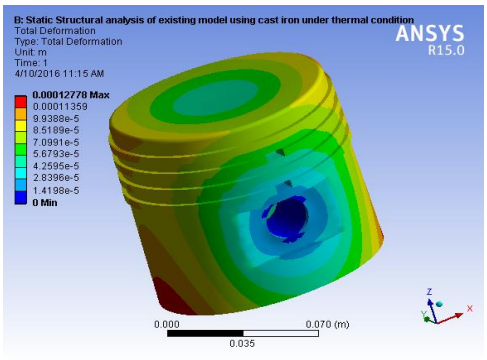
PRESSURE INPUT



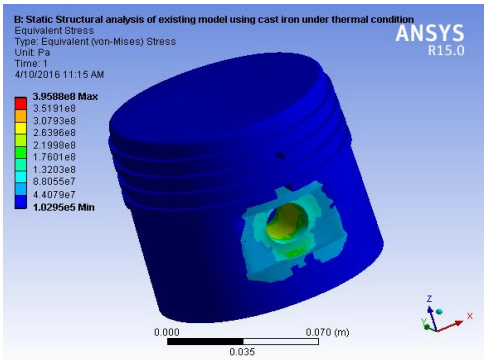
THERMAL CONDITIONS



STRAIN



TOTAL DEFORMATION



STRESS

REPORTS

Existing model	Total Deformation (m)		Equivalent Elastic Strain (m/m)		Equivalent (von-Mises) Stress (Pa)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Cast Iron	0	1.28E-04	1.17E-06	6.36E-03	1.03E+05	3.96E+08
Titanium	0	1.07E-04	6.45E-07	5.83E-03	61905	3.38E+08
Aluminium	0	2.74E-04	2.97E-06	1.21E-02	1.49E+05	5.79E+08
Zirconium	0	6.33E-05	5.92E-07	3.32E-03	91460	3.79E+08

Table-1: Table showing the structural analysis results for existing model

Bimetallic model	Total Deformation (m)		Equivalent Elastic Strain (m/m)		Equivalent (von-Mises) Stress (Pa)	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Cast Iron	0	1.14E-04	-1.88E-05	8.36E-03	438.44	1.50E+09
Titanium	0	1.02E-04	6.97E-09	8.59E-03	371.84	1.50E+09
Aluminium	0	2.05E-04	8.64E-09	9.82E-03	289.63	1.50E+09

Zirconium	0	2.05E-04	4.82E-09	8.00E-03	362.6	1.50E+09

Table-2: Table showing the structural analysis results for bimetallic model

CONCLUSION

Future Scope

The study on this project is done using only four materials i.e., Cast iron, Titanium, Aluminum alloy and Zirconium. So, study can be further extended by considering different materials for the study. Also, the bimetals used in this study can be replaced by different Metal matrix composites.

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