Design and FE Analysis of Diesel Engine Piston

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Abstract: **Piston is a component of reciprocating motors, reciprocating pumps, gas compressors and pneumatic cylinders, among other similar mechanisms. It is a moving component that is enclosed by a cylinder and is made of rigid gas piston rings. The piston converts the energy of the growing gases into mechanical energy. Drive the plunger in a cylinder liner or sleeve. Pistons are usually made of aluminum or cast-iron alloys. The main goal of the project is to design a 1300cc diesel engine piston for two cast iron and aluminum alloys. The relief models of the piston are designed using PRO-E. Designs are assessed by structural and thermal analysis using pressure and temperature respectively. The result is evaluated by determining the voltage, displacement, thermal gradient and thermal flow to determine the best design of the piston. Structural and thermal analysis is performed in ANSYS.**

Keyword: **Two-Wheeler Piston; CREO; ANSYS; Aluminum Alloy;**

I. INTRODUCTION

1.1 PISTON: In each engine, the piston plays an important role in working and producing results. The piston forms a guide and for the short distance carries the connecting rod and sends the blast force to the cylinder to the crankshaft through the connecting rod. Piston is the only active component and most important to the engine. The piston is one of the most important parts of the engine, but many of them are behind the stage, and carry out important work to transfer combustion-derived energy inside the combustion chamber to the crankshaft. Simply put, it carries the explosive energy of the combustion process to the crankshaft [1]. Apart from the crucial work you do above, there are some other features that the piston always does. They form a kind of seal between the combustion chambers formed inside the cylinders and the crank.

1.2 Construction of Piston: The top is known by many names such as crown, head or ceiling and thicker than the bottom. The lower part is known as dress. There were grooves made to accommodate pressure rings and oil rings. The groove, made for the oil ring, is wider and deeper than the grooves designed for the washer. The oil ring reduces excess oil flowing through the oil in the piston and prevents access to the combustion chamber, but helps to soften the gums to some extent. In some designs, the oil ring is provided below the top of the pin, called the space between the grooves in the name of the land. The piston diameter always remains smaller than the cylinder because the piston reaches a temperature higher than the cylinder wall and increases during the engine. Know the distance between the cylinder wall and the piston by removing the piston.

1.3 Materials for the Piston: - Cast aluminum alloy steel and cast iron etc. are the general material used for the piston internal combustion engine. Cast iron presses are not suitable for high speed engines because of their weight more. These pistons have greater strength and resistance to wear. The alloy made of aluminum alloy lighter, and provides operating temperatures much lower because of the high thermal conductivity. The expansion coefficient of this design of the piston [2][3]. The piston dirty to take fuel from the attempted bombing that produce fuel combustion on the crankshaft work (the big heavy part of the engine that spins due to piston movement). It takes tremendous pressure (about 1,000 pounds per square inch), despite the intense heat that you need. Now, when designing suckers, weight is a serious factor. Imagine the scenario - on the one hand you will need to pistons to pick up all the heat and pressure, but on the other hand still want to Adlakha.

II. LITERATURE REVIEW

The piston is part of a car that has converted heat and pressure energy from fuel combustion into mechanical work. Piston engine is the most complex component among cars. This paper describes the design procedure for a piston for a 4-stroke petrol engine for hero-pro amplitude and analysis by comparing to the dimensions of the original piston used in the bicycle. The design procedure involves determining the different piston dimensions using an analytical method under maximum power conditions. In this paper, the mechanical effect of loading and loading is taken into account when determining the different dimensions. The basic data of the engine is

taken from the existing engine type hero - the hero's wonder.

III. RELEATED STUDY

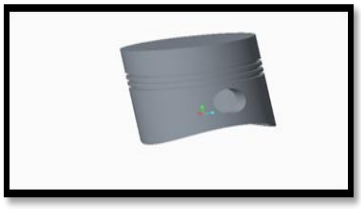
3.1 INTRODUCTION TO CREO: PTC CREO, pre-professional / engineer, is a three-dimensional collection of bundled software that is used to carry mechanical touch, animations, and CAD setup for corporate companies. It is one of the leading 3D CAD operations that includes a control-based control device. Using the parameters, scope, and capabilities to get your brand can promote development, as well as the same point. The prescription from Pro / ENGINEER Wildfire is understood to be CREO in 2010 [4]. The barter is based on a doctrine developed by the Technology Parameters Company (PTC) at any beginning to replace the injured of its followers with geographic crops, suggesting one in the plan, namely 2D, orthographic welding Fresh concept work.

3.2 MATHEMATICAL MODELLING: Of the devise from the un-spoiled miasma generator (get) there are actually even handy as a minimum trio easy method to enlarge melodramatic expertise. those are thusly:

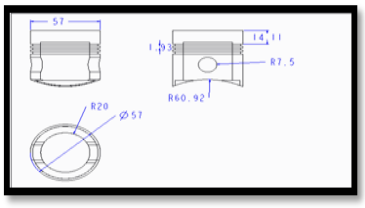
- mixed biological-rhythm applications,
- non-conventional methods and resources epithetical cutlass fresh (mixed steam/air) moreover
- extend smart transformer basin warmth (tit) through thirst-quenching powerful generator.

This actual analytical work of art towards the steam reproduction weapon individually managed the melodramatic method 3 which is through a melodramatic report in the fresh opera in reference to the inside of the frozen diesel blades. The dramatic stimulus may be unevenly unequaled by 1,800 kg with a sudden increase in curbing the cold in the walls of the devices [5]. The latest order in order to provide you with further breakdown and further expansion of the stunning diesel, the amazing maximum cold in the blades / rotors should be 1300 kb.

3D MODEL

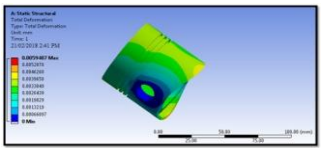


2D MODEL

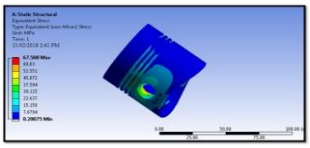


3.3 MATERIAL – STEEL

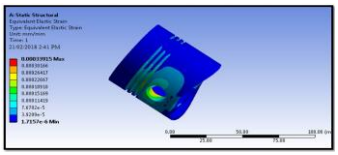
TOTAL DEFORMATION



VON-MISES STRESS

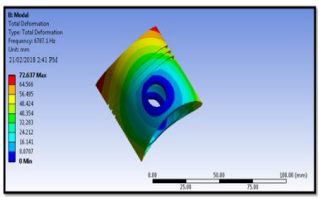


VON-MISES STRAIN

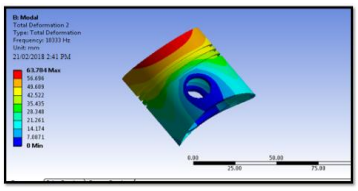


3.4 MODAL ANALYSIS OF DIESEL ENGINE PISTON

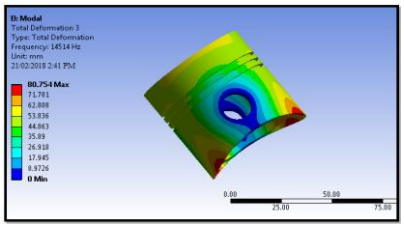
TOTAL DEFORMATION1



TOTAL DEFORMATION2



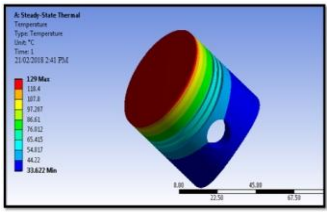
TOTAL DEFORMATION3



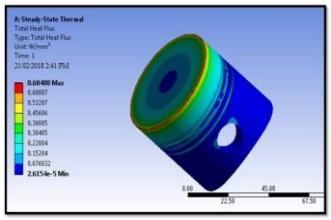
3.5 THERMAL ANALYSIS OF DIESEL ENGINE PISTON

MATERIAL – STEEL

TEMPERATURE



HEAT FLUX



IV. RESULT TABELS

4.1 STATIC ANALYSIS

MATERIAL	DEFORMATION(mm)	STRESS(N/mm2)	Strain
Steel	0.0059487	67.508	0.00033915
Cast iron	0.01817	67.771	0.00061901
Aluminum alloy	0.016742	67.096	0.00094959

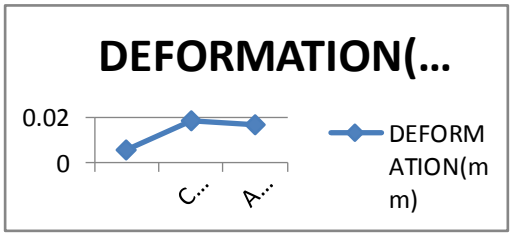
4.2 MODAL ANALYSIS

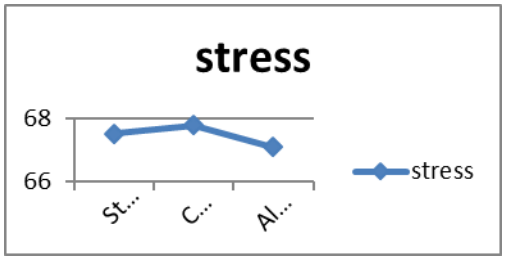
MATERIAL	frequency (hz)	deformation1` (mm)	frequency (hz)	deformation2(mm)	frequency (hz)	deformation 3(mm)
Steel	6787.1	72.637	10333	63.784	14514	80.754
Cast iron	5290	75.886	8010.2	66.629	11266	84.467
Aluminum alloy	6740.1	122.17	10349	107.28	14511	135.5

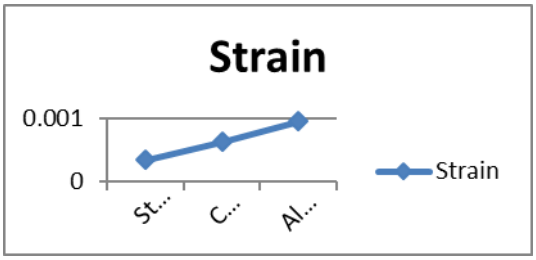
4.3 Thermal analysis

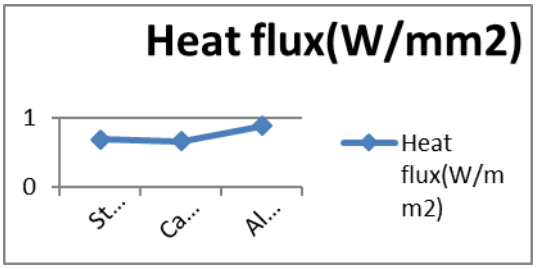
MATERIAL	Temperature (0C)	Heat flux(W/mm^2)
Steel	129	0.68408
Cast iron	129	0.65715
Aluminum alloy	129	0.88043

V. GRAPHS









VI. CONCLUSION

Physically, chemically and mechanically aluminum is a metal such as steel, copper, copper, zinc, lead or titanium. It can be melted, cast, molded, shaped like such metals and connected to electricity. In fact, my manufacturing and processing methods are often used as steel. Aluminum is a very light metal with a specific weight of 2.7 g / cm3, about one third of steel. For example, the use of aluminum in cars reduces energy consumption and weight while increasing load capacity. Its strength can be adjusted according to the desired application by changing the composition of its alloys. By observing static analysis, stress values are lower for aluminum alloy materials than steel and iron. Through thermal analysis, heat flow levels are more than aluminum alloys compared to steel and cast iron. It can

therefore be deduced that aluminum alloys are a better material for pistons.

VII. REFERENCES

[1]. Sl.No -1 Auther- Ever J. Barbero . Book Title- Interduction To Composite Material Design. Year – 2011. (Page- 1to 21).

[2]. Sl.No-2 V.D.A.Lessios . Book Titel- Structural Desing Of An Advanced Composite For A Aeronautical Hydralic Actuator. Vol.No 2. Page No-52 To 86

[3]. Srecko Manasijevic, Radomir Radisa, Srdjan Markovic,Zagorka AcimovicPavlovic , Karlo Raic, "Thermal analysis and microscopic characterization of the piston alloy AlSi13Cu4Ni2Mg", Intermetallics 19 (2011) 486 – 492. 2. 2. Gudimetal P, Gopinath C.V, "Finite Element analysis of Reverse Engineered Internal Combustion Engine Piston",AIJSTPME (2009) 2(4): 85-92.

[4]. Esfahanian, A. Javaheri, M. Ghaffarpour, "Thermal analysis of an SI engine piston using different combustion boundary condition treatments", Applied Thermal Engineering 26 4. (2006) 277 5

[5]. C.H. Li., Piston thermal deformation and friction considerations, SAE Paper 820086, 1982

