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DESIGN AND ANALYSIS OF FIN BODY WITH CROSS SECTIONAL FINS

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ABSTRACT: The Engine cylinder is one of the major automobile components, which is subjected to high temperature variations and thermal stresses. In order to cool the cylinder, fins are provided on the cylinder to increase the rate of heat transfer. By doing thermal analysis on the engine cylinder fins, it is helpful to know the heat dissipation inside the cylinder. The principle implemented in this project is to increase the heat dissipation rate by using the invisible working fluid, nothing but air. We know that, by increasing the surface area we can increase the heat dissipation rate, so designing such a large complex engine is very difficult. The main purpose of using these cooling fins is to cool the engine cylinder by air. The main aim of the project is to analyze the thermal properties by varying cooling fluid, material and fin geometries of cylinder fins. Parametric models of cylinder with fins have been developed to predict the thermal behavior. The models are created by the geometry, rectangular, circular and arc type geometries. Cooling fluids used in this thesis is air, oil. The 3D modeling software used is CREO. Thermal analysis is done on the cylinder fins to determine variation in temperature distribution. The analysis is done using ANSYS. Transient thermal analysis determines temperatures and other thermal quantities that vary over time.

Keywords: Fins, Design, Analysis and Heat transfer enhancement. ANSYS Work Bench

1 INTRODUCTION

1.1 Fins: A fin is a surface that extends from an object to increase the rate of heat transfer to or from the environment by increasing convection. The amount of conduction, convection, radiation of an object determines the amount of heat it transfers. Increasing the temperature difference between the object and the environment, increasing the convection heat transfer coefficient, or increasing the surface area of the object increases the heat transfer. Sometimes it is not economical or it is not feasible to change the first two options. Adding a fin to the object, however, increases the surface area and can sometimes be economical solution to heat transfer problems. Circumferential fins around the cylinder of a motor cycle engine and fins attached to condenser tubes of a refrigerator are a few familiar examples.

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Fig 1.1 fins

1.2 Principles: Most internal combustion engines are fluid cooled using either air (a gaseous fluid) or a liquid coolant run through a heat exchanger (radiator) cooled by air. Marine engines and some stationary engines have ready access to a large volume of water at a suitable temperature. The water may be used directly to cool the engine, but often has sediment, which can clog coolant passages, or chemicals, such as salt, that can chemically damage the engine. Thus, engine coolant may be run through a heat exchanger that is cooled by the body of water.

2. AIM OF THE PROJECT: The main aim of the project is to design cylinder with fins for a 150cc engine, by changing the thickness of the fins, changing the cooling fluid and to analyze the transient thermal properties of the fins. Analyzation is also done by varying the materials of fins. Present used material for cylinder fin body is Aluminum alloy 204 which has thermal conductivity of 110 – 150 w/mk.

Our aim is to change the material for fin body by analyzing the fin body with other materials and also by changing the thickness. Geometry of fins – Rectangular Thickness of fins – 3mm and 2.5mm Materials – Aluminum Alloy A204, Aluminum Alloy 6061, Magnesium alloys. Cooling Fluid – Air, Oil

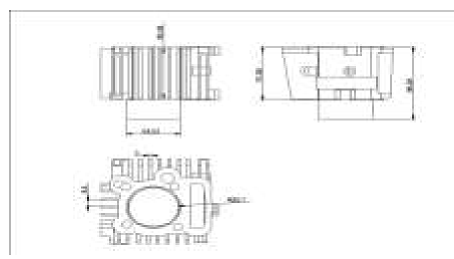
2.1 STEPS INVOLVED IN THE PROJECT

1. Modeling
2. Theoretical calculations
3. Transient thermal analysis

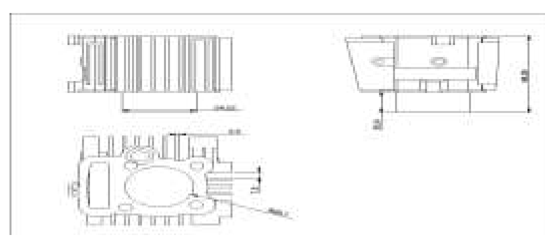
For modeling of the fin body, we have used **Pro-Engineer** which is parametric 3D modeling software. For analysis we have used ANSYS, which is FEA software.

2.2 2D DRAWINGS

3mm Thickness



2.5mm Thickness



2.3 CIRCULAR FIN

MATERIAL - ALUMINUM ALLOY 6061

TEMPERATURE

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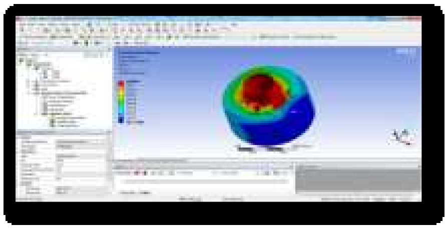
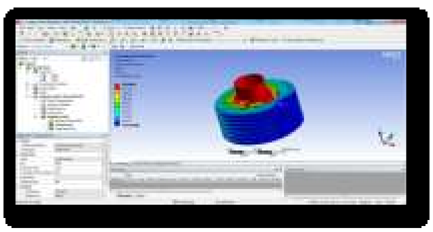
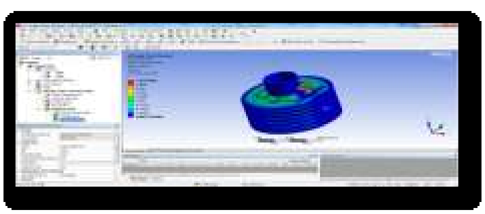


2.4 MATERIAL - ALUMINUM ALLOY

TEMPERATURE

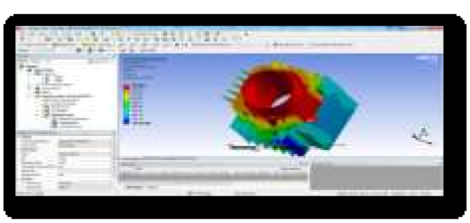


HEAT FLUX



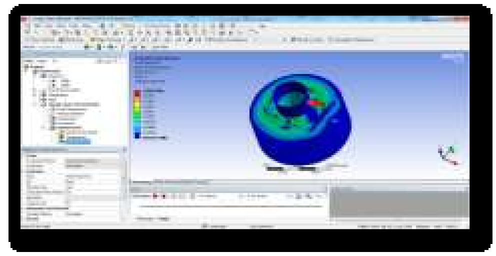
ARC TYPE FIN

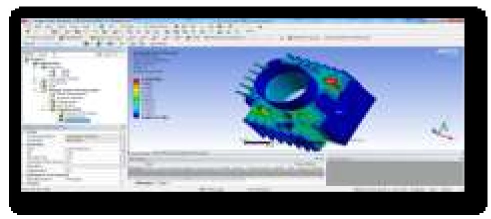
2.5 MATERIAL - ALUMINUM ALLOY 6061 TEMPERATURE



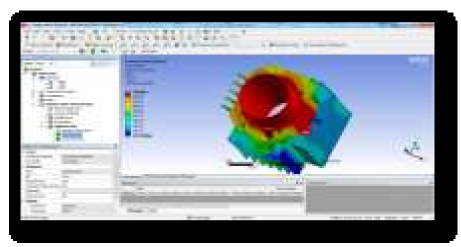
HEAT FLUX

HEAT FLUX





2.6 MATERIAL - ALUMINUM ALLOY TEMPERATURE



HEAT FLUX

2.7 FLUIDS- AIR CASE-1: RECTANGULAR FIN

MATERIAL - ALUMINUM ALLOY 6061 TEMPERATURE

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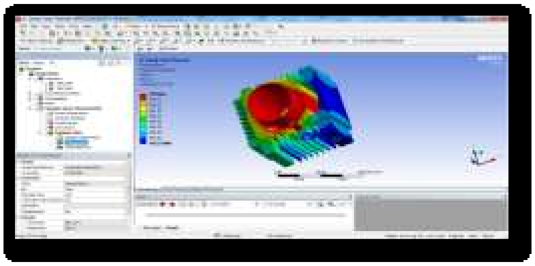
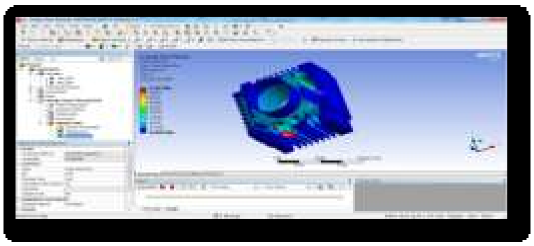
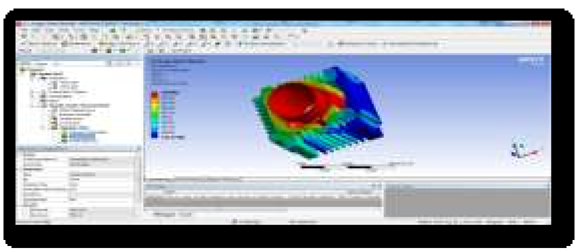


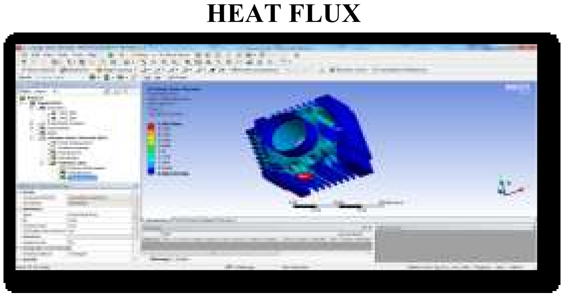


2.8 MATERIAL - ALUMINUM ALLOY

TEMPERATURE



HEAT FLUX



2.9 COMPARISON OF DIFFERENT MODELS WITH DIFFERENT MATERIALS

FLUID	MODELS	MATERIALS	TEMPERATURE (K)		Heat flux(w/mm^2)
			Max.	Min.	
Oil	Rectangular	Aluminum alloy 6061	550	447.9	2.9494
		Aluminum alloy	550	423.34	2.6816
		Cast iron	550	340.67	1.579
	Circular	Aluminum alloy 6061	550	367.27	2.8642
		Aluminum alloy	550	345.64	2.3237
		Cast iron	550	303.03	0.9229
	Arc type	Aluminum alloy 6061	550	441.03	1.9102
		Aluminum alloy	550	415.58	1.6765
		Cast iron	550	334.89	0.90213
Air	Rectangular	Aluminum alloy 6061	550	362.15	6.3662
		Aluminum alloy	550	341.37	5.3022
		Cast iron	550	301.75	2.341
	Circular	Aluminum alloy 6061	550	310.48	4.1587
		Aluminum alloy	550	303.24	3.111
		Cast iron	550	295.47	1.09
	Arc type	Aluminum alloy 6061	550	354.46	3.7025
		Aluminum alloy	550	334.74	3.0316
		Cast iron	550	299.98	1.257

3 CONCLUSION

In this thesis, a cylinder fin body for a 150cc motorcycle is modeled using parametric software CREO. The original model is changed by changing the fin geometries (rectangular, circular and arc type). In this thesis, two other materials are considered which have more thermal conductivities than

Aluminum Alloy. The materials are Aluminum alloy 6061 and aluminum alloy & cast iron. Thermal analysis is done for all the three materials. By observing the thermal analysis results, thermal flux is more for Aluminum alloy 6061 than other two materials and also rectangular fin, the heat transfer rate is increased. So we can conclude that using Aluminum alloy 6061 and taking rectangular fin geometry fluid air.

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