THERMAL ANALYSIS OF ENGINE CYLINDER WITH FINS USING ANSYS WORKBENCH

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Abstract:- The Engine cylinder is one of the major automobile component, which is subjected to high temperature variations and thermal stresses. In order to cool the cylinder, fins are provided on the surface of the cylinder to increase the rate of Heat transfer. By doing thermal analysis on the engine cylinder and fins around it, It is helpful to know the heat dissipation rate and Temperature Distribution inside the cylinder. 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 aim of the present project is to analyse the thermal properties like Directional Heat Flux, Total Heat Flux and Temperature Distribution by varying Geometry(Circular, Rectangular),material(Aluminium Alloy, Magnesium Alloy) and thickness of Fin (3mm,2mm) of an approximately square cylinder model prepared in SOLIDWORKS-2013 which is imported into ANSYS WORKBENCH-2016 for Transient Thermal analysis with an Average Internal Temperature and Stagnant Air-Simplified case as Cooling medium on Outer surface with reasonable Film Transfer Coefficient as Boundary Conditions.

Keywords:- Dissipation, Thermal conductivity, Film transfer coefficient, Internal Temperature, Stagnant Air-Simplified case, Boundary Conditions.

1. INTRODUCTION

As of late there has been incredible interest for elite, lightweight, reduced and practical warmth exchange parts. The blades are perceived as a standout amongst the best methods for expanding the warmth disseminated. The structure criteria of balances are distinctive for different applications, yet the essential concern is weight and cost. Thusly it is profoundly alluring to improve the measure of balances. The ideal measurements are those for which greatest warmth is scattered for a given weight or mass of the balance.

The best warmth exchange improvement can be accomplished by utilizing blades as components for warmth exchange surface region expansion. IC motor is a warmth exchange liquid to happen in the motors themselves, normally the consuming of fuel and air the oxygen substance of the air. Inside burning motors utilize warm transformation of the vitality of the fuel. In IC motor fuel vitality into thought process constrain.

What's more, subsequent to changing over the warming force supply overabundance warm should be expelled from the circle. Warm will move to the environment implies that a liquid with water and air. The Cylinder is the one of the significant segments in Motor, or, in other words high temperature varieties what's more, warm burdens. To cool the cylinder, blades are given on the surface of the cylinder to build the rate of warmth exchange rate.

Balances are Basically Mechanical structures which are utilized to cool different structures through the procedure of convection and conduction. Expanded blades are notable for improving the warmth move in IC motors. The development of air cooling framework is exceptionally less complex. In this manner it is critical for an air-cooled motor to use the blades adequately to acquire uniform temperature in the Engine cylinder.

An inner burning motor is a motor in which the ignition of a fuel happens in a burning chamber. Here, the extension of the high-temperature and high-weight gases created by burning applies coordinate power to segment of the motor, for example, cylinder, turbine cutting edges, or a spout. This power exchanges the segment over a separation, creating helpful mechanical vitality.

2. NATURAL AIR COOLING

In normal cause, larger parts of an engine remain exposed to the atmospheric air. When the vehicles run, the air at certain relative velocity impinges upon the

engine, and sweeps away its heat. The heat carried-away by the air is due to natural convection, therefore this method is known as Natural air-cooling. Engines mounted on 2-wheelers are mostly cooled by natural air.

As the heat dissipation is a function of frontal cross-sectional area of the engine, therefore there exists a need to enlarge this area. An engine with enlarge area will becomes bulky and in turn will also reduce the power by weight ratio. Hence, as an alternative arrangement, fins are constructed to enhance the frontal cross-sectional area of the engine. Fins (or ribs) are sharp projections provided on the surfaces of cylinder block and cylinder head. They increase the outer contact area between a cylinder and the air. Fins are, generally, casted integrally.

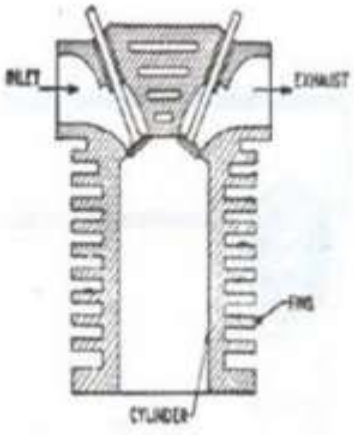


Fig 1. Natural air cooling

Fig 2. Automobile Fin

3. 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.

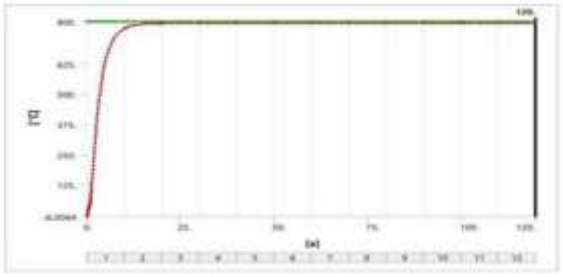
Thermal analysis calculates the temperature and heat transfer within and between components in your design and its environment. This is an important consideration of design, as many products and material have temperature dependent properties. Product safety is also a consideration—if a product or component gets too hot, you may have to design a guard over it.

Fig 3. Thermal analysis

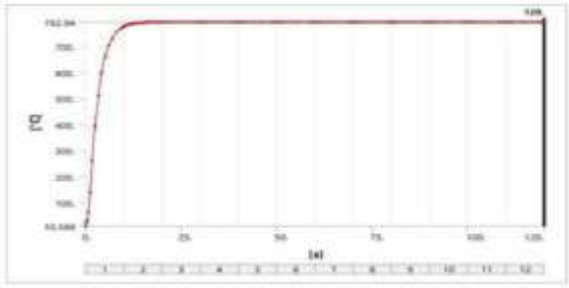
The heat flow through the components can be in a steady state (where the heat flow does not change over time) or transient in nature. The thermal analogy of a linear static analysis is a steady-state thermal analysis, while a dynamic structural analysis is analogous to a transient thermal analysis.

4. RESULTS

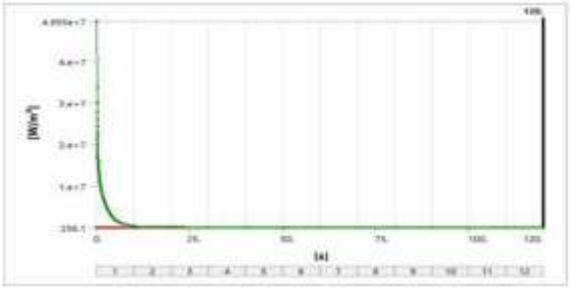
A model of cylinder with fins mounted on it is used for analysis in the present project. This is imported into ANSYS workbench environment and boundary conditions were applied as mentioned above. Analysis is carried out for different geometry of fins (circular and rectangular)with various thicknesses and materials. The results are shown below:-



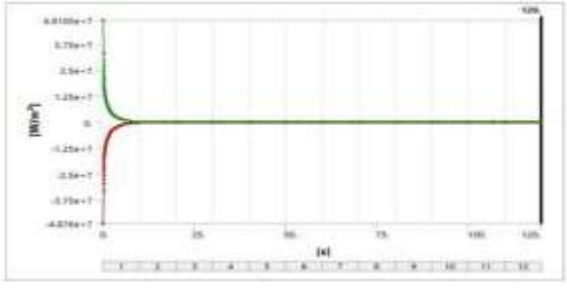
Time verses Temperature graph of Model-1



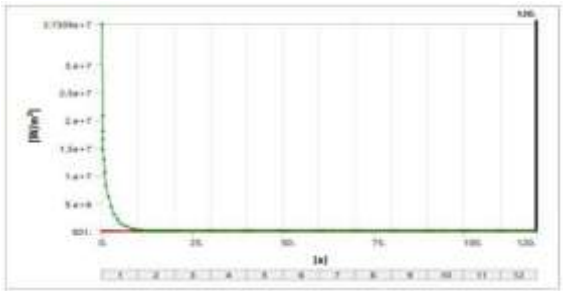
Time verses Temperature graph of Model- 2



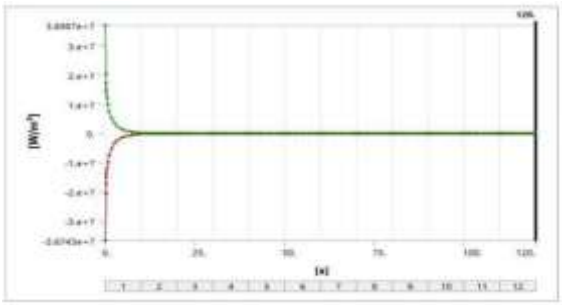
Time verses Total heat flux graph of Model-1



Time verses Directional heat flux graph of Model-1



Time verses Total heat flux graph of Model- 2



Time verses Directional heat flux graph of Model

5. CONCLUSIONS

The results shows, by using circular fin with material Aluminium Alloy is better since heat transfer rate of the finis more. By using circular fins the weight of the fin body reduces compared to existing rectangular engine cylinder fin.

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