RESEARCH ARTICLE OPEN ACCESS

Reduce the Heat of the Engine by Making Dimple in the Fins of the Two Wheeler Engine

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Abstract:

The main objectives of the heat transfer analysis is to enhance the heat transfer rate from system to surrounding. To transfer the heat from any system either by conduction or convection medium. Both modes of heat transfer has been enhanced by providing an additional equipments in the outer periphery of the heat transfer system.Fins are basically mechanical structures which are used to cool various structures by the process of convection. Most part of their design is basically limited by the design of the system. But still certain parameters and geometry could be modified to better heat transfer. In most of the cases simple fin geometry is preferred such as rectangular fins and circular fins. Many experimental works has been done to improve the heat release of the internal combustion engine cylinder and improves fin efficiency.This study presents the results of air flow and heat transfer in a light weight automobile engine, considering fins with dimple to increase the heat transfer rate. An analysis has been using ANSYS WORKBENCH version 12.0 was conducted to find the optimum number of dimples to maximizing the heat transfer across the Automobile engine body. The results indicate that the presence of fins with dimple shows improved results on the basis of heat transfer.

Keywords — **Media streaming, Cloud Computing, Non-linear pricing models.**

INTRODUCTION

1.1 Heat transfer by fins

Performance of various devices are based on heat transfer and widely used in the many industries, especially in power distribution sector (transformers), Automobile sector (engine cooling), Power Plant Sector, electric components, space industry etc.

One of the useful methods to take away heat transfer from surface area of thermal device was extended surface or fins. Pin fin is suitable for numerous applications including heat transfer removal from air cooled I C engines, Electrical Small Transfers etc.

"Pin fin geometry highly affects the different heat exchangers efficiency although these devices are used in various industries. Drop shaped pin fins can show more heat transfer with lower pressure drop from system and it was used for heat exchange purpose from past decades." In past this type of research work was based on experimental study, but having large technical and financial issues which was overcome by use of Ansys Workbench techniques. A computational study was performed by various researchers using commercial software's to find out optimal shaped fins. Various researchers considered heat transfer and pressure drop across the thermal devices surface area. Ansys Workbench in CFD analysis follow top to bottom procedure to perform simulation for any type of research problems. The first step is known as pre-processing, in which geometry making, mesh generation and boundary conditions of particular problem were defined by user. The heat transfer and associated pressure drop behavior are characterized by second step known as solution of problem statement made in first step. To find optimum shape or performance of any thermal device third step was very useful because in this step post processing of results was performed and conclusion was made by researches.

In the heat transfer, 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, or 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.

COMPONENTS OF EXPERIMENTS

7.1 THERMOCOUPLE (K Type)

A thermocouple is a temperature-measuring device consisting of two dissimilar conductors that contact each other at one or more spots, where a temperature differential is experienced by the different conductors (or semiconductors). It produces a voltage when the temperature of one of the spots differs from the reference temperature at other parts of the circuit. Thermocouples are a widely used type of temperature sensor for measurement and control, and can also convert a temperature gradient into electricity. Commercial thermocouples are inexpensive, interchangeable, are supplied with standard connectors, and can measure a wide range of temperatures. In contrast to most other methods of temperature measurement, thermocouples are self powered and require no external form of excitation. The main limitation with thermocouples is accuracy; system errors of less than one degree Celsius (°C) can be difficult to achieve

Any junction of dissimilar metals will produce an electric potential related to temperature. Thermocouples for practical measurement of temperature are junctions of specific alloys which have a predictable and repeatable relationship between temperature and voltage. Different alloys are used for different temperature ranges. Properties such as resistance to corrosion may also be important when choosing a type of thermocouple. Where the measurement point is far from the measuring instrument, the intermediate connection can be made by extension wires which are less costly than the materials used to make the sensor. Thermocouples are usually standardized against a reference temperature of 0 degrees Celsius; practical instruments use electronic methods of cold-junction compensation to adjust for varying temperature at the instrument terminals. Electronic instruments can also compensate for the varying characteristics of the thermocouple, and so improve the precision and accuracy of measurements.

Thermocouples are widely used in science and industry; applications include temperature measurement for kilns, gas turbine exhaust, diesel engines, and other industrial processes. Thermocouples are also used in homes, offices and businesses as the temperature sensors in thermostats, and also as flame sensors in safety devices for gas-powered major appliances.

7.2 General working principle of thermocouple

The working principle of thermocouple is based on three effects, discovered by Seebeck, Peltier and Thomson. They are as follows:

1) Seebeck effect: The Seebeck effect states that when two different or unlike metals are joined together at two junctions, an electromotive force (emf) is generated at the two junctions. The amount of emf generated is different for different combinations of the metals.

2) Peltier effect: As per the Peltier effect, when two dissimilar metals are joined together to form two junctions, emf is generated within the circuit due to the different temperatures of the two junctions of the circuit.

3) Thomson effect: As per the Thomson effect, when two unlike metals are joined together forming two junctions, the potential exists within the circuit due to temperature gradient along the entire length of the conductors within the circuit.

In most of the cases the emf suggested by the Thomson effect is very small and it can be neglected by making proper selection of the metals. The Peltier effect plays a prominent role in the working principle of the thermocouple.

INSTRUMENTATION USAGES

Engine running on the condition some heat produce this heat reduced more than ways of handle example of water cooling ,air cooling, lubrication oil and coolant oil etc.,,,

Generally light weight vehicle (bike) cooled engine body from atmosphere air with help of fins. Engine produce in the temperature were measured continuously fins base and fins end within help of thermocouple.

There are three thermocouple mounted different point. Thermocouple 1 (T_1) is mounted at fin base. Thermocouple 2 (T_2) is mounted at without dimples (normal fins side) fins end. Thermocouple 3 (T_3) is mounted at with applying dimples fins end.

ANSYS WORKBENCH VERSION 12.0

With the release of ANSYS 12.0, the underlying ANSYS Workbench framework hasbeen reengineered. An innovative project schematic view transforms the way engineerswork with simulation. Projects are represented graphically as connected systems in aflowchart-like diagram. At a glance, users can easily understand engineering intent, datarelationships and the state of the analysis project.
Working with the new project system is straightforward: simply drag the desiredanalysis system from the toolbox at left and drop it into the project schematic.Complete analysis systems contain all of the necessary components, guiding you throughthe analysis process as you work through the system from top to bottom.

The entire process is persistent. Changes can be made to any portion of the analysis and theANSYS Workbench platform will manage the execution of the required applications to updatethe project automatically, dramatically reducing the cost of performing design iterations.The ANSYS Workbench platform has been engineered for scalability. Building complex,coupled analyses involving multiple physics is as easy as dragging in a follow-on analysissystem and dropping it onto the source analysis. Required data transfer connections areformed automatically.

SIMPLE ANALYSIS OF PROJECT IN USING TOOL “ANSYS WORKBENCH VERSION 12.0”

8.1 Simple Analysis using material property value and symbol

Table.8.1.Using material property Aluminium alloy

Aluminium alloy			
Property’s	Symbol	Values	Units
Density	ρ	2790	Kg/m^3
Thermal diffusivity	α	68.20×10^{-6}	m^2/s
Specific heat	c	883	j/kg K
Thermal conductivity	k	168	W/mK

Table.8.2.Using material property Air

Property’s values of gases at one Atmospheric pressure and temperature 30°C			
Property’s	Symbol	Values	Units
Density	ρ	1.165	Kg/m^3
Absolute viscosity	μ	18.63×10^{-6}	Ns/m^2
Kinematic viscosity	γ	1.128	m^2/s
Thermal diffusivity	α	19.12×10^{-6}	m^2/s
Prandle number	Pr	0.701	-
Specific heat	C_p	1005	j/kg K
Thermal conductivity	k	0.02675	W/mK

8.2 Analyses for cylindrical shaped fins

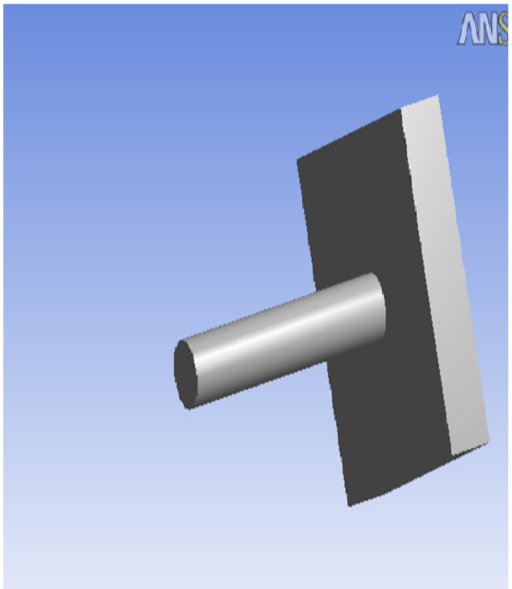

Fig.8.1Circular fin without hole

Input values	Plate base temperature =1500°C Convection heat transfer coefficient(h)=1W/m^2°C

Table.8.3 Circular fin (without hole) dimension

Material	Aluminium Alloy
Base plate size	Height =100mm Length =100mm Thicknees =20mm
Circular fin dimension	Diameter = 20mm Length =100mm

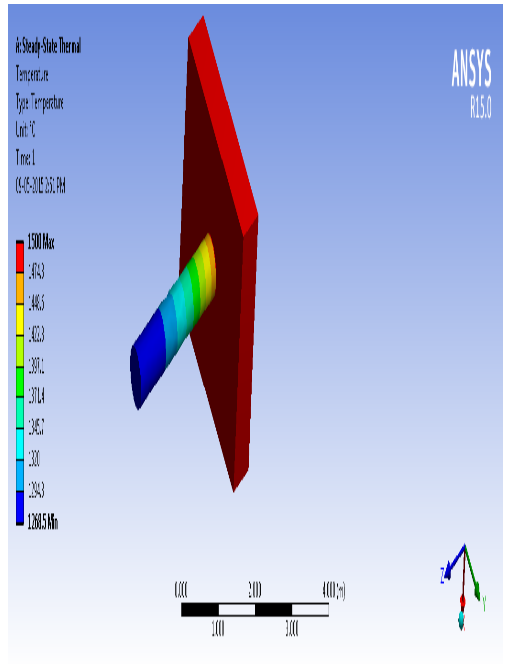

Fig 8.2 Temperature distributionin circular fins without ho

Table.8.4 Circular fins without hole in temperature distribution

Output of Temperature distribution in fin	
Max temperature	1500°C
Min temperature	1268.5°C

8.2.2 Analysis of total heat flux

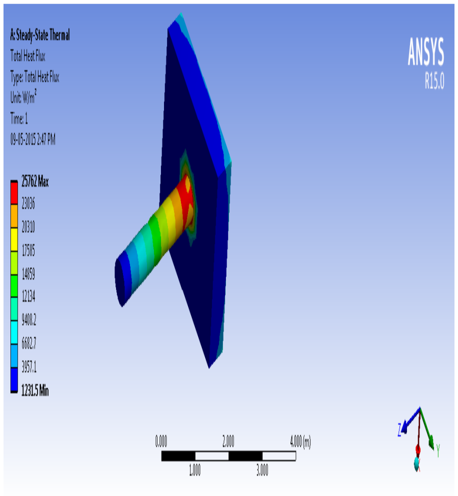

Fig.8.3 Total heat fluxin circular fins without hole

Table 8.5Circular fins without hole in total heat flux

Material	Aluminium alloy
Base plate size	Height =100mm Length =100mm Thicknees =20mm
Circular fin dimension	Diameter = 20mm Length =100mm
Hole diamension	Number of hole =4 Diameter =5mm

Output of heat flux	
Min Heat flux	1231.5 W/m^2
Max Heat flux	25762W/m^2

Analysis for cylindrical shaped fins with dimples apply

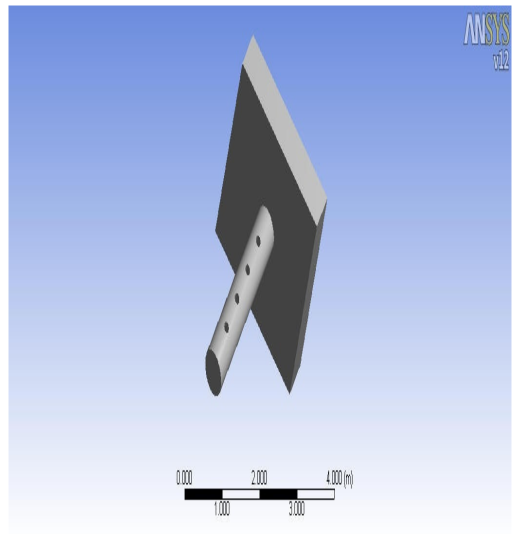

Fig.8.4.Circular fin with hole

Table 8.6.dimension of circular fin with hole

Temperature distribution in circular fin with hole

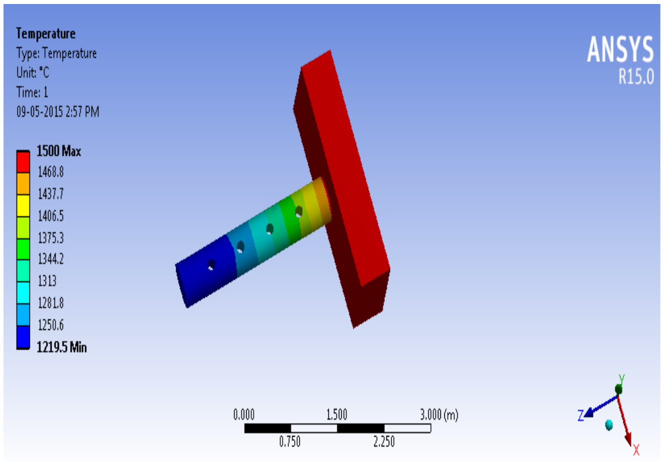

Fig.8.5 Temperature distribution in circular fin with hole

Table 8.7 Circular fin with-hole in temperature distribution

8.3.2 Analysis of total heat flux

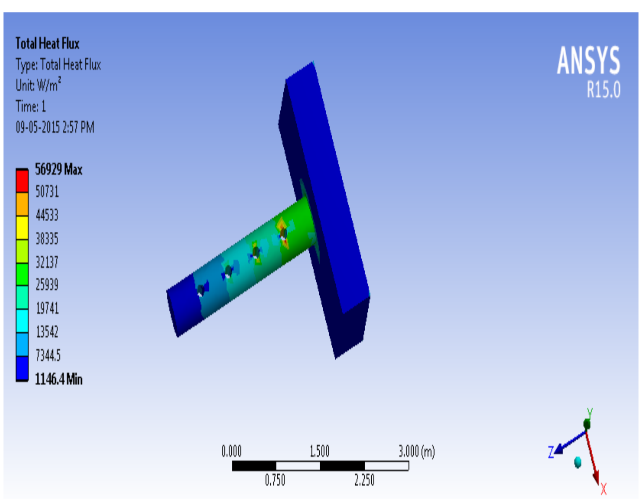

Fig.8.6. Analysis of total heat flux in circular fin with hole

Table 8.8 Analysis of total heat flux in circular fin with hole

Output of total heat flux	
Max heat flux	56929 W/m^2
Min heat flux	1146.4W/m^2

8.4Analysis of the simple rectangular fins

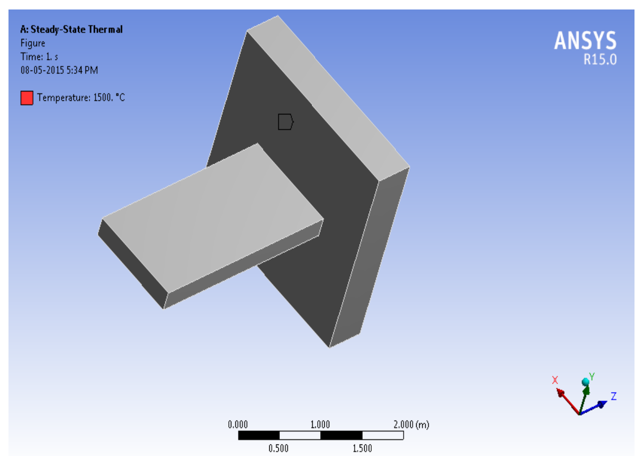

Table 8.9 Dimension of simple rectangular finswithout dimples

Material	Aluminium Alloy
Base plate size	Height =100mm;Length =100mm;Thickens

	=20mm
flat fin dimension	Thickens = 10mm;Length =100mm; breadth=50mm

8.4.1Temperature distribution

rectangular fins without dimples

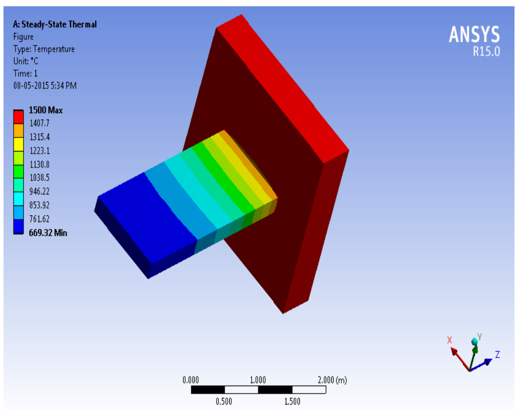

Fig8.8 Rectangular finstemperature distribution

Table 8.10Temperature distributionrectangular finswithout dimples

Input values	Plate base temperature =1500°C Convection =5w/m^2°c
Output of Temperature distribution in fin	
Max temperature in fin	1500°C
Min temperature in fin	669.32°C

8.5 Analysis of the simple rectangular fins with dimples

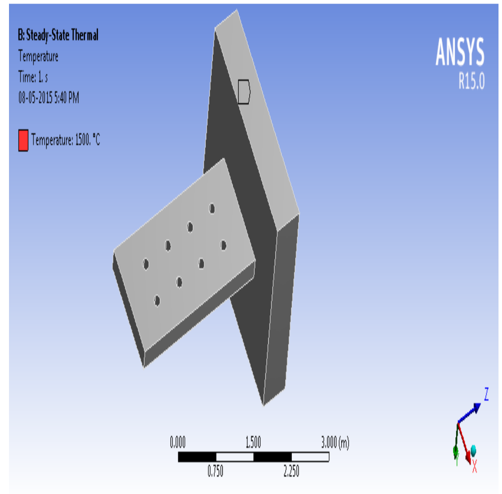

Table 8.11 Dimension ofrectangular finswith dimples

Material	Aluminium Alloy
Base plate size	Height =100mm;Length =100mm;Thickens =20mm
flat fin dimension	Thickens = 10mm;Length =100mm; breadth=50mm
Hole dimension	Number of holes(dimples) =8 no's Diameter =5mm

8.5.1Temperature distribution in rectangular fins with dimples

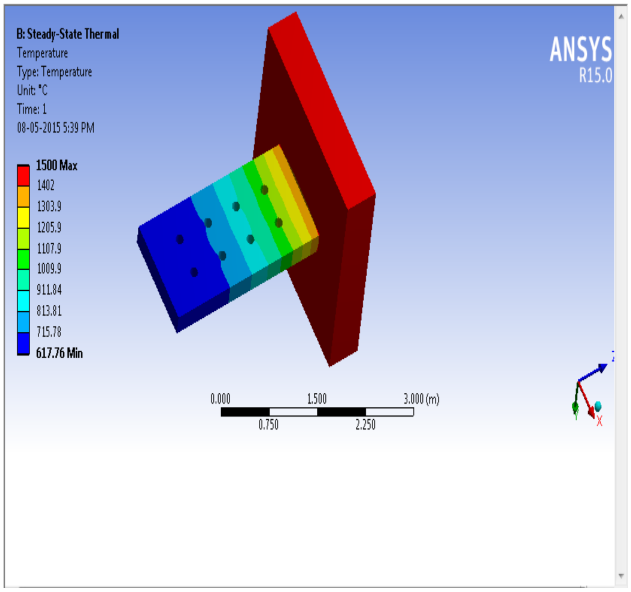

Fig 8.10

Temperature distribution

Table 8.12 Temperature distributionrectangular fins with dimples

Input values	Plate base temperature =1500°C Convection heat tran coefficient =5 w/m^{2}°(
Output of Temperature distribution in fin	
Max temperature in fin	1500°C
Min temperature in fin	617.76°C

PHOTOGRAPHY

CONCLUSION

- Experiments work carried without fins and with fins along with dimples and the following conclusion were arrived in the present work.
- The temperature of engine body at various location respect to time the value of temperature increase with increase of in time.
- The fin base temperature has been higher in the case of fins with dimples than without dimples
- The overall heat transfer rate using fins along with dimples base been higher then without dimples.
- An analytical work has been carried out using ansys tool as form there is a good agreement of theoretical results with experimental result