iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** II **Month of publication:** February 2022

DOI: https://doi.org/10.22214/ijraset.2022.40220

Investigation of Tip Temperature of a Ring Fashioned Fin for CI Engine Using Ansys Modeling

Prof. Vipin Mehta[1], Dr. Sanjay Kateray[2], Prof. Sati Vidisha[3], Dr. P L Verma[4]
[1]*Associate Professor in All Saints 'College of Technology Bhopal .MP*
[4]*Director in Govt Engg College Shahdol MP*

Abstract: As the name imply prolonged surfaces to extract most amount of heat via out the surfaces. There are such a lot of researcher check out the heat transfer from the C I engine by using the use of fins, however nobody can calculate the top temperature of fin and to formulate the result by way of using Finite Element approach. It's far very vital to transfer warmness from the C I engine .The warmth transfer coefficient may be decided the usage of superior FEA codes which include fluid mechanics .Those simplified terms constitute a aggregate of several elements ,which include powerful floor vicinity ,lateral fin conduction ,boundary layer formation and cloth conductivity. It's miles very difficult to modeled a hoop form fin .Each pin should be individually discredited ,increasing the modeling time significantly .On this studies we have to used simulation application will be advanced for predicting and optimizing thermal performance of different sorts of fin component like round fin, axial fin and we compare ring form fin with triangular profile .The end result of the ring form fin can be additionally in comparison with the ones axial fins and ring shape fin with triangular profile the use of finite detail evaluation software advanced on Ansys software. Apart from this we additionally look into the temperature size and thermal pressure distribution.
Keywords: Geometric modeling, thermal stress distribution, triangular profile,

I. INTRODUCTION

Fins are the extended surfaces that are used to enhance warmth switch with the aid of the convection mode and are utilized in a wide range of industries as well as all home applications. Fins are normally used for heat control in electric home equipment consisting of computer systems, electricity station and substation transformers and widely used in an I C Engine cooling together with in automobile radiator. Harper and Brown called this a cooling fin, which later became recognized merely as a fin. A three-D Model of the fins is created as consistent with the size of actual sample [escort engine]At first temperature and thermal pressure distribution is carried out in circular a fin that's the actual sample and the axial fins are created with identical surface area of the ring form fins. The result of an axial fin is as compared with the end result of the round fins.

A growing variety of engineering disciplines are concerned with energy transitions requiring the rapid motion of warmth. They produce an expanding call for for high performance warmth switch components with step by step smaller weights, volumes, expenses, or accommodating shapes .Extended surfaces warmness switch is the examine of high performance warmth transfer additives with recognize to those parameters and of their conduct in a whole lot of thermal environments .Typical additives are determined in such various application as air land- space vechels and electricity sources ,in chemical refrigeration in cryogenic techniques, in electric and digital system, in conference furnace and gas mills.

II. OBJECTIVE OF RESEARCH

Geometric Modeling
Temperature and thermal stress distribution
Investigation of tip temperature
Finite Element Analysis of ring fashioned fin.
Comparative thermal take a look at may be performed
Compare the effects of triangular and exiting profile.
Three Nomenclatures
S=floor place in m2
p =fin perimeter in m
p1 =ratio of elliptical spine diameters,dimensionless
q =heat waft in W
R =radius feature, dimensionless

f =feature, dimension vary
M =changed fin overall performance parameter
d =diameter in m
C =arbitrary regular, dimensionless
b =fin top in m
A =Cross sectional area in m2
θ=extra temperature in K
T= Temperature in K
ok=thermal conductivity in W/mk
h=convective warmth transfer coefficient in W/m2K

III. LITERATURE OVERVIEW

Abdullah, H Alessa et al. [1] had studied the herbal convection warmness transfer enhancement from a horizontal rectangular fin embedded with The equilateral triangular perforations. The warmth dissipation fee from the perforated fin is examine to that of the equivalent strong one .The impact of geometrical dimensions of the perforated fin and thermal homes of the fin was studied in detail. They performed that, for positive price of triangular dimensions, the perforated fin can bring about heat transfer enhancement .The value of enhancement is proportional to the fin thickness and its thermal conductivity .The perforations of fins complements warmth dissipation fees and on the equal time decreases the expenditure of the fin fabric .

B Ramdas pradip et al. [2]had studied the numerous industries are making use of thermal systems wherein overheating can harm the device components and cause failure of the system .So as to conquer this trouble ,thermal machine with powerful emitters such as ribs ,fins ,baffles and so forth are suited .The want to boom the thermal overall performance of the systems,thereby affective electricity ,fabric and cost saving has brought about improvement and use of many strategies termed as " Heat switch Augmentation ".Those are (a) floor roughness ,(b)plate baffle and wave baffle, (c)perforated baffle ,(d) inclined baffle, (e)porous baffle , (f) corrugated channel, (g) twisted tape inserts , (h) discontinuous crossed ribs and grooves. Most of those enhancement techniques are based on the baffle arrangement. Use of warmth transfer enhancement techniques cause increase in heat transfer coefficient but on the cost of increase in stress drop.

Sable, M.Jet al [3] had investigated for herbal convection adjoining to a vertical heated plate with a a couple of v kind partion plates (fins) in ambient air surrounding. As as compared to conventional vertical fins, this v kind partion plates work now not handiest as prolonged surfaces however also as flow turbulator. In order to decorate the warmth switch,V shaped partition plates (fins) with edged faced upstream had been attached to the 2 identical vertical plates .V type fin array layout carry out better than rectangular vertical fin array and V fin array with bottom spacing design .The overall performance become located to enhance in addition ,with increase inside the peak of the V plates (fin peak).

IV. METHODS AND METHODOLOGY

A. Six Steps in the Finite Element Method

1) *Step 1 –Discretization:* The problem domain is discretized into a collection of simple shapes ,or elements.

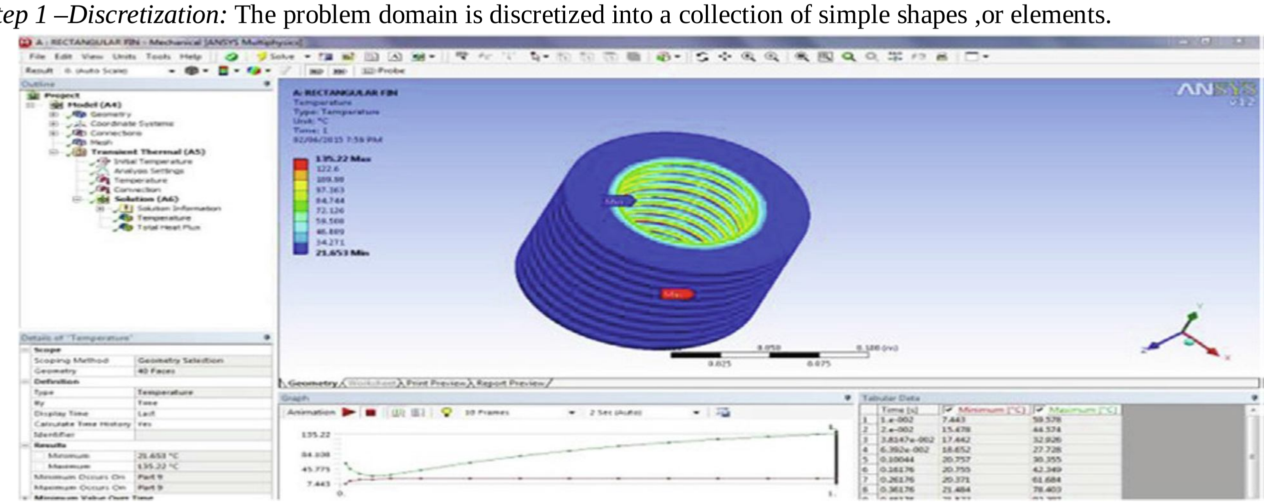


Fig. 1 Temperature distinction for rectangular

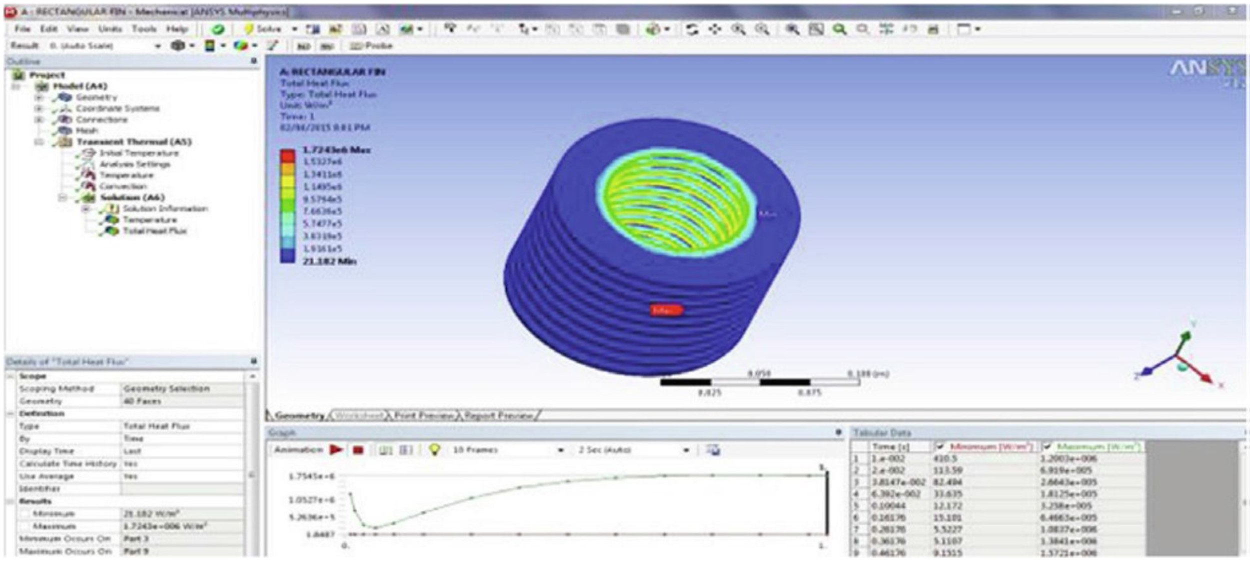


Fig. 2. Heat flux for rectangular

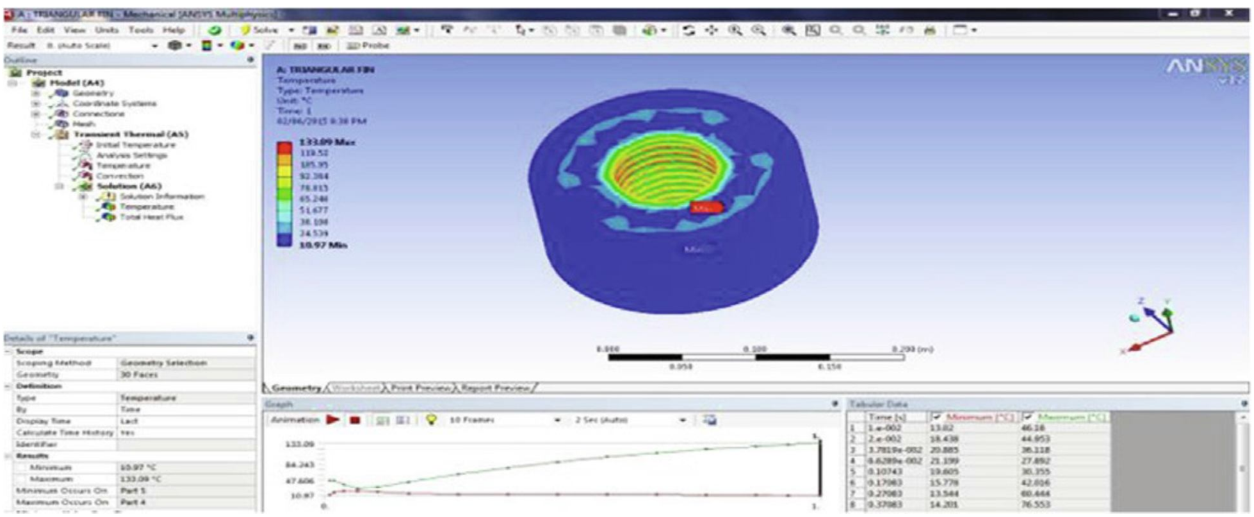


Fig. 3. Temperature difference for triangular.

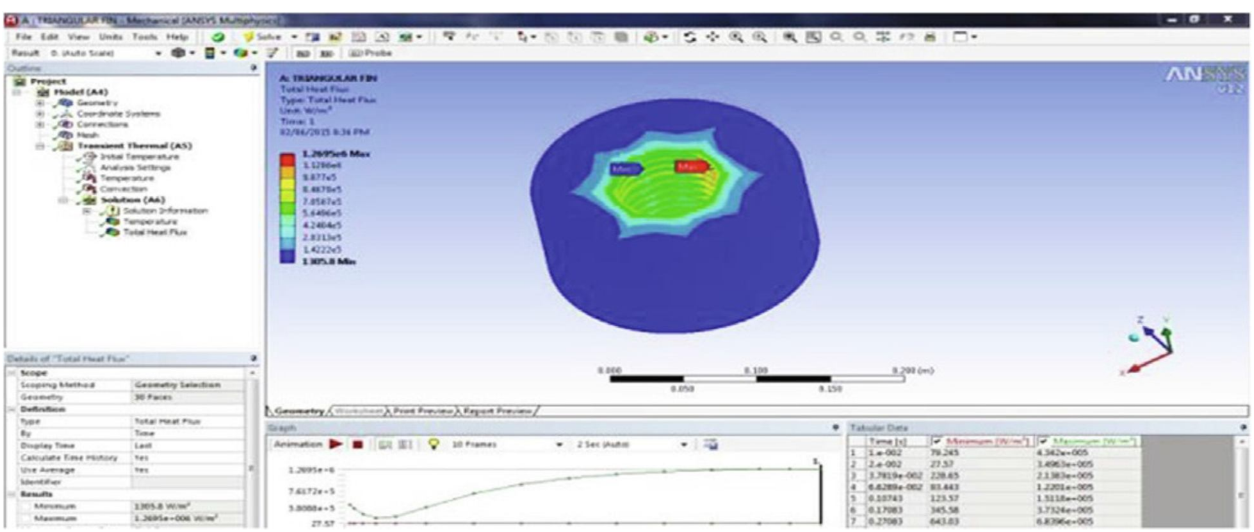


Fig. 4. Heat flux for triangular.

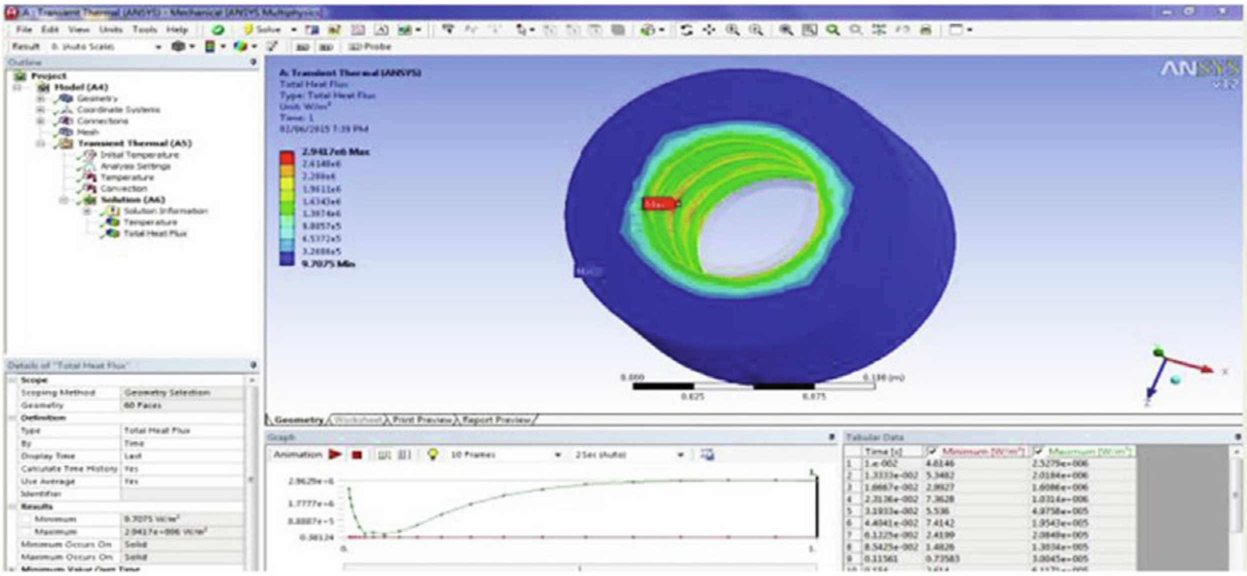


Fig. 5. Heat flux for elliptical

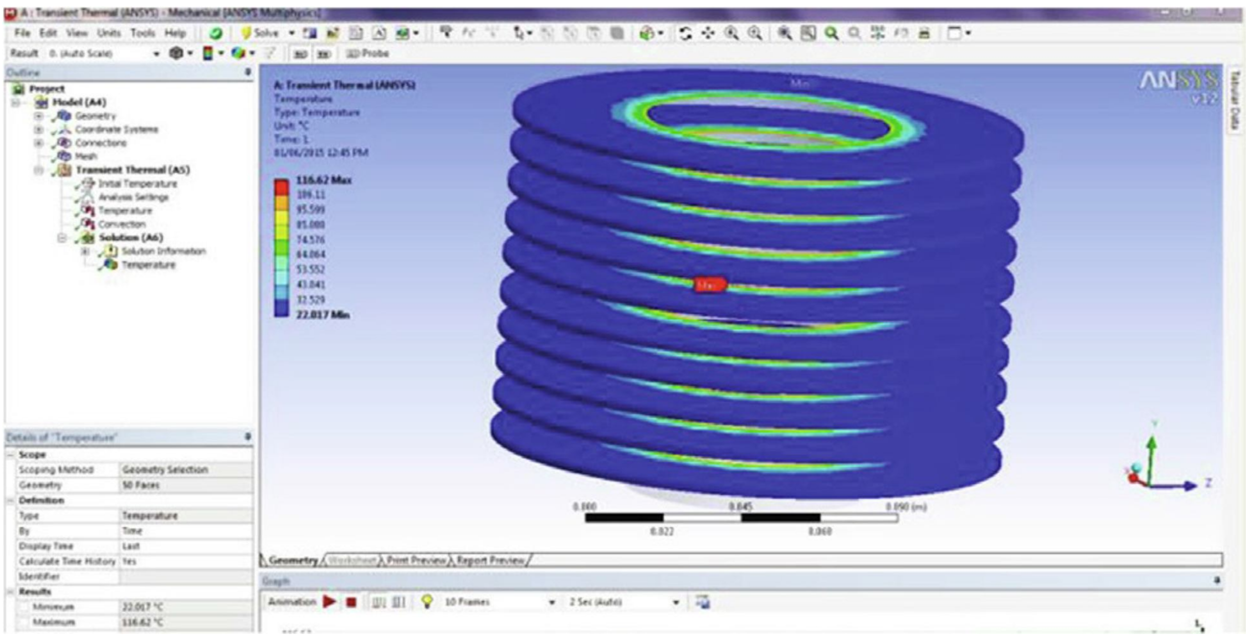


Fig. 6. Heat flux for trapezoidal.

V. AVAILABILITY OF DATA AND MATERIAL

Table 1

Engine specification C I Engine (Diesel Engine)

No of cylinders	4
Bore	88.9 mm
Stroke	101.6 mm
Piston displacement	2184 cc
Compression ratio	17:1
Fuel used	Diesel
Engine position	Vertical

Table 4
Result Analysis

SNo	Different cross section	TIP Temperature (DegreeC)
1	Rectangular	140.43
2	Triangular	58.23
3	Elliptical	88.73
4	Trapezoidal	110.21

VI. DESIGN CALCULATION

A. Calculation for Rectangular fin

Thickness , t=4 mm
Length , l=33.45 mm
Base Temperature ,T_1=230 Degree C
T_1 =230+273
T_1 =503 K

Ambient Temperature =27 DegreeC
=27+273
=300K
Heat Transfer Coefficient ,h =80 W/m^2K
Thermal Conductivity k =43.28W/mk
Now consider as temperature T_1 to T_2
Area =b×l
Area =0.00442×0.003345
Area = 0.0001478 m^2

$$Ak/l_1\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}+hpl1/6\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}\begin{Bmatrix}T1\\ T2\end{Bmatrix}=QA/L+PhT_\infty l/2\ \frac{1}{1}$$

$$\begin{bmatrix}0.402 & -0.402\\ -0.402 & 0.402\end{bmatrix}+\begin{bmatrix}0.035 & 0.021\\ 0.021 & 0.035\end{bmatrix}\begin{Bmatrix}T1\\ T2\end{Bmatrix}=\begin{pmatrix}12.231\\ 12.231\end{pmatrix}$$

$$\begin{bmatrix}0.52 & -0.467\\ -0.467 & 0.52\end{bmatrix}\begin{pmatrix}T1\\ T2\end{pmatrix}=\begin{pmatrix}12.231\\ 12.231\end{pmatrix}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Let us consider temperature T_2 to T_3

$$Ak/l_1\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}+\frac{hpl1}{6}\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}\begin{Bmatrix}T1\\ T2\end{Bmatrix}=\frac{QA}{l}+phT\infty\Big/2\ \frac{1}{1}$$

$$\begin{bmatrix}0.52 & -0.467\\ -0.467 & 0.52\end{bmatrix}\begin{pmatrix}T2\\ T3\end{pmatrix}=\begin{pmatrix}12.231\\ 12.231\end{pmatrix}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Assemble the finite element Equ (1) and (2)

Type equation here.

$$\begin{bmatrix}0.52 & -0.412 & 0\\ -0.412 & 0.52+0.52 & -0.412\\ 0 & -0.412 & 0.52\end{bmatrix}\begin{Bmatrix}T1 & 12.231\\ T2= & 12.231\\ T3 & 12.231\end{Bmatrix}\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The first row and first column of the stiffness matrix (K) have been set equal to zero except for the main diagonal ,which has been set equal to 1

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1.04 & -0.412 \\ 0 & -0.412 & 0.52 \end{bmatrix} \begin{matrix} T1 & 12.231 \\ T2 = & 12.231 \\ T3 & 12.231 \end{matrix}$$

The first row of the force matrix is replaced by the known Temperature at node 1

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1.04 & -0.412 \\ 0 & -0.412 & 0.52 \end{bmatrix} \begin{matrix} T1 & 573 \\ T2 = & 250.23 \\ T3 & 19.34 \end{matrix}$$

$1.04\times T_2-0.412\times T_3 = 250.23$…………………………..(4)

$-0.412\times T_2+0.52\times T_3 = 19.34$…………………………..(5)

$T_3 = 470.587$ K

$T_3 = 197.50$ DegreeC

$T_2 = 210.23$DegreeC

VII. CONCLUSION

This venture describe various feasible overall performance factors .These terms display a combination of several aspect, together with fabric conductivity ,lateral fin conduction ,boundary layer formation and powerful move segment region .While we comparing the circular fin of trapezoidal pass segment ,the rectangular fin ,triangle fin ,elliptical profile fin (hold the fin hole and no of segment regular for all) it become determined that ,the triangle profile fins yield a lower tip temperature distribution than other as proven within the table comparing with the length of the fin and area optimization elliptical fin can provide higher output than the actual sample .The elliptical fin warmth switch evaluation represents handiest one set of layout parameters relesing to form based totally upon the cross section of fins .There may additionally exist different designs which produces better results in usual thermal performance .

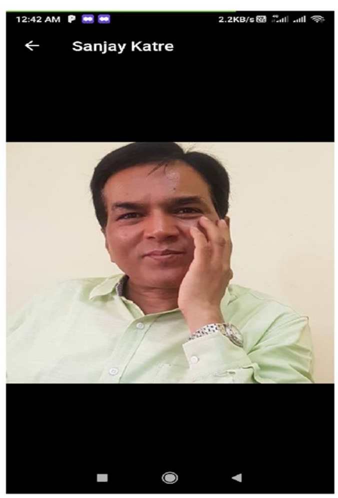
REFERENCES

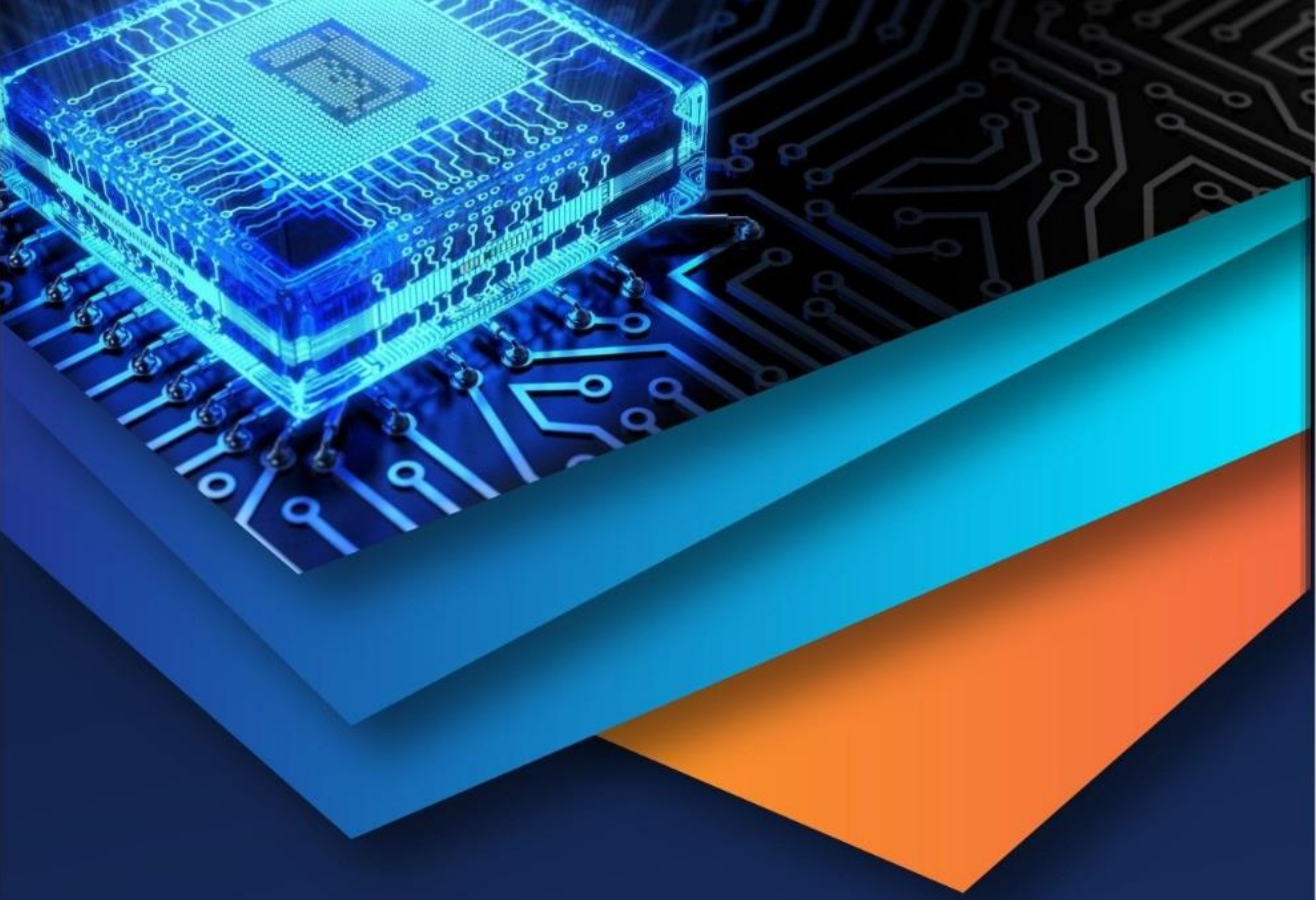
[1] U.Akyol ,K.Bilen, heat transfer and thermal performance analysis of surface with hollow rectangular fins, Appl.Therm.Eng 26 (2006)209-216,
[2] A.H.AIEssa ,Mohammed Q,Al-Odat,Enhancement of natural covection heat transfer from a fin by triangular perforation of bases parallel and towards its base .Arbian j .Sci.Eng.34(28)(2009)531-544
[3] S .D.Suryawanshi ,N.K.Sane.Natural convection heat transfer from horizontal rectangular inverted notched fin arrays ,j.Heat Transfer 131(8)(2009)
[4] B.Sahin.A.Demir,Thermal performance Analysis and optimum design parameter of heat exchanger having perforted pinfin,Energy convers manage 49 (2008)1684-1695
[5] M.R.Shaeri ,M. Yaghoubi ,K .jafarpur,heat transfer analysis of lateral perforated fin heat sinks,Appl.Energy 86 (2009) 2019-2029,
[6] Mohamadl.Al-Widyan,Amiad Al-Shaarawi,Numerical investigation of heat transfer enhancement for a perforated fins in natural convection ,lnt.j.Eng Res. Appl.2 (2012)175-184
[7] ji jinn Foo.CheeSeng Tan ,Heat transfer enhancement with perforated fins subject to impinging flow .int.j.Mech .comput .Manut Res,1 (2012)
[8] R.K. Rajput.Heat and Mass Transfer ,S Chand &company Ltd,New Delhi,2006
[9] S. Chamoli,R Chauhan ,N.S .Thakur ,Numerical investigation of heat transfer and thermal performance analysis of surface with circular fins I.nt.j.Energy Sci.1 (2011)11-18
[10] A .H.AlEssa ,Fayez ,M S Al- Hussain .the effect of orientation of square perforation on the heat transfer enhancement from a fin subjected to natural convection .Heat Mass Transfer 40 (2004)509-515

ACKNOWLEDGEMENT

VIPIN MEHTA; Presently working as Associate Professor in ALL SAINTS' COLLEGE OF TECHNOLOGY GANDHINAGAR BHOPAL MP INDIA. he has obtained his bachelor degree in MECHANICAL ENGG from **SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (SATI) VIDISHA , MP ,INDIA** in year **2006** and master degree **in HEAT POWER ENGG** from **SSSIST SEHORE** MP INDIA in year 2012.

Dr SANJAY KATAREY; Presently working as a professor in **SAMRAT ASHOK TECHNOLOGICAL INSTITUTE DEGREE COLLEGE VIDISHA, MP, INDIA.** he has obtained his bachelor of engg from SATI VIDISHA MP INDIA in the year 1982.he did his Mtech **from SATI VIDISHA MP INDIA** in the year 1998 .he was awarded the of Doctor of Philosophy (PhD) from **BUIT BHOPAL MP INDIA** in year 2008.he is published 30 papers in national and international journal.





10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY