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Thermal Analysis on Heat Distribution in Fins of Compressor Cylinder by Varying Profile Using Fem

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ABSTRACT

Most of the air compressors are either reciprocating piston type or rotary vane screw. Centrifugal Compressors are common in very large applications such as supply a high-pressure clean air to fill gas cylinders, supply a large amount of moderate pressure air to power pneumatic tool. In air compressor heat can be generated by two ways, heat produced by friction as well as by due to compressing of air at high pressure. So, this heat will transfer to atmosphere by fins. As engineers we are primarily interested in knowing the extent to which particular extended surfaces or fin arrangements could improve heat transfer from a surface to the surrounding fluid. To determine the heat transfer rate associated with a fin, we must first obtain the temperature distribution along the fin.

In this work we altered geometrical shapes of fins for analysis and select most effective cooling fin. Finite element method (FEM) is important numerical technique used in engineering analyses. In this work Rectangular, triangular, concave, & convex profile fin of Aluminum nitride and Aluminum alloy A204 were preferred for analysis. Analysis the parameters such as heat transfer rate through fin, fin efficiency and effectiveness through free and forced convection heat transfer mode.

INTRODUCTION

Most modern internal combustion engines are cooled by a closed circuit carrying liquid coolant through channels in the engine block and cylinder head, where the coolant absorbs heat, to a heat exchanger or radiator where the coolant releases heat into the air (or raw water, in the case of marine engines).

Thus, while they are not ultimately cooled by the liquid, because of the liquid-coolant circuit they are known as water-cooled. In contrast, heat generated by an air-cooled engine is released directly into the air. (Direct Cooled Engine) Typically this is facilitated with metal fins covering the outside of the Cylinder Head and cylinders which increase the surface area that air can act on. Air may be force fed with the use of a fan and shroud to achieve efficient cooling with high volumes of air or simply by natural air flow with well designed and angled fins.

In all combustion engines, a great percentage of the heat generated (around 44%) escapes through the exhaust, not through either a liquid cooling system nor through the metal fins of an air-cooled engine (12%). About 8% of the heat energy finds its way into the oil, which although primarily meant for lubrication, also plays a role in heat dissipation via a cooler.

HEAT TRANSFER

Heat transfer is a thermal energy which occurs in transits due to temperature difference. The modes of heat transfer are conduction, convection and radiation. Fin is a thin component or appendage attached to larger body or structure. Based upon the cross sectional area type, straight fins are of different types such as rectangular fin, triangular fin, trapezoidal fin parabolic fin or cylindrical fin. Fin performance can be measured by using the effectiveness of fin, thermal resistance and efficiency. Triangular fins have applications on cylinders of air cooled cylinders and compressors, outer space radiators and air conditioned systems in space craft. Several authors paid attention in analyzing the performance of fins. Thirumaleshwar in his book provided an introduction to modes of heat transfer. He had given detailed information of extended surfaces such as boundary conditions and analysis. Arora et al. in their book provided an introduction to triangular fins and they had given detailed information of triangular fins its boundary conditions and analysis. Incropera in his book proposed a correlation for triangular fins. He discussed two dimensional fin analysis participating in heat transfer. Mahesh et al in their book gave practical applications of triangular and rectangular fins. Kumar et al. In their article provided experimental investigation to predict the performance of heated triangular fin array within a vertically oriented and air filled rectangular enclosure to analyze the effects of several influencing parameters for their wide ranges; Rayleigh number $295214 \leq Ra \leq 773410$, fin spacing, 25 mm $\leq S \leq 100$ mm and fin height 12.5 mm $\leq L \leq 37.5$ mm for constant heat flux boundary conditions at the heated and cooled walls of the enclosure. They developed an empirical correlation relating Nusselt number to several influencing parameters. Teerakulpisut in his paper presented application of modified Bessel functions in the analysis of extended surface heat transfer and differential equations are formulated from the fundamentals of conduction and convection heat transfer. Rahim et al. in their paper analysed heat transfer through a wall containing triangular fins partially embedded in its volume, Coupled heat diffusion equations governing each constituent are solved numerically using an iterative finite volume method. Numerical and the analytical results are attained in their paper. It is found that the fin-root can act simultaneously as a heat sink and heat source for the wall.

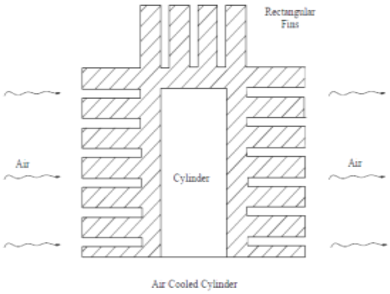
LITERATURE REVIEW

Magarajan et al calculated heat release of an IC engine cylinder cooling fins with six numbers of fins having pitch are determined numerically using commercially available CFD tool Ansys Fluent. The heat release from the cylinder which is calculated numerically is validated with the experimental results. With the help of the available numerically results, the design of the I.C engine cooling fins can be modified for improving the heat release and efficiency.

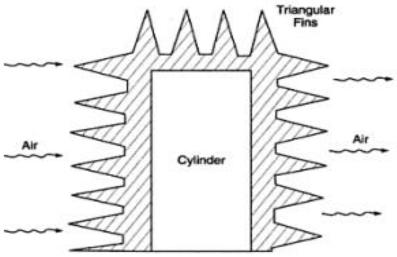
Barhatte et al [3] studied the fin flats which are modified by removing the central fin portion by cutting a triangular notch. This dissertation report presents an experimental analysis of the results obtained over a range of fin heights and heat dissipation rate. Attempts were made to establish a comparison between the experimental results and results obtained by using CFD software.

DESCRIPTION AND WORKING OF FINS

As fins are introduced to enhance heat transfer from a base which is at high temperature, rectangular fins and triangular fins are considered for analysis on two stroke air cooled engine. Engine life and effectiveness can be improved with effective cooling. The cooling mechanism of the air cooled engine is mostly dependent on the fin size. The heat is conducted through the engine parts and convicted to air through the surfaces of the fins. Insufficient removal of heat from engine will lead to high thermal stresses and lower engine efficiency. As air-cooled engine builds heat, the cooling fins allow the wind and air to move the heat away from the engine. Considering an air cooled petrol engine with two stroke, at no load condition engine does not generate power. When load increases on an engine, the upward movement of a piston causes compression of the previously available charge inside the cylinder. Thus, during upward stroke, suction and compression of charge takes place simultaneously, and both transfer port and exhaust port remain closed. At the end of compression stroke, the charge is ignited by a high voltage electric spark. After ignition of charge, hot high pressure gases expand. The piston goes downwards and compresses the charge drawn in the crank case. At the end of expansion stroke, exhaust port which is slightly placed higher than the transfer port, opens releasing the burnt gases from cylinder to the atmosphere. Fins are provided on a periphery of engine. Exhaust heat is exposed to outside of engine cylinder. Air cooled engines have fins to radiate heat to surrounding air. Cylinder is made of cast iron and fins are made of stainless steel.



Air cooled cylinder with rectangular fins



Air cooled cylinder with triangular fins

IDENTIFICATION OF PROBLEM

By different profiles (Rectangular, triangular, concave, & convex profile fin) of compressor fins are taken and varying with different materials Aluminum nitride and Aluminum alloy A204. Study the heat transfer through fins. By Calculating heat transfer rate through fin, fin efficiency and effectiveness through free and forced convection heat transfer mode. By numerical method Check the heat transfer ratio in various profiles.

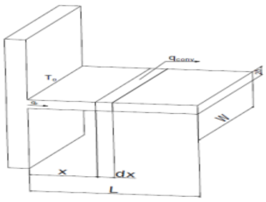
AIM OF THE WORK

Objective: - Alter geometrical shapes of fins for analysis and select most effective cooling fin.

ANALYSIS OF RECTANGULAR AND TRIANGULAR FIN

Rectangular Fin:

The rectangular fin with L as the length of the fin, as thickness of the fin and W width of fin and assuming the heat flow is unidirectional and it is along length and the heat transfer coefficient (h) on the surface of the fin is constant.



Rectangular fin attached to cylinder

Heat lost by fin, (Qr) (1)

where, k = thermal conductivity, W/mK

A_c= cross section area of fin, m^2

m= fin parameter, ($\sqrt{hP/kAc}$)

P= perimeter of fin, (2W+4δ), m

θ_o= temperature difference, K

h= heat transfer coefficient, W/m^2K

Mass of rectangular fin, (mr) = 2δ×ρ×L .... (2)

where, ρ= density of fin material, kg/m^3

Rate of heat flow per unit mass through rectangular fin

$$q_r = \frac{KA_c m\theta_o \frac{h\cos hmL + km\sin hmL}{km\cos hmL + h\sin hmL}}{2\delta\times\rho\times L} \quad ....3$$

Efficiency of rectangular fin, (ηr)

$$= \frac{\text{Heat loss with fin}}{\text{heat loss from the fin}}$$

if entire surface is maintained at room temperature

$$= \frac{-KA_c m\theta_o \frac{h\cos hmL + km\sin hmL}{km\cos hmL + h\sin hmL}}{2WLh\,\theta o} \quad ....4$$

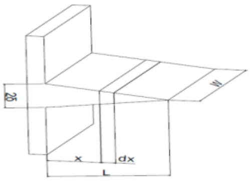
Effectiveness of rectangular fin, (ϵ_r)

$$= \frac{\text{Heat loss with fin}}{\text{heat loss from the fin}}$$

$$= \frac{-KA_c m\theta_o \frac{h\cos hmL + km\sin hmL}{km\cos hmL + h\sin hmL}}{2A_c\theta o} \quad .... 5$$

Triangular Fin:

For a triangular fin representing length of fin L, thickness, 2δ and width of fin, W and assuming the heat flow is unidirectional and it is along length and the heat transfer coefficient (h) on the surface if the fin is constant.



Triangular fin attached to cylinder

Heat lost by triangular fin,

$$\varrho = 2W\theta_o\sqrt{(hk\delta)}\left[\frac{I_1(2B\sqrt{L})}{I_0(2B\sqrt{L})}\right] \text{ .... (6)}$$

where, θ_o= temperature difference, K

k = thermal conductivity, W/mK

B= fin parameter, ($\sqrt{hL/k\delta}$)

I1= Bessel function of first kind

I0=Bessel function of first kind

The mass of triangular fin,

$$(mt) = \frac{1}{2} \times 2\delta \times L \times W \times \rho \text{ ....(7)}$$

ρ = Density of fluid kg/m3

Rate of heat flow per unit mass (q) = $\frac{\text{Heat flow through fin}}{\text{mass if fin}}$

$$= \frac{2W\sqrt{hk\delta}\theta_0\frac{I_1(2B\sqrt{L})}{I_0(2B\sqrt{L})}}{\frac{1}{2}\times 2\delta \times L \times W \times \rho} \text{ .... (8)}$$

Efficiency of triangular fin (ht)

$$= \frac{2W\sqrt{hk\delta}\theta_0\frac{I_1(2B\sqrt{L})}{I_0(2B\sqrt{L})}}{2WL\,h\theta_0} \text{ .... (9)}$$

Effectiveness of triangular fin, (ϵt) = $\frac{\text{Heat lost with fin}}{\text{Heat loss without fin}}$

$$= \frac{2W\sqrt{hk\delta}\theta_0\frac{I_1(2B\sqrt{L})}{I_0(2B\sqrt{L})}}{hA_b\theta_0} \text{ .... (10)}$$

where,

Ab = base area of triangular fin, (W x 2δ), m2

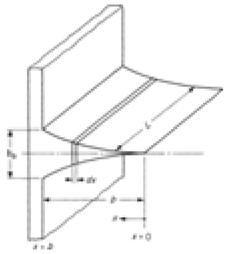
Longitudinal Fin of Concave Parabolic Profile

For the longitudinal fin of concave parabolic profile shown in below fig, it is noted that the exponent on the general fin profile of eq. Satisfies the geometry when n = ∞. The profile function for this fin then becomes.

General Profile Equation:

$$f_2(x) = \frac{\delta_b}{2}\left(\frac{x}{b}\right)^{(1-2n)/(1-n)} \text{ ----------------(11)}$$

$$f2(x) = \frac{\delta_b}{2}\left(\frac{x}{b}\right)^2 \text{ ---------------------(12)}$$



And $\frac{df_2(x)}{dx} = \frac{\delta_b}{b}\frac{x}{b}$

When these are substituted into eq. (1.4), the governing differential equation for the temperature excess, θ(x) = T (x) − Ts , becomes

$$x^2\frac{d^2\theta}{dx^2} + 2x\frac{d\theta}{dx} - m^2b^2\theta = 0 \qquad (13)$$

where again, m = (2h/kδ)1/2

Equation (13) is an ordinary second-order differential equation with variable coefficients. It is known as an Euler equation and its general solution is obtained by making the transformation x = ev or v = ln x. Then

$$\frac{d\theta}{dx} = \frac{d\theta}{d\vartheta}\frac{d\vartheta}{dx} = \frac{1}{x}\frac{d\theta}{d\vartheta} \text{ and } \frac{d^2\theta}{dx^2} = \frac{d\,[\,(1/x)\,(d\theta/d\vartheta)]}{dx} = -\frac{1}{x^2}\frac{d\theta}{d\vartheta} + \frac{1}{x}\frac{d\,(d\theta/d\vartheta)}{dx}$$

and after simplification, $\frac{d^2\theta}{dx^2} = -\frac{1}{x^2}\frac{d\theta}{d\vartheta} + \frac{1}{x^2}\frac{d^2\theta}{d\vartheta^2}$

With these transformations in hand, eq. (13) becomes

$$x^2\left(\frac{1}{x^2}\frac{d^2\theta}{d\vartheta^2} - \frac{1}{x^2}\frac{d\theta}{d\vartheta}\right) + 2x\left(\frac{1}{x}\frac{d\theta}{d\vartheta}\right) - m^2b^2\theta = 0$$

Canceling common terms gives an ordinary differential equation with constant coef- ficients:

which has as its solution $\frac{d^2\theta}{d\vartheta^2} + \frac{d\theta}{d\vartheta} - m^2b^2\theta = 0$

which has as its solution $\theta = c_1e^{\alpha v} + c_2\,e^{\beta v}$

or in terms of the independent variable x

$$\theta(x) = c_1x^{\alpha} + c_2\,x^{\beta} \text{ ---(14)}$$

Where $\alpha, \beta = -\frac{1}{2} \pm \frac{1}{2}\,(\,1 + 4m^2b^2\,)^{1/2}$

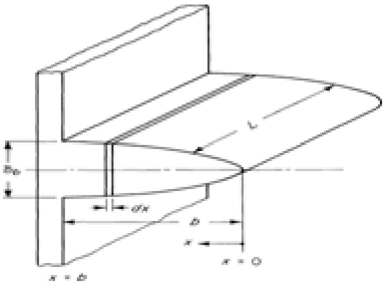
The general solution may be written $\theta(x) = c_1 x^{\alpha} + \frac{c_2}{x^{1/\beta}}$ ------ (15)
and it can be observed that at x = 0, the temperature excess, T −Ts , will be unbounded unless C2 = 0. Therefore,$\theta(x) = c_1 x^{\alpha}$
and from a consideration of the temperature excess at the fin base where x = b, the particular solution is obtained as $\theta(x) = \theta_b (\frac{x}{b})^{\alpha}$

Heat flow through the base of the fin is obtained by differentiating eq. (15) and evaluating the derivative at x = b. Noting that A = δbL, the result is $q_b = kA \frac{d\theta}{dx} !_{x=b} = \frac{k\delta_b L\theta_b \alpha}{b}$ Or
$q_b = \frac{k\delta_b L\theta_b}{2b} [-1 + \sqrt{1 + (2mb)^2}]$ ---------------(20)

The expression for the fin efficiency results when eq. (20) is divided by the ideal heat flow, qid = 2hbLθb:
$\eta = \frac{k\delta_b L\theta_b [-1+\sqrt{1+(2mb)^2}]}{(2b)(2hbL\theta_b)}$---------------(21)
This may be simplified by multiplying the numerator and denominator by − 1 − ,1 + (2mb)2 and noting that as m2 = 2h/kδb,
$\eta = \frac{-1+\sqrt{1+(2mb)^2}}{2(mb)^2} \frac{-1-\sqrt{1+(2mb)^2}}{-1-\sqrt{1+(2mb)^2}}$ -----------------(22)
so that $\eta = \frac{2}{1+\sqrt{1+(2mb)^2}}$ ----------------(23)
Values of η as a function of mb have been plotted from eq.

Longitudinal Fin of Convex Parabolic Profile

For the longitudinal fin of convex parabolic profile shown . it is noted that the exponent on the general fin profile of eq. (11) satisfies the geometry when n = 1/3 The profile function for this fin then becomes
Longitudinal fin of convex parabolic profile.
$f2(x) = \frac{\delta_b}{2} (\frac{x}{b})^{1/2}$ and $\frac{df_2(x)}{dx} = \frac{\delta_b}{4\sqrt{bx}}$ ------(25)
When these are substituted into eq. (11), the governing differential equation for the temperature excess, θ(x) = T (x) − Ts, becomes



$\sqrt{x} \frac{d^2\theta}{dx^2} + \frac{1}{2\sqrt{x}} \frac{d\theta}{dx} - m^2\sqrt{b}\theta = 0$ where again, $m = (2h/k\delta)^{1/2}$
A termwise comparison with the general Bessel equation leads to the general solution for the temperature excess, θ(x) = T (x) − Ts :
$\theta(x)\, x^{1/4} [C_1 I_{1/3} (\frac{4}{3} mb^{1/4}x^{3/4}) + C_2 I_{-1/3} \left(\frac{4}{3} mb^{1/4}x^{3/4}\right)]$ -----(26)
Evaluation of the arbitrary constants in eq. (1.23) requires careful consideration of the infinite series expansions of the two Bessel functions.
Define a transformed variable u:
$u \equiv \frac{4}{3} mb^{1/4}x^{3/4}$
so that eq. (26) may be rewritten as
$\theta(u) = \Omega u^{1/3} [C_1 I_{1/3} (u) + C_2 I_{-1/3} (u)$ Where $\Omega \equiv (\frac{3}{4mb^{1/4}})^{1/3}$
and where the boundary conditions of in terms of the trans- formed variable u are
$\theta (u = u_b = \frac{4}{3} mb) = \theta_b$ ------(27) And $\frac{d\theta}{du} \Big|_{u=0} = 0$ ----(28)
Use of the boundary condition of eq. (1.25b) requires multiplication of each of the terms of the infinite series expansion
for I1/3(u) and I−1/3(u) by u followed by aterm-by-term differentiation. When this procedure is performed, the term involving $\frac{d}{du} [u^{1/3} I_{1/3} (u)]$ becomes unbounded at x = 0. This requires that C1 = 0. Then application of the boundary condition of eq. (27) yields a value for C2 such that the particular solution of eq. (28) in terms of u becomes $\theta(u) = \frac{\Omega u^{1/3} \theta_b I_{-1/3} (u)}{\Omega {u_b}^{1/3} \theta_b I_{-1/3} (u_b)} = \theta_b (\frac{u}{u_b})^{1/3} \frac{I_{-1/3} (u)}{I_{-1/3} (u_b)}$

and in terms of x, $\theta(x) = (\frac{x}{b})^{1/4} \frac{I_{-1/3}(\frac{4}{3} mb^{1/4} x^{3/4})}{I_{-1/3}(\frac{4}{3} mb)}$------- (29)

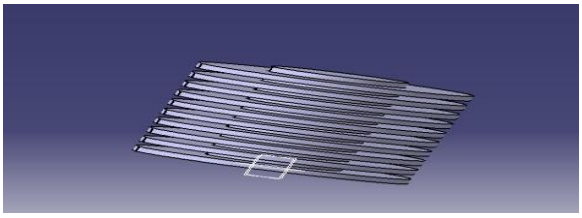
The heat flow through the base of the fin is obtained by differentiating eq. (30) term by term and evaluating the derivative at x = b. Again noting that A = δbL, $q_b = k\delta_b Lm\theta_b \frac{I_{2/3}(\frac{4}{3}mb)}{I_{-1/3}(\frac{4}{3}mb)}$ ------(30)

The fin efficiency can be obtained by taking the ratio of eq. (30) to the ideal heat flow, qid = 2hbLθb:

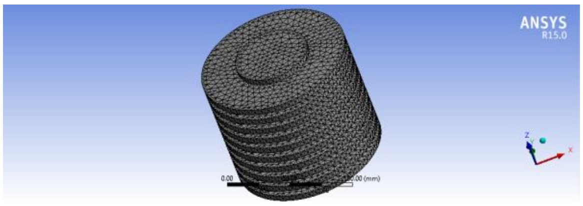
$$\eta = \frac{q_b}{2hbL\,\theta_b} = \frac{mk\,\delta_b\,\theta_b\,I_{2/3}(\frac{4}{3}mb)}{2hbL\,\theta_b\,I_{-1/3}(\frac{4}{3}mb)} \quad \text{OR} \qquad \eta = \frac{1}{mb}\frac{I_{2/3}(\frac{4}{3}mb)}{I_{-1/3}(\frac{4}{3}mb)}$$

Values of η as a function of mb have been plotted

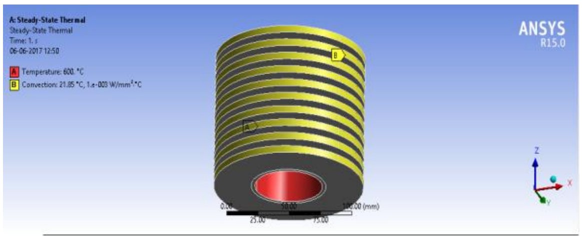
Model in CATIA V5 for rectangular fin



Mesh model in ANSYS OF RECTANGULAR FIN

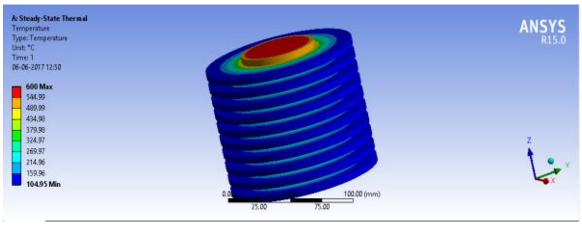


Temperature Input for Thermal Analysis

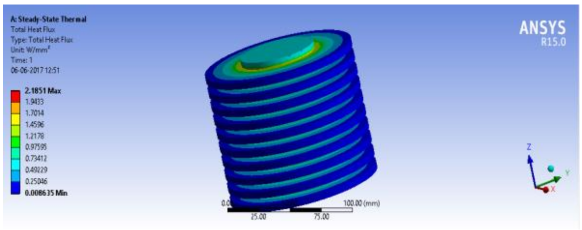


Case1: Material used for Rectangular Fin: Insulin

Temperature flow in Insulin material

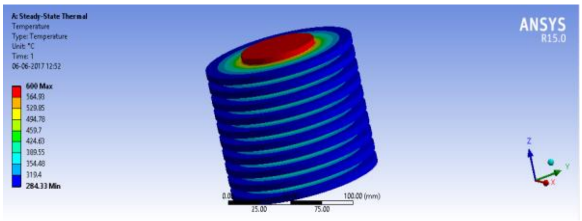


Heat flux in insulin material

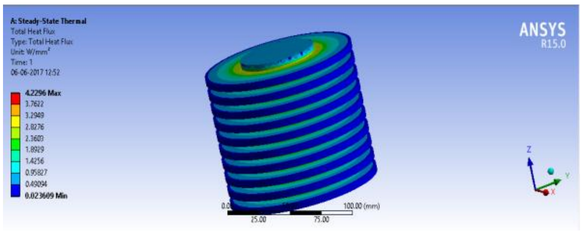


Case2: Material used for Rectangular Fin: Aluminium nitride

Temperature flow in Aluminium nitride material

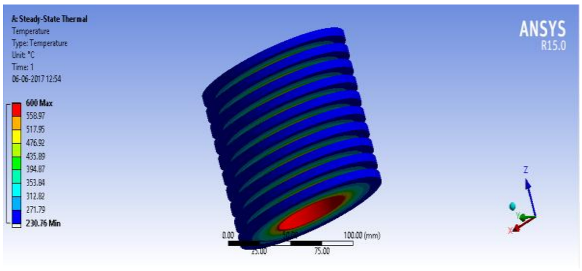


Heat flux in Aluminium nitride material

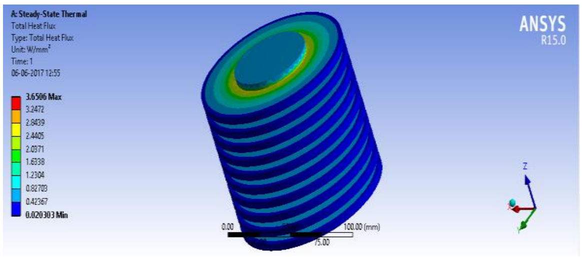


Case3: Material used for Rectangular Fin: Aluminium Alloy A204

Temperature flow in Aluminium Alloy A204 material



Heat flux in Aluminium Alloy A204 material



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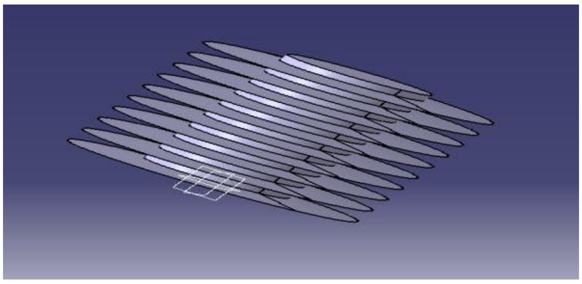
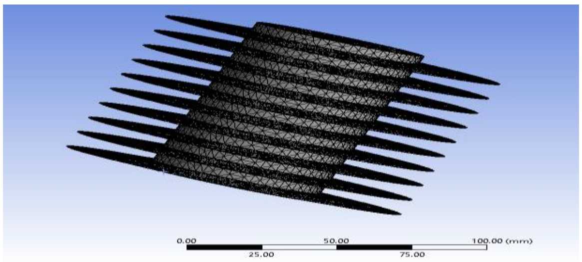
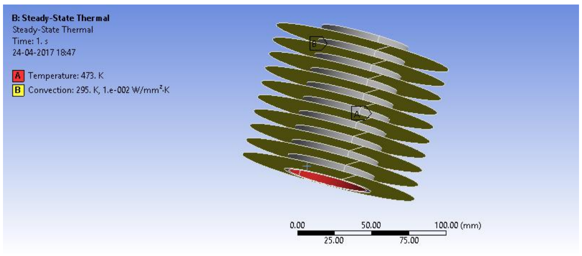
Model in CATIA V5 for triangular fin



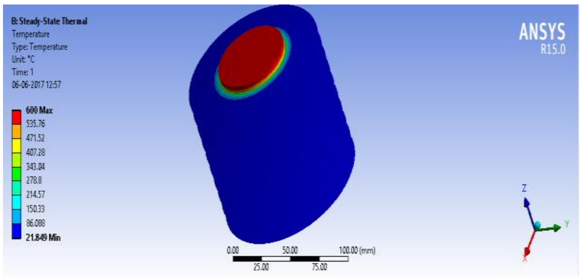
Mesh model in ANSYS OF TRIANGULAR FIN



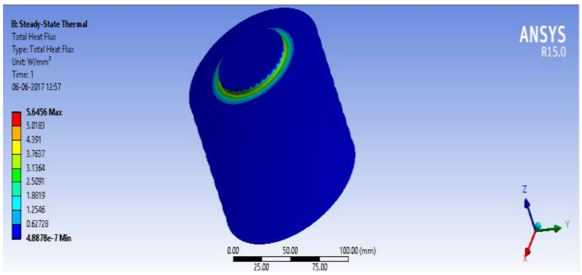
Temperature Input for Thermal Analysis



Case1: Material used for triangular Fin: Insulin Temperature flow in Insulin material

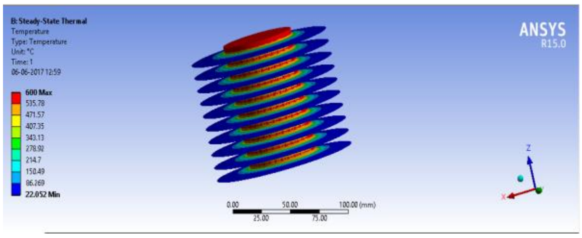


Heat flux in insulin material

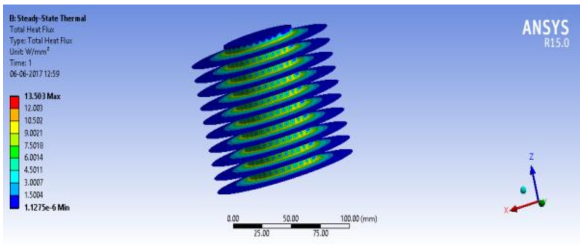


Case2: Material used for triangular Fin: Aluminium nitride

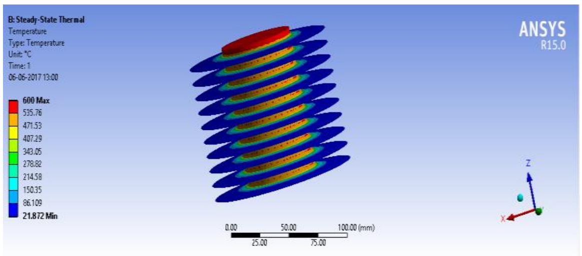
Temperature flow in Aluminium nitride material



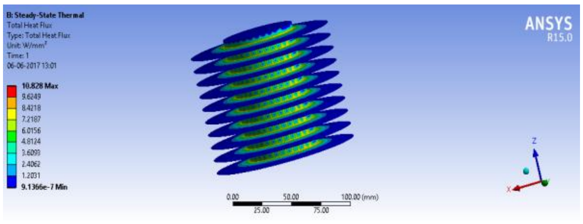
Heat flux in Aluminium nitride material



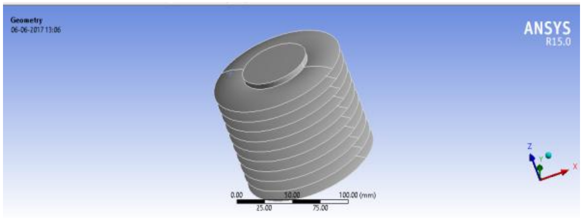
Case3: Material used for triangular Fin: Aluminium Alloy A 204 Temperature flow in Aluminium Alloy A 204 material



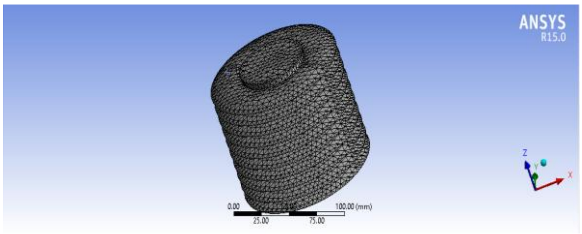
Heat flux in Aluminium Alloy A204 material



CATIA V5 MODEL IMPORTED TO ANSYS OF CONVEX FIN

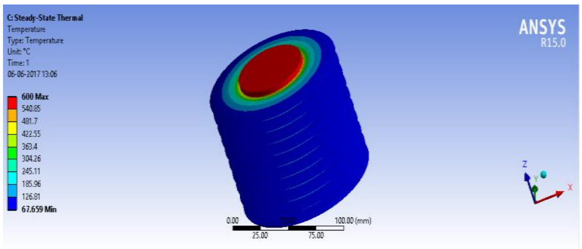


Mesh model in ANSYS

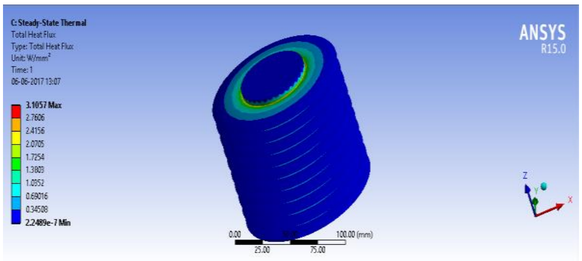


Case1: Material used for convex Fin: Insulin

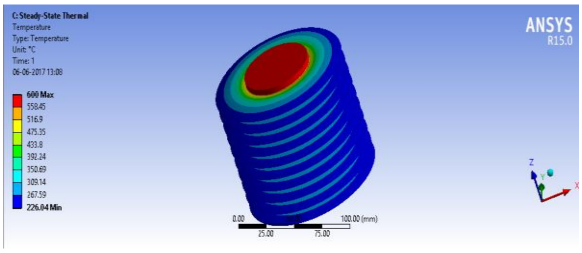
Temperature flow in Insulin material



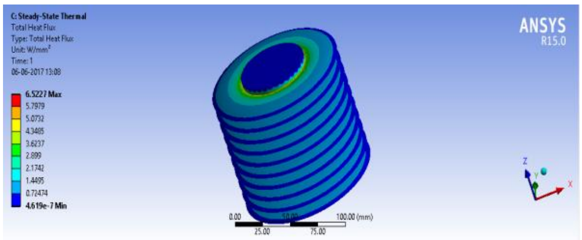
Heat flux in insulin material



Case2: Material used for convex Fin: Aluminium nitride, Temperature flow in Aluminium nitride material

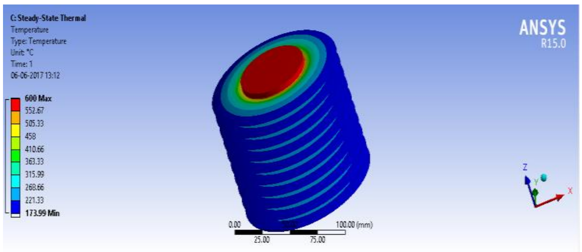


Heat flux in Aluminium nitride material

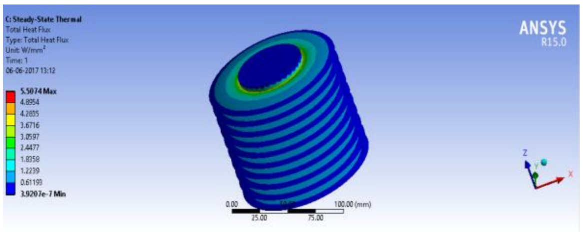


Case3: Material used for convex Fin: Aluminium Alloy A 204

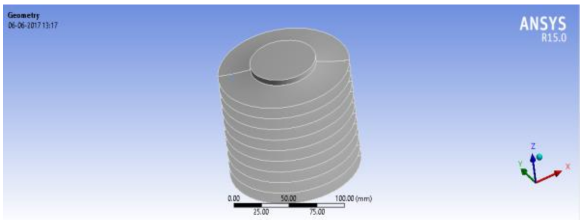
Temperature flow in Aluminium Alloy A 204 material



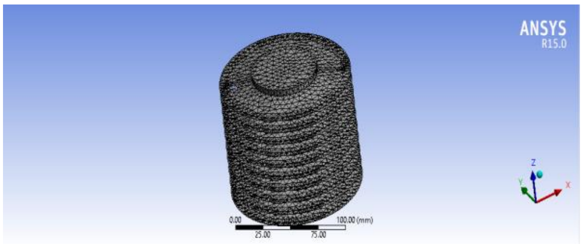
Heat flux in Aluminium Alloy A204 material



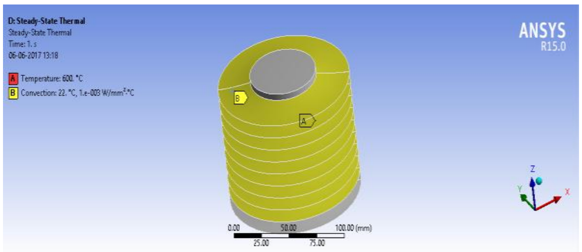
CATIA V5 MODEL IMPORTED TO ANSYS OF CONCAVE FIN



Mesh model in ANSYS



Temperature Input for Thermal Analysis



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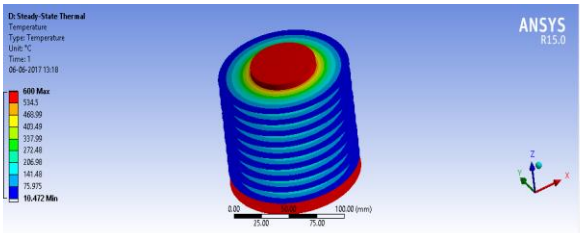
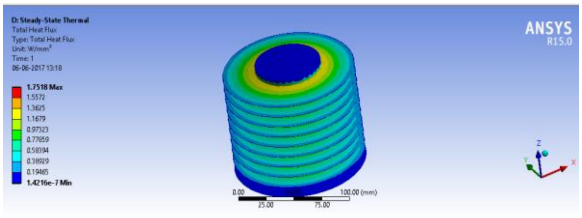
Case1: Material used for concave Fin: Insulin

Temperature flow in Insulin material

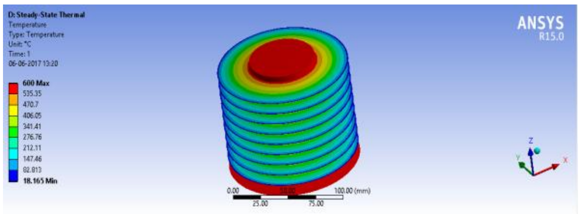


Heat flux in insulin material

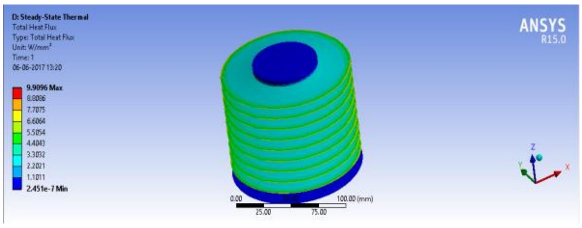


Case2: Material used for concave Fin: Aluminium nitride

Temperature flow in Aluminium nitride material

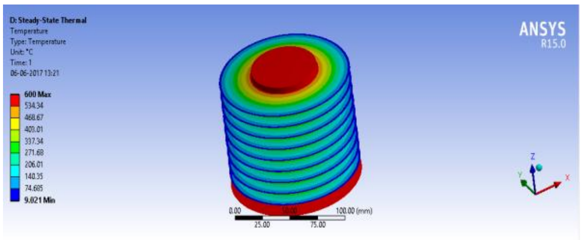


Heat flux in Aluminium nitride material

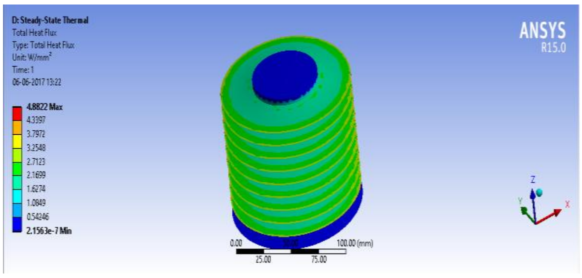


Case3: Material used for concave Fin: Aluminium Alloy A 204

Temperature flow in Aluminium Alloy A 204 material

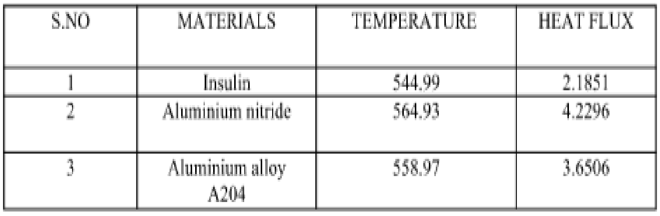


Heat flux in Aluminium Alloy A204 material



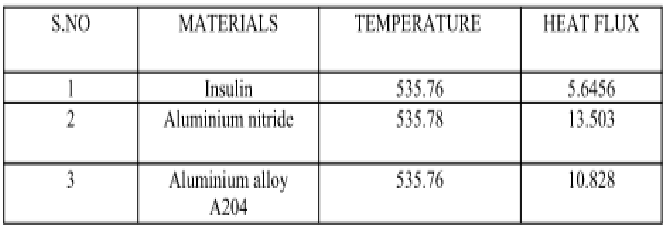
RESULTS AND DISCUSSION

FIN WISE TEMPERATURE AND HEAT FLUX TABLES RECTANGULAR FIN



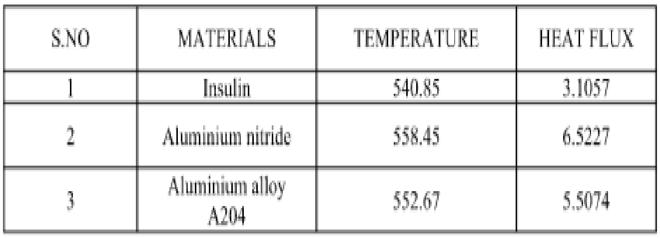
S.NO	MATERIALS	TEMPERATURE	HEAT FLUX
1	Insulin	544.99	2.1851
2	Aluminium nitride	564.93	4.2296
3	Aluminium alloy A204	558.97	3.6506

TRIANGULAR FIN



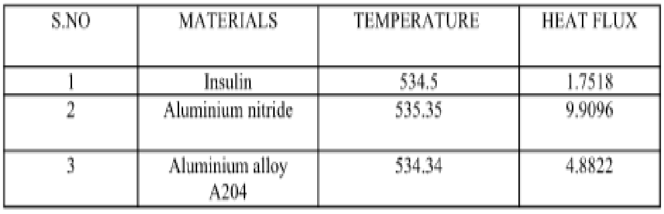
S.NO	MATERIALS	TEMPERATURE	HEAT FLUX
1	Insulin	535.76	5.6456
2	Aluminium nitride	535.78	13.503
3	Aluminium alloy A204	535.76	10.828

CONVEX FIN



S.NO	MATERIALS	TEMPERATURE	HEAT FLUX
1	Insulin	540.85	3.1057
2	Aluminium nitride	558.45	6.5227
3	Aluminium alloy A204	552.67	5.5074

CONCAVE FIN



S.NO	MATERIALS	TEMPERATURE	HEAT FLUX
1	Insulin	534.5	1.7518
2	Aluminium nitride	535.35	9.9096
3	Aluminium alloy A204	534.34	4.8822

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MATERIAL WISE TEMPERATURE AND HEAT FLUX TABLES

TEMPERATURE AND HEAT FLUX FOR INSULIN MATERIAL:

S.NO	FIN TYPES	TEMPERATURE	HEAT FLUX
1	Rectangular fin	544.99	2.1851
2	Triangular fin	535.76	5.6456
3	Convex fin	540.85	3.1057
4	Concave fin	534.5	1.7518

TEMPERATURES AND HEAT FLUX ALUMINIUM NITRIDE MATERIAL:

S.NO	FIN TYPES	TEMPERATURE	HEAT FLUX
1	Rectangular fin	564.93	4.2296
2	Triangular fin	535.78	13.503
3	Convex fin	558.45	6.5227
4	Concave fin	535.35	9.9096

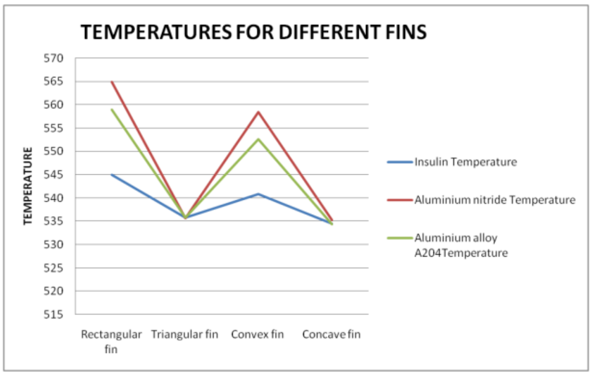
TEMPERATURES AND HEAT FLUX ALUMINIUM ALLOY A204 MATERIAL:

S.NO	FIN TYPES	TEMPERATURE	HEAT FLUX
1	Rectangular fin	558.97	3.6506
2	Triangular fin	535.76	10.828
3	Convex fin	552.67	5.5074
4	Concave fin	534.34	4.8822

TEMPERATURE TABLE FOR DIFFERENT TYPE OF FINS

S.no	Fin type	Insulin Temperature	Aluminium nitride Temperature	Aluminium alloy A204 Temperature
1	Rectangular fin	544.99	564.93	558.97
2	Triangular fin	535.76	535.78	535.76
3	Convex fin	540.85	558.45	552.67
4	Concave fin	534.5	535.35	534.34

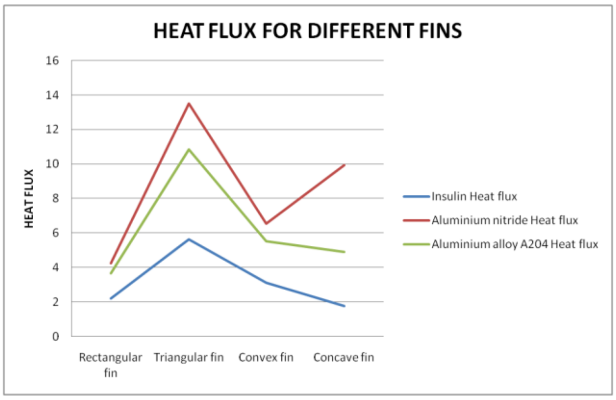
LINE GRAPH FOR TEMPERATURES



HEAT FLUX TABLE FOR DIFFERENT TYPE OF FINS

S.no	Fin type	Insulin Heat flux	Aluminum nitride Heat flux	Aluminum alloy A204 Heat flux
1	Rectangular fin	2.1851	4.2296	3.6506
2	Triangular fin	5.6456	13.503	10.828
3	Convex fin	3.1057	6.5227	5.5074
4	Concave fin	1.7518	9.9096	4.8822

LINE GRAPH FOR HEAT FLUXS



CONCLUSION

In present work, a cylinder fin body is modeled and transient thermal analysis is done by using CATIA V5 and ANSYS. These fins are used for air cooling systems for two wheelers. In present study, Insulin Heat flux & Aluminium, Aluminium nitride is compared with Aluminium Alloy A204. The varying parameters (i.e., geometry) are considered in the study, By changing the shape of the fin to Rectangular fin, Triangular fin , Convex fin, & Concave fin, the weight of the fin body reduces thereby increasing the heat transfer rate and efficiency of the fin. The results shows, by using Concave fin with material Aluminium Alloy A204 is better since heat transfer rate of the fin is more. By using Concave fins the weight of the fin body reduces compared to existing rectangular engine cylinder fin.

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