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"PARAMETRIC STUDY AND THERMAL ANALYSIS OF HEAT SINK IN CPU BY USING ANSYS SOFTWARE"

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ABSTRACT

This project uses Thermal transient analysis to identify a cooling solution for a desktop computer. In this modern world speed determines everything especially desktop PC, CPU have been popular. The computer revolution is growing rapidly in almost every field. CPU is the electronic components, which produces a lot of heat that reduces the performance. In this study the forced convection cooling of heat sinks mounted on CPU are investigated. The design is based on total chassis power dissipation. This represents significant power dissipation for the chassis components (Main processor chip, other chipsets North bridge heat sink and South bridge heat sink) the main processing chip has fin attachments (heat sink) over it for heat dissipation. Here take three different geometries like Rectangular heat sink, Circular heat sink , and Tapered heat sink and materials used Aluminium alloy and CAD model have prepared on SOLIDEDGE and thermal analysis has done on ANSYS thermal transient analysis. all three material like Circular heat sink, Taper Fins heat sink and Rectangular heat sink separately are 78 °C, 79.56 °C and 78°C . Here we can obviously saw that Circular heat sink Aluminium materials have less estimation of temperature contrast with different geometries. So it is used for future design. We get most extreme heat flux an incentive for all material like Circular heat sink, Taper Fins heat sink and Rectangular heat sink individually are 2.92 w/mm^2, 0.90 w/mm^2, 0.925 w/mm^2 and 0.832 w/mm^2.

Keyword: *Thermal transient, CPU, Aluminium, Rectangular heat sink, Circular heat sink , Tapered heat sink and heat flux, heat flow.*

I. INTRODUCTION

Thermal administration has turned into a basic component in the present electronic structure, as increasingly minimized plans have prompted more noteworthy trouble in expelling heat from the framework. So as to keep the segments inside their safe working territory, the working temperature of the segments must not surpass the maker indicated most extreme temperature. A decrease in working temperature expands the segment future and along these lines builds the unwavering quality of the framework.

The activity of many designing frameworks results in the age of warmth. This undesirable result can cause genuine overheating issues and now and again prompts disappointment of the framework. The warmth delivered inside a framework must be disseminated to its surroundings so as to keep up the framework at its suggested working temperatures and working viably and dependably. So as to accomplish the ideal rate of warmth dissemination, with minimal measure of material, the ideal mix of geometry and direction of the finned surface is required, which are commonly known as warmth sinks.

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Thermal sinks are utilized to move heat far from the gadget so as to keep up a lower gadget temperature. By and large, expanding the warmth sink surface territory decreases the thermal sink warm obstruction, making it progressively viable in exchanging heat from a segment to the surrounding air. The warmth dispersal from the finned frameworks to the outer surrounding climate can be acquired by utilizing the instruments of the convection and radiation warmth exchange. The impact of radiation commitment in absolute warmth exchange rate is very low because of low emissivity estimations of utilized blade materials, for example, Aluminum and Duralumin amalgams.

II. OBJECTIVE

There are following objective are to be expected from the present work.

- To predict the heat transfer rate from existing design in computer system
- To optimize the heat sink design from the basis of heat transfer rate.
- To maximize the heat transfer rate from the CPU heat sink
- To design heat sink cost effective with maximum heat transfer rate.

III. RESULTS AND DISCUSSIONS

Step 1: Aggregation information and knowledge related to cooling fins of IC engines.

Step 2: a totally parametric model of the engine block with fin is made in CATIA software system package.

Step 3: Model obtained in Step a try of is analyzed using ANSYS 19.2 (Workbench), to get the heat or heat rate, thermal gradient and nodal temperatures.

Step 4: Manual calculations are done.

Step 5: Finally, we tend to tend to check the results obtained from ANSYS and manual calculations for completely different material, shapes and thickness.

IV. CALCULATION

In this case, the section Ac is constant. If P is assumed as the section perimeter:

$$\frac{d^2T}{dx^2} - \frac{h \cdot P}{k \cdot A_c}(T - T_\infty) = 0$$

Replacing

$$\theta(x) = T(x) - T_\infty$$

$$m = \sqrt{\frac{h \cdot P}{k \cdot A_c}}$$

A second order differential equation is obtained:

The restrictions are adiabatic tip (x=H) and fixed base temperature Tb.

$$\left.\frac{d\theta}{dx}\right|_{x=H} = 0 \qquad \theta_b = T_b - T_\infty$$

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$$\theta(x) = \frac{\cosh\{m(H-x)\}}{\cosh(mH)}\theta_b$$

Where H is the fin high (m).
To know the power dissipated, the heat transfer at the fin base is analyzed.

$$q_b = kA\frac{d\theta}{dx}\Big|_{x=0}$$

Substituting $\frac{d\theta}{dx}\Big|_{x=0}$ for the derivative of equation

$$q_b = \sqrt{hPkA_c}\cdot\theta_b\tanh(mH)$$

The efficiency is the ratio between the maximum heat rate that a perfect fin can dissipate and the heat rate that dissipate a real fin. The maximum power that can dissipate a perfect fin is deduced from the Newton's law of cooling , expressed as

$$q_{max} = h\cdot A\cdot(T_b - T_{amb}) = hA_f\theta_b$$

V. MODELING & SIMULATIONS

5.1 Dell CPU Cooling fins

5.1.1 Circular fins heat sink Aluminium

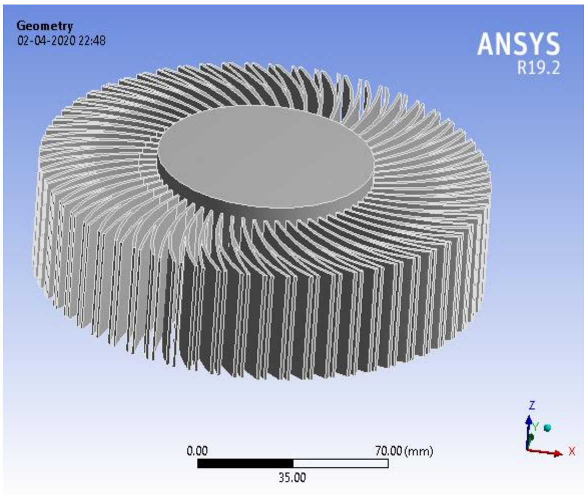

Fig. 5.1 Circular flared heat sink import ANSYS

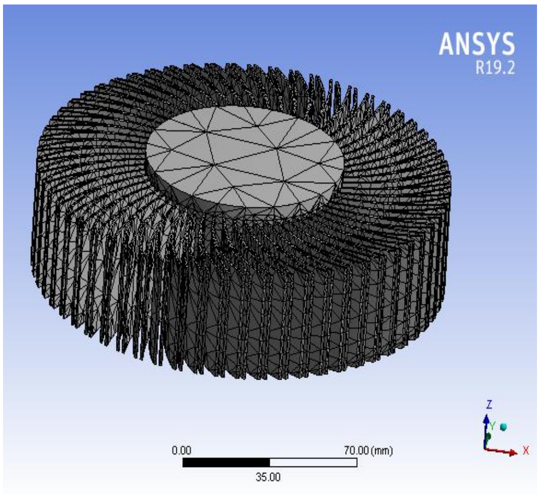

Fig. 5.2 Circular flared heat sink meshing ANSYS

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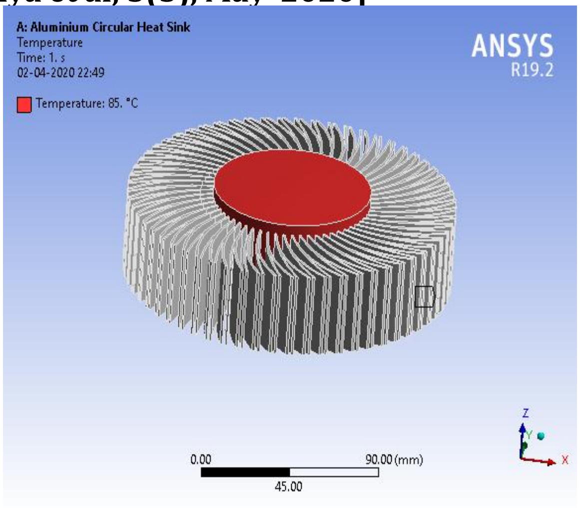

Fig. 5.3 Circular flared heat sink temperature boundary

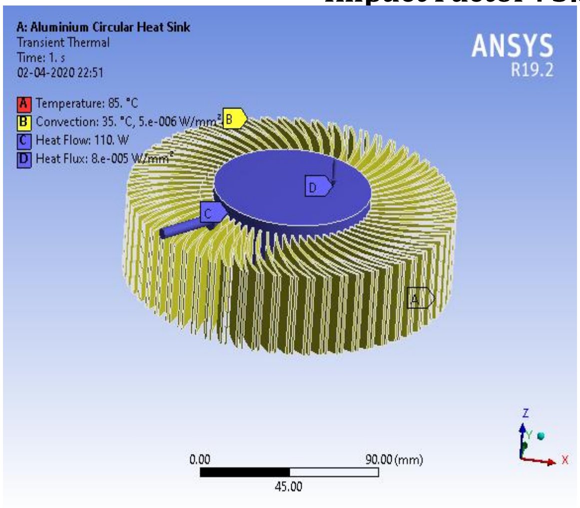

Fig. 5.4 Circular flared heat sink thermal boundary condition

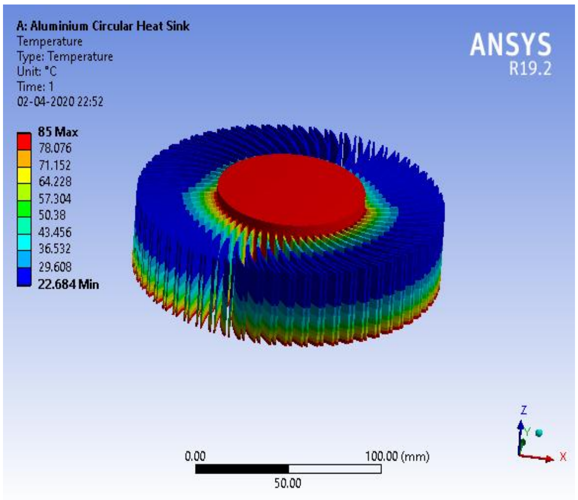

Fig. 5..5 Circular flared heat sink temperature result

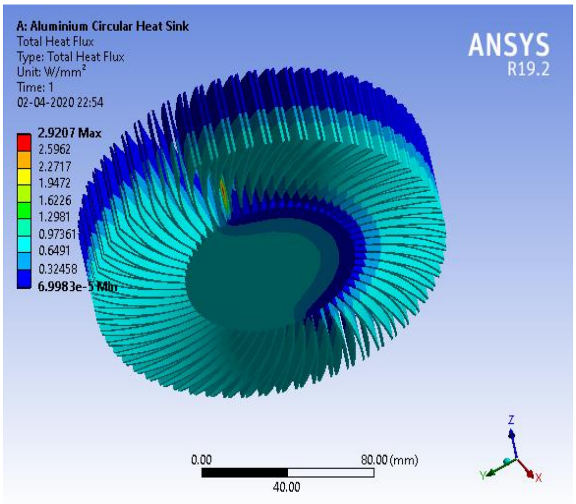

Fig. 5.6 Circular flared heat sink heat flux result

5.1.2 Taper fins heat sink Aluminium

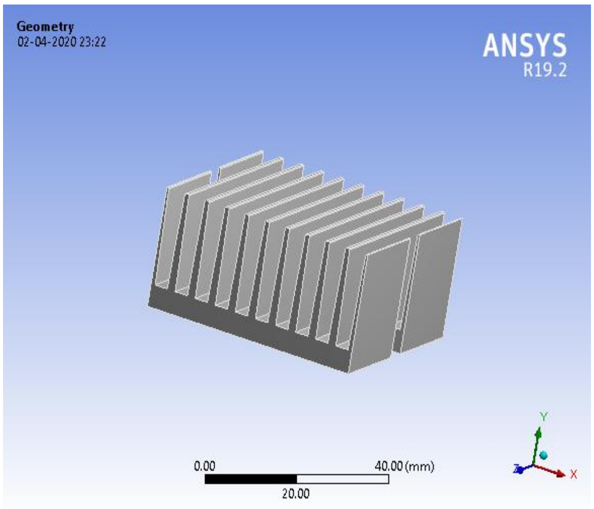

Fig. 5.7 Taper fins heat sink import ANSYS

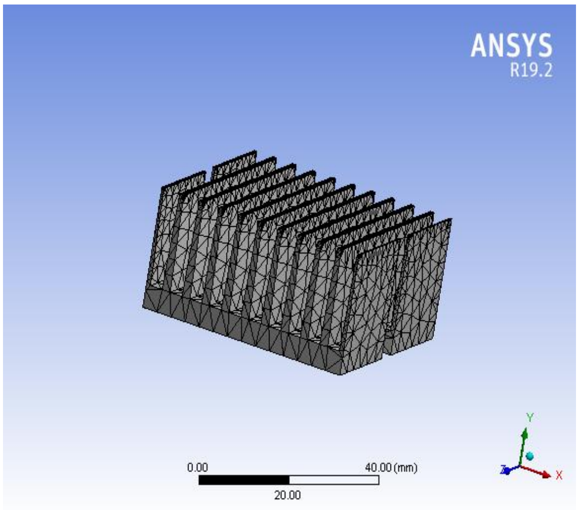

Fig. 5.8 Taper fins heat sink meshing ANSYS

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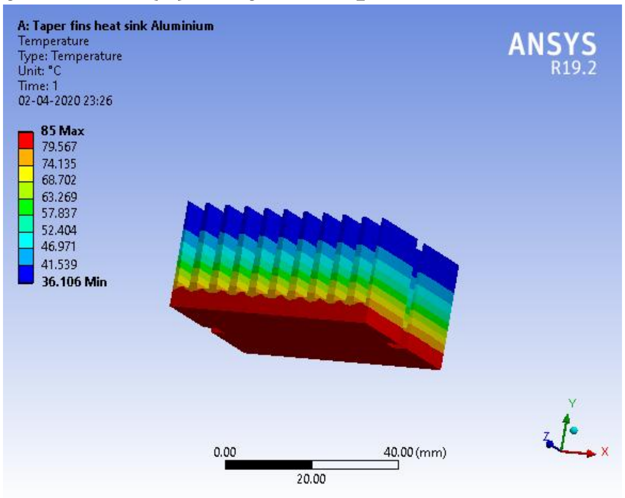

Fig. 5.9 Taper fins heat sink temperature result

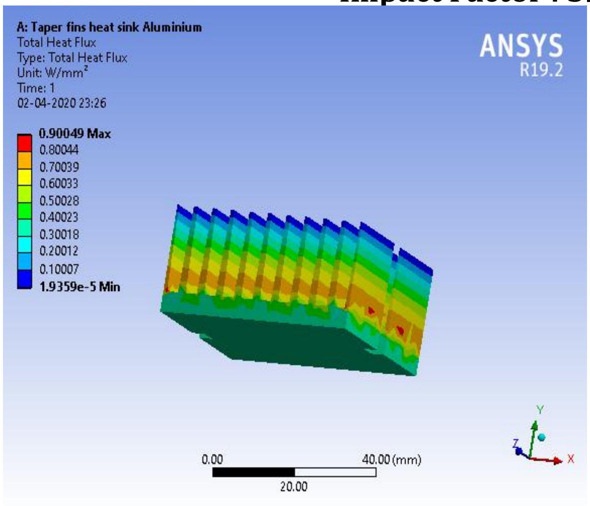

Fig. 5.10 Taper fins heat sink heat flux result

5.1.3 Rectangular fins heat sink Aluminium

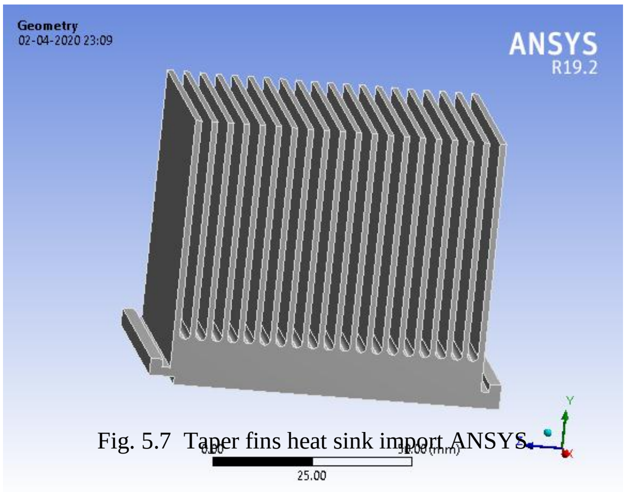

Fig.5.11 Rectangular fins heat sink import ANSYS

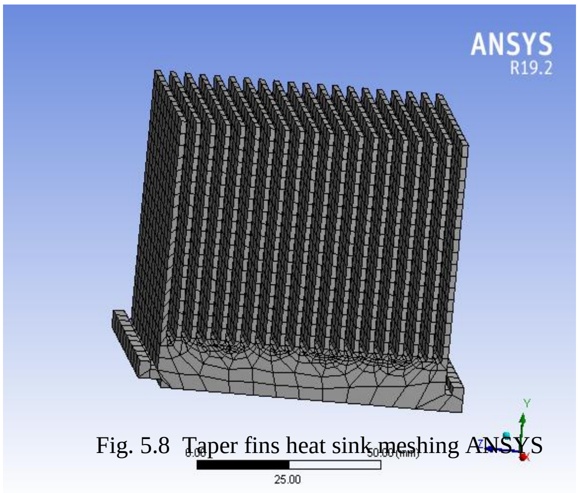

Fig. 5.12 Rectangular fins heat sink meshing ANSYS

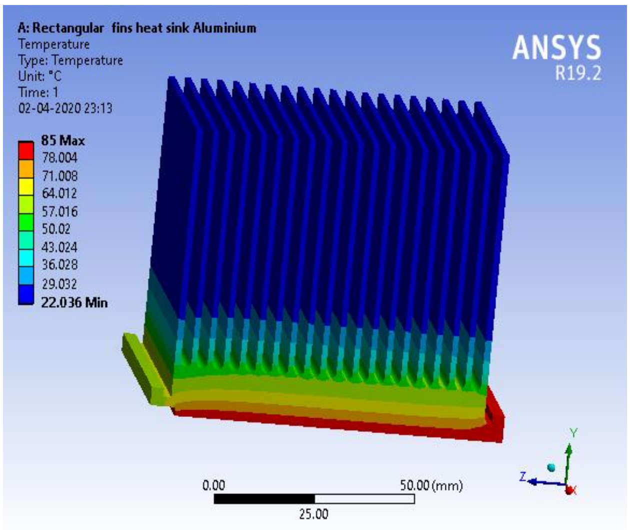

Fig. 5.13 Rectangular fins heat sink temperature result

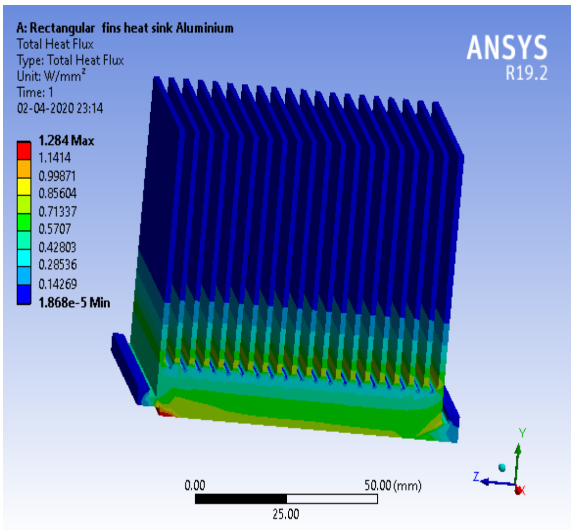

Fig. 5.14 Rectangular fins heat sink heat flux result

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VI. RESULT & DISCUSSION

We get most extreme temperature esteem for all three material like **Circular heat sink**, **Taper Fins heat sink** and Rectangular **heat sink** separately are 78 °C, 79.56 °C and 78°C . Here we can obviously saw that **Circular heat sink aluminium** materials have less

estimation of temperature contrast with different geometries. So it is used for future design. We get most extreme heat flux an incentive for all material like **Circular heat sink**, **Taper Fins heat sink** and **Rectangular heat sink** individually are 2.92 w/mm^2, 0.90 w/mm^2, 0.925 w/mm^2 and 0.832 w/mm^2. Here we can unmistakably saw that **Circular heat sink aluminium** materials have more heat flux value with different geometries. So it is ok for future plan.

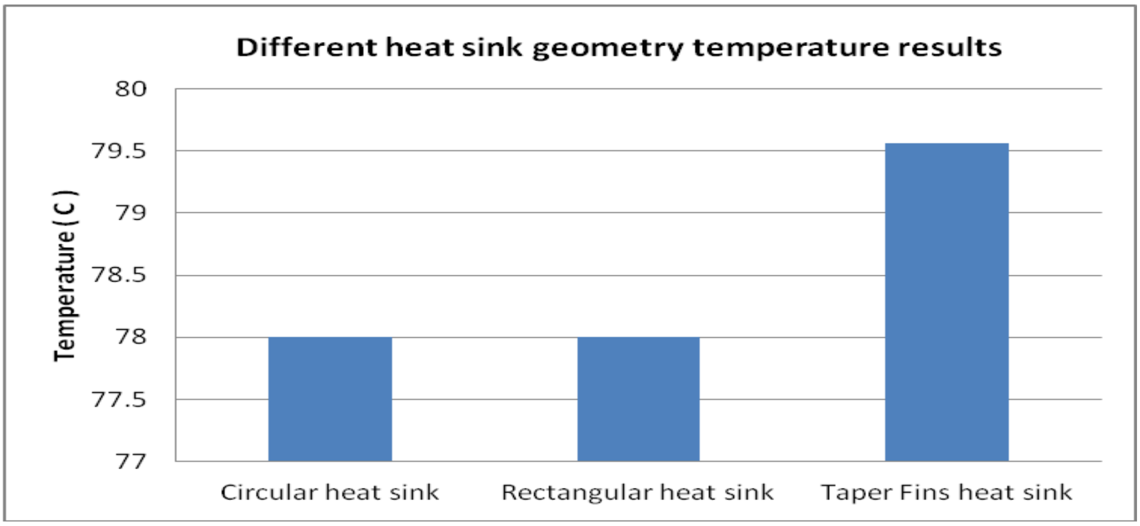

Fig. 6.1 Different heat sink geometry temperature results

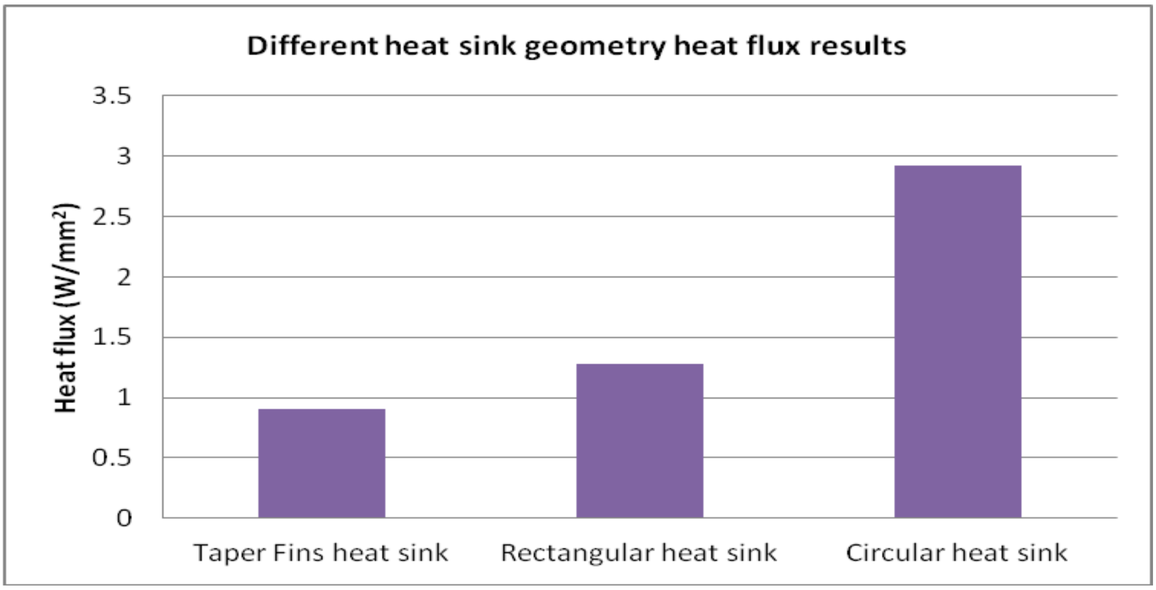

Fig. 6.2 Different heat sink geometry heat flux results

VII. CONCLUSION

For Optimization and analysis of a heat sink following conclusion has been drawn which significantly affects the performance of heat sink.

1. predict the heat transfer rate from existing design in computer system
2. To optimize the heat sink design from the basis of heat transfer rate.
3. To maximize the heat transfer rate from the CPU heat sink
4. To design heat sink cost effective with maximum heat transfer rate

Circular heat sink aluminium materials have more heat flux value with different geometries. So it is ok for future plan.

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