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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 Aluminum alloy and CAD model have prepared on SOUDEDGE 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 Aluminum 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 wlm 0.90 w/mm", 0.925 wlmm2 and 0.832 wtmm:*

Keyword: *Thermal transient, CPU, Aluminum, 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.

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. TYPES OF HEAT SINKS

A heat sink is designed to maximize its surface area in contact with the cooling medium surrounding it, such as the air. Air velocity, choice of material, protrusion design and surface treatment are factors that affect the performance of a heat sink. Heat sink attachment methods and thermal interface materials also affect the die temperature of the integrated circuit. Thermal adhesive or thermal paste improve the heat sink's performance by filling air gaps between the heat sink and the heat spreader on the device. A heat sink is usually made out of aluminum or copper.

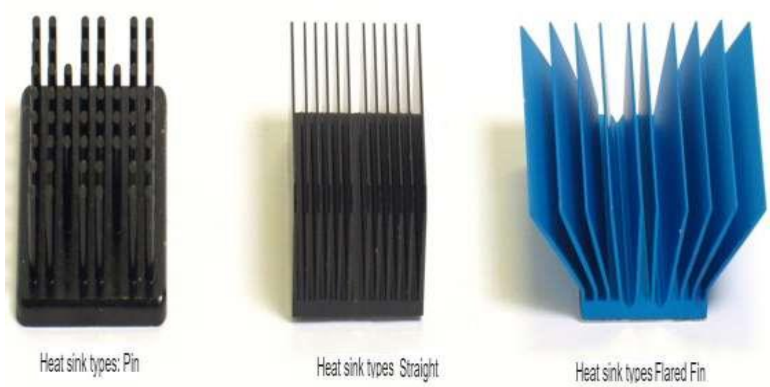

Figure 1 Types of fins

Figure 2: Heat sinks CPU arrangements

III. LITERATURER REVIEW

Dhumne and Farkade et al. [1] They have done warmth trade assessment of cylinder molded punctured cutting edges in astonished game-plan. The punctured adjusts of different sizes were used for the assessment. The results showed that Nusselt number additions with decrease in breathing space extent and bury balance isolating. The disintegration variable additions with decreasing in cover balance scattering.

Singh, B. Ubhi., et.al. [2] They have made and separated the glow trade through cutting edge development in plate adjusts. They found out about various geometries, for instance, rectangular, trapezium, triangular, and round extensions in plate adjust. The results showed that plate sharp edge with increases offered 5% to 13% more warmth trade than balance without extensions. The sufficiency of rectangular increase plate balance is more than interchange sorts of development.

D.D Palande and Walunj et. al [3] They have done exploratory assessment of evaluation dainty plate edges heat sink under basic convection. They have examined cutting edges concerning viewpoint extent and particular radiator information wattage the result showed that ordinary convection heat trade increases with warmth data. The convective warmth trade increases with perspective extent.

M. Reddy and G. Shivashankaran et al. [4] They have done numerical entertainment of obliged convection heat trade overhaul by porous pin fins balance at rectangular channel. They had found out about round, long roundabout and short bended pin sharp edge heat sink by changing inlet speeds for example 0.5m/s, 1m/s, 1.5m/s and 2m/s using ANSYS CFD natural programming. The result showed that the glow move efficiencies in porous pin balance are around half higher than solid pin balance.

M. Ali, Tabassum et.al. [5] Performed warm and water driven assessment of rectangular offset displays with different gap size and number. They changed puncturing from 0 to 2, and contrasted opening broadness structure 0mm to 3mm. The results showed that glow trade and weight drop extended with extension in Reynolds number for all adjusts.

K. Dhanawade and Sunnapwar et.al. [6] They have done the warm assessment of square and indirect punctured sharp edge bunch by compelled convection. They have changed the range of gap for the assessment for example 10mm square, 8mm square, and 6mm square and for indirect puncturing 10mm, 8mm, 6mm estimation. The result got exhibited that the Nusselt numbers extended with extension in Reynolds number, warm contact extended with development in puncturing and usage of punctured equalization assemble the glow trade besides there is diminishment in weight, saving of material that finally decays the utilization on balance material.

K. Chaitanya and G. Rao et al.[7] They have done the transient warm assessment of drop shaped pin sharp edge group using CFD. They have done the close to concentrate between round shape pin sharp edge and drop formed pin balance. The results showed that the glow trade extended due to development in contact surface zone in fluid and the equalization. There was extension in the weight drop for drop shaped pin offsets appeared differently in relation to indirect pin adjusts.

Junaidi, Ansari et.al. [8] They have done warm examination of spread pin cutting edge heat sink. They have done CFD assessment using ANSYS Fluent 12.1 with different focuses (for example 4 degrees, 5 degrees, 6 degree and 7 levels) of inclination of pin sharp edge with respect to base plate. The glow trade in the midst of regular convection is more in spread pin balance structure. The spread pin balance gives better air disturbance.

S. R Pawar and R. B. Varasu [9] They have the glow trade by basic convection from triangular scored sharp edge display. They found out about different indent geometries, for instance, balance without score, cutting edge with 20% indent with an area compe nsation and offset with 40% indent with extend pay concerning various parameters, for instance, stature, length, score estimation, balance isolating and balance thickness. The investigations showed that glow trade coefficient is lower in indented sharp edge when appeared differently in relation to without score. The glow trade increases with extension in indent size with an area compensation.

Hagote and Dahake et. al [10] They have improved the ordinary convection heat trade coefficient by using V-balance group. They analyzed the V-balance using ANSYS CFX and probably. They used plate sharp edges where the parities were composed at an inclination of 60^0C.

V. Karthikegn, Babu et.al. [11] They illustrated and dismembered the normal convection heat trade coefficient between rectangular cutting edge display with extension and equalization group without increase. The glow trade through cutting edge bunch with rectangular development, indirect enlargement, trapezoidal extension, triangular development, 18mm gap, 20 mm puncturing, 22 mm gap. The edge show with rectangular developments has least temperature close to the finish of equalization group, when diverged from offset display with rectangular increase, without enlargement and with gap.

Prakash.T [12] This paper uses CFD to perceive a cooling answer for a work station. Right now speed chooses everything especially work territory PC, CPU have been predominant. The PC upset is growing rapidly in essentially every field. CPU is the electronic fragments, which conveys a huge amount of warmth that decreases the introduction.

Nilesh Khamkar el.al [13] The reliably rising transistor densities and trading speeds in microchips have been went with a shocking augmentation in the structure heat movement and force dispersal. Right now rising IC engines got together with a lot of progressively stringent execution and steadfast quality essential have made warm organization issues constantly obvious in the structure of present day micro electronics systems.

Ibrahim Mjallal el.al [14] As the temperature of electronic gadgets builds, their disappointment rate increments. That is the reason electrical gadgets ought to be cooled. One of the promising cooling strategies is utilizing Phase Change Materials (PCMs). Another detached temperature the executives' strategy, that includes the immediate situation of PCMs on the chip, has been investigated and created. PCMs are potential temperature controllers that can store warm vitality and discharge it during dissolving and freezing separately. This paper analyzes the temperature dissemination on a warm the sink with and without PCM with various extents of warmth motion. Additionally, two diverse PCMs with various densities, to be specific salt-hydrate and wax, have been explored in cooling electronic gadgets.

IV 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.

V 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.

VI. CALCULATION

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

A second order differential equation is obtained: The restrictions are adiabatic tip (x=H) and fixed base temperature Where H is the fin high (m).

To know the power dissipated, the heat transfer at the fin base is analyzed.

The efficiency is the ratio between the maximum heart 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:

VII. MODELING & SIMULATIONS

- **Creation of Aluminum**

This is gotten from the mineral bauxite. Bauxite is changed over to aluminum oxide (alumina) by methods for the Bayer Process.

- **Yearly Demand of Aluminum**

The usage of reused aluminum is financially and earth persuading. Then again there's nothing more needed than 5 % of this to remit and reuse one ton of aluminum. There is no differentiation in quality among virgin and reused aluminum amalgams.

- **Employments of Aluminum**

Unadulterated aluminum is delicate, pliable, deterioration safe and has a high electrical conductivity. It is generally utilized for foil and conductor joins, at any rate alloying with different parts is basic to give the higher qualities expected to different applications. Aluminum is one of the lightest structure metals, having solidarity to weight degree better than steel.

By using particular mixes of its great properties, for example, quality, non-abrasiveness, usage resistance, recyclability and formability, aluminum is being utilized in a dependably developing number of businesses. This combination of things ranges from fundamental materials through to thin bundling foil.

- **Thickness of Aluminum**

Aluminum has a thickness around 33% that of steel or copper making it one of the lightest fiscally open metals. The resultant high solidarity to weight degree makes it a basic partner material permitting broadened payloads or fuel hypothesis resources for vehicle undertakings unequivocally.

- **Nature of Aluminum**

Unadulterated aluminum doesn't have a high adaptability. Regardless, the advancement of alloying portions like manganese, silicon, copper and magnesium can build the quality properties of aluminum and produce an amalgam with properties modified to express applications. Aluminum is fitting to cold conditions. It has the perfect circumstance over steel in that its inflexible nature increments with reducing temperature while holding its quality. Steel then again winds up delicate at low temperatures.

- **Deterioration Resistance of Aluminum**

Right when acquainted with air, a layer of aluminum oxide shapes rapidly ostensibly of aluminum. This layer has stupefying security from use. It is genuinely impervious to most acids in any case less invulnerable to salts.

VIII. 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 aluminum 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/mnr^2, 0.90 w/mrrr', 0.925 w/mm'' and 0.832 w/mm^2. Here we can unmistakably saw that Circular heat sink aluminum materials have more heat flux value with different geometries

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.

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