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"A REVIEW ON HEAT SINK OF CPU"

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ABSTRACT

This paper uses thermal 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. There are many designs of heat sink to improve the efficiency, few heat sink designs are selected and analyzed, which would be give the maximum heat dissipation. There are many ways of cooling such as air cooling, heat pump cooling. The modified fin geometry with air cooling which is more effective and economic, since the water cooling requires water pump, a separate cooling system for coolant and a separate flow circuit.

Keyword: *Aspect ratio, Fins, Heat sinks*

I. INTRODUCTION

With the rapid development of electronic technology, electronic appliances and devices now are always ever-present in our daily lives. However, as the component size shrinks, the heat flux per unit area increases dramatically. The working temperature of the electronic components may exceed the desired temperature level. Thus, promoting the heat transfer rate and maintaining the die at the desired operating temperature have played an important role in insuring a reliable operation of electronic components. There are a number of methods in electronics cooling, such as jet impingement cooling [1, 2] and heat pipe [3-5]. Conventional electronics cooling normally used forced air cooling with heat sink showing superiority in terms of unit price, weight and reliability. To design a practical heat sink, some criteria such as a large heat transfer rate, a low pressure drop, and a simpler structure should be considered. Porous-channel heat sinks or heat sinks combined with porous structures have been also suggested to improve the thermal performance of heat sinks [6-8]. Among various types of heat sinks, plate-fin and pin-fin heat sinks are widely used owing to their own advantages. The plate-fin heat sinkhas the advantages of a small pressure drop, a simple design and easy fabrication. On the other hand, the pin-fin heat sink has the advantages of a high heat transfer rate due to the redeveloping regions and an even thermal performance independent of the direction of the fluid flow [9, 10]. Recently, Kim et al. [11] revealed that the effective heat sink type between plate-fin and pin-fin heat sinks could be determined depending on the pumping power and heat sink length. In addition to above research activities, there has been a new attempt to combine the advantages of plate-fin and pin-fin heat sinks [12]. Usually, these types of heat sinks have several cuts, termed cross-cuts in the present study, perpendicular to the direction of the fluid flow. Xu et al. [13] demonstrated a new silicon micro channel heat sink composed of longitudinal micro channels and several transverse micro channels that divide the entire flow path into several independent zones. Experiments for strip fin heat sinks were performed and empirical correlations were proposed to predict the Nusselt number and pressure drop [14, 15]. Noda et al. [16] performed numerical simulations of heat sinks.

II. LITERATURE REVIEW

Optimal geometries have enhanced heat transfer surfaces which allow devices to take advantage of one of the following options consisting size reduction, increased thermodynamic process efficiency which leads to lower operating costs, increased heat exchange rate for fixed fluid inlet temperatures, or reduced pumping power for fixed heat duty. There are number of methods in electronic cooling to maintain the unwanted heat dissipation during the operation of such devices, which have been studied and investigated by different researchers.

Chung and Luo, (2002) have analyzed for unsteady heat transfer by using jet impingement cooling system. Turbulence staticsin the stagnation region for an axis symmetric impinging jet cooling system was arranged (Nishino et al., 1996). Heat pipe cooling technology for desktop PC and CPU has been used by Kum et al., (2003). An experimental investigation for the thermal performance of an asymmetrical flat plate heat pipe has been conducted (Wang and Vafai, 2000). CPU with variable heat sink base plate thickness has been analyzed thermally (Mohan and Govindarajan, 2010) by using CFD. Further by the same authors, an experimental and CFD analysis of heat sinks with base plate for CPU cooling has been conducted (Mohan and Govindarajan, 2011) and was observed that the velocity field around the heat sink was affected by the presence of the other components inside the chassis as well as the chassis walls which redirect the hot air back into CPU heat sink.

A numerical study was presented on six CPU heat sinks of the same model, namely a copper heat sink, aluminium heat sink and graphite-metal heat sinks to analyze the temperature distribution and thermal resistance (Liu et al., 2012) and was concluded that the heat dissipation effect of graphite-copper heat sink is better than that of copper one and far better than that of aluminium one, which on further

come to the final conclusion that a reasonable design need to consider material and thickness of the base, height and thickness of the fin along with the heat transfer area of sink. It was the basis of the references for the design of CPU heat dissipation and some necessary theoretical basis for the cooling design of the electronic equipments. A heat sink was designed on geometry based optimization tool with the principle of superposition, whose analysis can be simplified by using a repeating cell (Stadler, 2008). The majority of this work was done with a constant surface temperature boundary condition which had consistently led to designs with one large square channel located closed to the hot surface being shown as the best solution, which resulted in contrast to current designs.

Ayli et al., (2013), have investigated for cooling of electronic equipments to design vortex promoters. Different shapes of vortex promoters were used in the experimental study for turbulent flow and the results were used to validate the previous computational works. The work was related to experimental and computational analysis of heat transfer in electronic systems. An analysis and modeling for heat sink with rectangular fins with through holes was done for efficient cooling of electronic devices for optimal performance (Sukumar et al., 2013) and was observed that in the sense of junction temperature interrupted fins are efficient than continuous and was also found that through holes for the interrupted fins has better performance than interrupted rectangular fins of heat sinks and reduction in weight due to more material removal from the standard.

Light emitting diode (LED) is a modern lighting device in which if the heat dissipation mechanism is not well designed, the induced high temperature will cause the reduction of illumination and life time of lamp. Therefore, the heat sink design has become a key technology for LED lighting device. It was designed and analyzed by Chu et al., (2015), for LED cooling purpose. By using CFD software FLUENT, heat flux and temperature around the heat sink were analyzed, and the surface temperature distribution was also investigated.

Liu and Garimella, (2004), have analyzed for optimal thermal performance of micro-channels heat sinks and the results obtained by them were demonstrated that the models developed offer sufficiently accurate redictions for practical designs, while at the same time being quite straightforward to useThe comparative study of heat sink having fins of various profiles namely rectangular, Trapezoidal, rectangular Interrupted, square, circular inline and staggered, has been thermally analyzed by using CFD (Kansal and Laad, 2015) and was observed that the optimum cooling is achieved by the heat sink design which contains circular pin fins.

III. SUMMARY

Researchers have found that rectangular plate fin heat sinks are easy to manufacture. Heat transfer rate from rectangular plate heat sinks in vertical orientation is more as compared to horizontal one. Heat transfer rate from plate heat sinks depends on base-to-ambient temperature difference as well as fin geometry. Geometric parameters like fin length, fin height, thickness play a significant role on convective heat transfer. It is observed that with an increase in fin height, fin length and base-to-ambient temperature difference heat transfer rate increases proportionately.

It is also found that optimum fin spacing depends on above mentioned parameters. Investigators have come to conclusion that optimum fin thickness depends on height, solid conductivity and conductivity of the surrounding fluid but is independent of Rayleigh number, fluid viscosity and length. Optimum fin spacing though differs for a difference in fin length and fin height this difference is not significant. It is proposed to investigate combined effect of low aspect ratio, variation in height and length as well as heat input on convective heat transfer and ultimately optimum fin spacing is to be achieved. Simultaneusly flow pattern of air on plate surfaces in various positions is to be studied.

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