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A Literature Review on Different Heat Sink

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***Abstract*—A heat sink system is presented in this research work: a heat sink is a passive heat exchanger that transfers heat. The heat sink is typically a metallic part which can be attached to a device releasing energy in the form of heat, with the aim of dissipating that heat to a surrounding fluid in order to prevent the device overheating. Heat sink is an electronic component or a device of an electronic circuit which disperses heat from other components (mainly from the power transistors) of a circuit into the surrounding medium and cools them for improving their performance, reliability and also avoids the premature failure of the components. The device transfers heat to the heat sink by conduction. The primary mechanism of heat transfer from the heat sink is convection, although radiation also has a minor influence. Here in this work, it review the different performance parameters of heat sink and also reviews the used of different use of heat sink.**

***Keywords*—Heat Sink, Review, Heat Transfer, Performance Parameters.**

I. INTRODUCTION

A heat sink is a component that increases the heat flow away from a hot device. It accomplishes this task by increasing the device's working surface area and the amount of low-temperature fluid that moves across its enlarged surface area. Based on each device's configuration, we find a multitude of heat sink aesthetics, design, and ultimate capabilities. A heat sink (also commonly spelled heat sink) is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant, where it is dissipated away from the device, thereby allowing regulation of the device's temperature. In computers, heat sinks are used to cool CPUs, GPUs, and some chipsets and RAM modules. Heat sinks are used with high-power semiconductor devices such as power transistors and optoelectronics such as lasers and light-emitting diodes (LEDs), where the heat dissipation ability of the component itself is insufficient to moderate its temperature. Each heat sink is valuable in applications that may have varying: Heat sinks are one of the most common forms of thermal management in technology, machinery, and even in natural systems. These components are so ubiquitous that they're easy to overlook, even by those who are familiar with the technology. We'll address the basic working principles involved in heat sinks, introduce active and passive heat sink configurations, and discuss how some users implement heat sinks in their applications. 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.

In this part, a 3D conjugated heat transfer model for Nano-Encapsulated Phase Change Materials (NEPCMs) cooled Micro Pin Fin Heat Sink (MPFHS) is presented. The governing equations of flow and heat transfer are solved using a finite volume method based on collocated grid and validated by comparing results with the available data in the literature. The effect of nanoparticles volume fraction, inlet velocity, and bottom wall temperature are studied on Nusselt and Euler numbers as well as temperature contours in the system. The results indicate that considerable heat transfer enhancement is possible when using NEPCM slurry as a coolant and the degree of enhancement increases with increasing inlet velocity and volume fraction. However, with increasing bottom wall temperature, the Nusselt number first increases then decreases. The former is due to higher heat transfer capability of coolant at temperatures over the melting range of PCM particles due to partial melting of nanoparticles in this range and latent heat contribution effect into the heat transfer rate. While the latter phenomena is due to the lower capability of NEPCM particles and consequently coolant in absorbing heat at temperatures above the temperature correspond to fully melted NEPCM. It was observed that NEPCM slurry has a drastic effect on Euler number, and with increasing volume fraction and decreasing inlet velocity the enhancement in Euler number increases.

Plate Fin Heat Sink:-Plate-fin heat sinks as implied by their name are heat sink geometries that have their extruded fins running across the entire length of the base in the form of a plate. These types of heat sinks are the most commonly used in electronic devices. Heat sinks with plate fins can be modeled in different shapes and can also be arranged in different forms to force the direction of flow. Plate-fin heat sinks usually cover a larger surface area across the base of the heat sink. Hence, generally has a larger area for heat transfer since there's an increase contact area between the working fluid(air) and the material surface.

Pin Fin Heat Sink:-Heat sinks with pin fin extrusions are widely used based on the ability to increase their surface area through the increase in the number of pins. Pin fin extrusions are usually layered across the base of a heat sink in a specified order or pattern so as to enhance airflow. One advantage of using pin fins over plate fins is that the direction of flow does not necessarily need to be precisely defined since all sides could work as an inlet though or outlet. In most cases depending on geometry, there is a direction of flow inlet and outlet that increase the performance of the pin fin heat sink and should be taken into account when mounted on the object to be cooled.

Geometry Heat Sink :- With improved methods of manufacturing, manufacturers and researchers are able to manufacture objects of different shapes and dimensions. With geometry being a factor that affects the performance of heat sinks, the ability to manufacture heat sinks of different exotic geometries enables both thermal engineering and researchers to optimize heat sinks based on geometry modification. In this study, different heat sink geometries are analyzed under the same conditions and compared to each other based on their thermal performance and cost of operation. The exotic geometries in this study were modeled based on knowledge from fluid dynamics and heat transfer to better improve heat sink performance.

Fig.1 The geometry of Heat Sinks

As far as history goes, the field of electronics cooling does not have a very long past. A rather quick look through my personal reference material that is strictly geared towards cooling electronics had at the earliest some US Navy documents from the 1950s . Comparing the solution techniques available today to those available then shows that we have both much better tools and harder problems (although I still like to refer to the suggested heat transfer coefficient value of ~10 W/m2-K for natural convection when not much else is known). Perhaps because of the shorter history and the tendency of engineers working in this field always being exposed to the latest and greatest electronics, the electronics cooling community sometimes doesn't venture out and learn from related fields. When we start solving problems without doing significant research, we can live in a fairy tale world where we think that our problems are strictly unique to us. There can be a benefit of taking some time to examine the past and finding out that other smart engineers have often looked at similar problems and may have relevant information that would help us with understanding. The use of heat exchanges theory provides a good example where there is a possible benefit from thinking about the problems we are solving from more than one viewpoint. Consider the simple illustration of a heat sink shown in Figure-2 Heat sink suppliers and designers, especially in air cooled electronics, like to use a thermal resistance type description such as Rth = 1/hA = (Tsurf - Tcool-in)/q

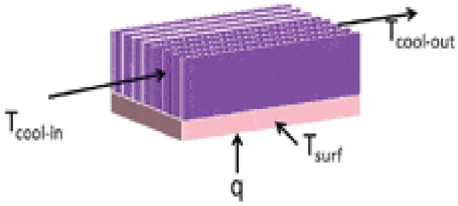

Fig. 2 Simple heat sink

Since the resistance can vary with the coolant velocity, information about how Rth varies with velocity may be provided. The coolant temperature of reference is the inlet temperature. While this approach is convenient, there isn't much need to think about using a minimum amount of coolant and other constraints such as noise and prime power to move the coolant may dictate the flow rate. Engineers that come from an avionics background typically consider that the coolant will change temperature as the waste heat is added. Often, the coolant flow rate is specified in terms of flow rate per KW of heat such that the temperature rise of the coolant from inlet to exit is constant for different electronic assemblies. The mindset is to use the coolant as efficiently as possible because additional coolant is either not possible or very expensive. One of the potential benefits of applying heat exchanger theory to electronics cooling is that it can provide one way of looking at efficiency. Moffat provides a good discussion on heat exchanger theory applied to air cooled heat sinks and general heat exchanger theory can be found in most heat transfer textbooks [While the theory was mostly developed to deal with two fluids, a bounding case where one of the fluid temperatures did not change (such as with condensation or evaporation) simplifies the equations and can be representative of heat sinks used to cool electronics. A uniform temperature for Tsurf is only an approximation but useful for illustration. Heat exchanger analysis frequently uses what is known as the effectiveness-NTU method where the effectiveness represents the actual heat transfer divided by the maximum possible heat transfer. The NTU, or Number of Transfer Units, is a dimensionless parameter that relates the heat transfer convective resistances to the coolant flow heat capacity. While the details are beyond the scope of this short column, a typical heat sink (or cold plate) can be described with the following equations (assuming that the simplifying assumption of one surface temperature is reasonable). One way to increase the NTU term is to decrease the coolant heat capacity but while our effectiveness increased, the resulting temperature for the surface may not be acceptable. The other way is to increase the hA term which means either larger area or a higher effective heat transfer coefficient. The engineering challenge is to minimize the decrease in effectiveness as coolant flow rates increase. Note that the limit is when the surface temperature and the coolant exit are at the same temperature, or the system has an effectiveness of 1. This limit is formally only for a constant temperature boundary condition (as opposed to uniform flux or mixed boundary condition) and is only a theoretical maximum, but it does provide a basis for comparison. More complex systems such as cold plates with multiple heat sources or significant coolant temperature variation may require more detail to assess but the general trends are similar. Historical electrical analogy treatment of cold plates (typical in avionics) sub-divides the problem into zones and accounts for the coolant rise but make the assumption that a heat transfer coefficient relative to a local coolant temperature is known. Some heat sink resistance calculations add in a “fluid resistance” but the reader is cautioned that this terminology can be problematic We are often asked to help design more efficient systems but sometimes the definition of efficient is vague. From the perspective of coolant in and out temperatures, the heat transfer process is 100% efficient and the heat ended up in the coolant. However, the real question may be, can the cooling job be accomplished with a lower flow rate and still have acceptable temperatures? Thermal engineers can participate and even lead discussions on developing even more efficient systems but we benefit when we look at problems from multiple viewpoints and even venture out into the research from related fields.

Different types of heat sink:-

- **The source generates heat.**
  This source may be any system that creates heat and requires the removal of said heat to function correctly, such as: Mechanical- Electrical- Chemical- Nuclear- Solar- Friction
- **Heat transfers away from the source.**
  Heat pipes can also aid in this process. In direct heat sink-contact applications, heat moves into the heat sink and away from the source via natural conduction. The heat sink material's thermal conductivity directly impacts this process. That's why high thermal conductivity materials such as copper and aluminum are most common in the construction of heat sinks.
- **Heat distributes throughout the heat sink.**
  Heat will naturally travel through the heat sink via natural conduction moving across the thermal gradient from a high temperature to a low-temperature environment. This ultimately means that the heat sink's thermal profile will not be consistent. As such, heat sinks will often be hotter towards the source and cooler towards the sink's extremities.

II. LITERATURE REVIEW

Mauro, A. W., et.al (2010), In this research work presented flow boiling saturated CHF data in a multi-micro channel copper heat sink have been collected with three HFC refrigerants: R134a, R236fa and R245fa. The test section was fed by a singular system with one central inlet and two outlets, called split flow, which provided much better performance in terms of CHF attainable compared with the single inlet/outlet system (and also reduced the pressure drop). For all the tests carried out, the saturated CHF increased with mass velocity. For R236fa and R134a, an increase of saturation temperature resulted in a slight decrease of CHF, while the inlet subcooling provided a moderate positive effect on CHF. For R245fa the effect of saturation temperature and inlet subcooling tended to be negligible. The highest CHF values have been reached with R134a (330 W/cm2 for G = 1500 kg/m2 s). With this fluid it was possible to achieve higher flow rates with the test facility, thanks to its lower two-phase pressure drop. On the other hand, making the comparison over the same range of mass velocity, R245fa yielded CHF values comparable with R134a. The experimental data were compared with five prediction methods, including one numerical method [1].

Koşar, et.al. (2010), In this research work presented unstable boiling was studied in three different micro-pin fin heat sinks. Pressure signals and flow images were acquired under unstable boiling conditions, which were accompanied by severe temperature fluctuations. The main conclusions drawn from this study are: Similar to parallel micro channel array, flow instabilities are of concern during flow boiling in micro-pin fin heat sinks. Onset of boiling was accompanied by considerable flow instabilities in all the tested micro-pin fin heat sinks with a corresponding increase in surface temperature. For water, the magnitude of the pressure drop fluctuations before and after unstable boiling was not significant regardless the shape of the pin fin. Peak to peak pressure drop fluctuations remain small compared to the time averaged pressure drop for all the devices For R-123, a drastic change is observed in the pressure signals with the initiation of unstable boiling, and a sharp increase in the magnitude peaks of the FFT profiles becomes apparent. Moreover, not only the spectrum peak increases significantly but the side-lobe energy also significantly increases after the inception of unstable boiling, which is an indicator of rapid bubble growth instability. For the devices operated with water (both circular and hydrofoil shaped micro-pin fin devices), no significant change is observed in the FFT profiles with unstable boiling. Upstream compressible volume instability rather than rapid bubble growth instability prevails under these unstable boiling conditions [2].

Dogruoz, et.al (2010), In this research work presented with the invention as well as implementation of advanced electronics, smaller, compact, low weight, and low cost devices with aggressive thermal performances are demanded. In order to respond to this need, advanced thermal materials have been developed. Although these materials are relatively new, novel applications start to utilize them to meet certain design requirements. In this research work presented, four different advanced materials were studied as well as aluminum and copper as baseline materials. Authors developed a design of experiments for our simulations with 343 cases in total to understand conduction and convection resistances of extruded heat sinks in a natural convection environment. Simulations were carried out via commercially available CFD software by taking advantage of the tool's periodic boundary condition capability. In simulating the test cases, effect of the convection has also been studied by changing the heat sink base temperature. Pareto charts presented the relationships and strengths for both conductive and convective thermal resistances, as well as minimum fin temperatures [3].

Chein,, et.al (2010), In this research work presented copper foam fabricated using the electroforming technique was employed as the heat-sinking material. Because of the special flow characteristic of fluid flow in the copper foam and enlarged heat transfer area, the copper foam heat sink has better performance as compared with those of single-channel, plate-fin and pin-fin heat sinks. The measured results also indicated that the thermal resistance of copper-foam heat sink decreases with the decrease in porosity which can be controlled by the electroforming time [4].

Liu, et.al (2011), In this research work presented, two micro staggered square high pin fin heat sinks with different channel sizes were fabricated. Using deionized water as working fluid, the performance of pressure drop and heat transfer in staggered square long micro pin fins were experimentally studied. The main conclusions include:1) For both heat sinks, the pressure drop increased with the Rec number. The flow friction factor transition phenomenon appeared at Rec 300. 2) Both heat sinks exhibited huge heat dissipation capability. The experimental data showed that, for the type 2 heat sink, the heat dissipation could reach 2.83 106 W/m2 at the flow rate of 57.225 L/h and the surface temperature of 73.4 C, and, therefore, meet the demand of high power heat removal. The heat dissipation increased with the flow rate for a fixed surface temperature while the increasing rate decreased with the flow rate. 3) The Nusselt number increased with the fin Reynolds number. For both heat sinks, the heat transfer was over predicted by the previous correlations. Therefore, we presented new correlations for the average Nusselt number prediction. The Nusselt number varies as Re0.61. 4) The heat resistance decreased with the pressure drop. The deceleration rate was faster for the small pressure drop and slower for the large pressure drop [5].

Reyes, et.al,. (2011), In this research work presented the effect of tip clearance on micro-channel flow based thermal control systems when, owing to engineering design restrictions, the flow itself cannot be considered as fully developed. The study has accounted for two parameters of practical interest, namely the heat transfer and the pressure drop (which is related to the pumping power). Four configurations involving a tip clearance have been analyses and compared to a baseline configuration of micro-channel flow without tip clearance. The height of the square section micro-channels was 500 mm. Tip clearances of 250 mm, 500 mm, and 1000 mm were considered. One additional configuration with the channels perpendicular to the main flow and a tip clearance of 500 mm was studied. For each configuration, six different volume flow rates were considered. These flow rates, in the case of the baseline configuration, led to Reynolds numbers in the range from 416 to 2600. The main conclusion of the work been presented is that implementation of tip clearance in active micro-channel based thermal control systems is an attractive option form the practical industrial application standpoint owning to two arguments: The added manufacturing cost is negligible since most of the manufacturing complexity is associated the micro-machining of the micro-channels, while the top wall can be easily set at a lower or higher height. The deterioration in heat transfer caused by the tip clearance is small while the savings in pumping power are large. In our study, for the optimum tip clearance height, the heat transfer (at the lowest volume flow rate, Re ¼ 416) was 83% of the baseline configuration. However, the required pumping power was only 18% of the baseline case. The advantage of introducing a tip clearance can also be illustrated noting that the required pumping power can almost be halved maintaining the thermal efficiency [6].

Yu, et.al. (2011), In this research work presented numerical analyses were conducted to optimize a radial heat sink adapted to a circular LED light. Experiments were performed to validate the numerical model, and the agreement was good. To determine the optimum model, three types of heat sink (L, LM and LMS models) were compared and the LM model exhibited superior thermal performance. Parametric studies were performed to compare the effects of three geometric parameters (number of long fins, long fin length and middle fin length) and an operating parameter (heat flux) on the thermal resistance and average heat transfer coefficient for the heat sink array. As the number of long fins, middle fin length and long fin length increased, the thermal resistance and average heat transfer coefficient decreased. It was found that optimum values of the geometric parameters existed for maximizing heat transfer performance, i.e., minimizing thermal resistance. Finally, the heat sink geometry (number of long fins,long fin length and fin length ratio) was optimized using a CCD and an EA. By varying weighting factors, Pareto front was investigated with respect to heat flux. Pareto front showed trade-off between minimal thermal resistance and minimal mass of heat sink. It was found that it was impossible to optimize both thermal performance and heat sink mass at the same time, and there existed upper limit to the ratio of weighting factors (x1/x2). Acknowledgment This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (No. 2010-0008537) [7].

Chen, et.al (2012), In this research work presented a 3D heat sink model for the dynamic simulation of heat dispersion process. Based on the developed 3D model, we have analyzed the distinction between the plate- and pin-fin heat sinks explicitly and systematically. Simulation results show clearly that the pin-fin heat sink can lead to much better heat dispersion than plate-fins, mainly due to the providence of a larger heat dispersion area. Authors also observed from the 3D simulation results that the plate-fin heat sink presents a significantly contorted temperature distribution compared with the pin-fin heat sink. The effects of pin fin diameter, fin numbers and air approaching velocity on optimal conditions and the overall performance of the pin-fin heat sinks have been investigated thoroughly. The thermal analysis has shown obviously that these key factors have nonlinear and interacting effects on entropy generation rate. To optimize the cylindrical pin-fin heat sinks, a real-coded genetic algorithm is applied for both the in-line and staggered arrangements. The entropy generation rate, which takes account of the air resistance and thermal resistance simultaneously, is adopted as the objective function to be minimized. The obtained optimal results has revealed that the proposed optimization approach is superior to existing methods, which provides less entropy generation rate while at the same time maintaining considerably lower air-approaching velocity [8].

III. HEAT DESIGN PRINCIPLE

Heat transfer principle:-A heat sink transfers thermal energy from a higher-temperature device to a lower-temperature fluid medium. The fluid medium is frequently air, but can also be water, refrigerants or oil. If the fluid medium is water, the heat sink is frequently called a cold plate. In thermodynamics a heat sink is a heat reservoir that can absorb an arbitrary amount of heat without significantly changing temperature. Practical heat sinks for electronic devices must have a temperature higher than the surroundings to transfer heat by convection, radiation, and conduction. The power supplies of electronics are not absolutely efficient, so extra heat is produced that may be detrimental to the function of the device. As such, a heat sink is included in the design to disperse heat.Using the mean air temperature is an assumption that is valid for relatively short heat sinks. When compact heat exchangers are calculated, the logarithmic mean air temperature is used.Fourier's law of heat conduction shows that when there is a temperature gradient in a body, heat will betransferred from the higher-temperature region to the lower-temperature region. The rate at which heat is transferred by conduction, is proportional to the product of the temperature gradient and the cross-sectional area through which heat is transferred. When it is simplified to a one-dimensional form in the x direction, it can be expressed as:

$$qk = -KA\frac{dt}{dx}$$

Using the mean air temperature is an assumption that is valid for relatively short heat sinks. When compact heat exchangers are calculated, the logarithmic mean air temperature is used. The above equations show that:

When the air flow through the heat sink decreases, this results in an increase in the average air temperature. This in turn increases the heat-sink base temperature. And additionally, the thermal resistance of the heat sink will also increase. The net result is a higher heat-sink base temperature.

The increase in heat-sink thermal resistance with decrease in flow rate will be shown later in this article. The inlet air temperature relates strongly with the heat-sink base temperature. For example, if there is re circulation of air in a product, the inlet air temperature is not the ambient air temperature. The inlet air temperature of the heat sink is therefore higher, which also results in a higher heat-sink base temperature.

If there is no air flow around the heat sink, energy cannot be transferred. A heat sink is not a device with the "magical ability to absorb heat like a sponge and send it off to a parallel universe" Natural convection requires free flow of air over the heat sink. If fins are not aligned vertically, or if fins are too close together to allow sufficient air flow between them, the efficiency of the heat sink will decline

Design Factors

Thermal resistance:-For semiconductor devices used in a variety of consumer and industrial electronics, the idea of thermal resistance simplifies the selection of heat sinks. The heat flow between the semiconductor die and ambient air is modelled as a series of resistances to heat flow; there is a resistance from the die to the device case, from the case to the heat sink, and from the heat sink to the ambient air. The sum of these resistances is the total thermal resistance from the die to the ambient air. Thermal resistance is defined as temperature rise per unit of power, analogous to electrical resistance, and is expressed in units of degrees Celsius per watt (°C/W). If the device dissipation in watts is known, and the total thermal resistance is calculated, the temperature rise of the die over the ambient air can be calculated.

The idea of thermal resistance of a semiconductor heat sink is an approximation. It does not take into account non-uniform distribution of heat over a device or heat sink. It only models a system in thermal equilibrium and does not take into account the change in temperatures with time. Nor does it reflect the non-linearity of radiation and convection with respect to temperature rise. However, manufacturers tabulate typical values of thermal resistance for heat sinks and semiconductor devices, which allows selection of commercially manufactured heat sinks to be simplified.

Commercial extruded aluminium heat sinks have a thermal resistance (heat sink to ambient air) ranging from 0.4 °C/W for a large sink meant for TO-3 devices, up to as high as 85 °C/W for a clip-on heat sink for a TO-92 small plastic case.[5] The popular 2N3055 power transistor in a TO-3 case has an internal thermal resistance from junction to case of 1.52 °C/W.[6] The contact between the device case and heat sink may have a thermal resistance between 0.5 and 1.7 °C/W, depending on the case size and use of grease or insulating mica washer.

Material:-The materials for heat sink applications should have high heat capacity and thermal conductivity in order to absorb more heat energy without shifting towards a very high temperature and transmit it to the environment for efficient cooling.The most common heat sink materials are aluminium alloys Aluminium alloy 1050 has one of the higher thermal conductivity values at 229 W/(m·K) and heat capacity of 922 J/(kg·K),[9] but is mechanically soft. Aluminium alloys 6060 (low-stress), 6061, and 6063 are commonly used, with thermal conductivity values of 166 and 201 W/(m·K) respectively. The values depend on the temper of the alloy. One-piece aluminium heat sinks can be made by extrusion, casting, skiving or milling. Copper has excellent heat-sink properties in terms of its thermal conductivity, corrosion resistance, bio fouling resistance, and antimicrobial resistance (see also Copper in heat ex changers). Copper has around twice the thermal conductivity of aluminium, around 400 W/(m·K) for pure copper. Its main applications are in industrial facilities, power plants, solar thermal water systems, HVAC systems, gas water heaters, forced air heating and cooling systems, geothermal heating and cooling, and electronic systems.Copper is three times as dense and more expensive than aluminium, and copper is less ductile than aluminium. One-piece copper heat sinks can be made by skiving or milling. Sheet-metal fins can be soldered onto a rectangular copper body.

Fin EFFICIENCY

Fin efficiency is one of the parameters that makes a higher-thermal-conductivity material important. A fin of a heat sink may be considered to be a flat plate with heat flowing in one end and being dissipated into the surrounding fluid as it travels to the other.[12] As heat flows through the fin, the combination of the thermal resistance of the heat sink impeding the flow and the heat lost due to convection, the temperature of the fin and, therefore, the heat transfer to the fluid, will decrease from the base to the end of the fin. Fin efficiency is defined as the actual heat transferred by the fin, divided by the heat transfer were the fin to be isothermal (hypothetically the fin having infinite thermal conductivity).

Fin Arrangement

A pin-fin heat sink is a heat sink that has pins that extend from its base. The pins can be cylindrical, elliptical or square. A pin is one of the more common heat-sink types available on the market.A second type of heat-sink fin arrangement is the straight fin. These run the entire length of the heat sink. A variation on the straight-fin heat sink is a cross-cut heat sink. A straight-fin heat sink is cut at regular intervals.Free-convection flow around a pin-fin heat sink In general, the more surface area a heat sink has, the better it works However, this is not always true. The concept of a pin-fin heat sink is to try to pack as much surface area into a given volume as possible As well, it works well in any orientation. Kordyban has compared the performance of a pin-fin and a straight-fin heat sink of similar dimensions. Although the pin-fin has 194 cm2 surface area while the straight-fin has 58 cm2, the temperature difference between the heat-sink base and the ambient air for the pin-fin is 50 °C, but for the straight-fin it was 44 °C, or 6 °C better than the pin-fin. Pin-fin heat sink performance is significantly better than straight fins when used in their intended application where the fluid flows axially along the pins rather than only tangentially across the pins. Another configuration is the flared-fin heat sink; its fins are not parallel to each other, a. Flaring the fins decreases flow resistance and makes more air go through the heat-sink fin channel; otherwise, more air would bypass the fins. Slanting them keeps the overall dimensions the same, but offers longer fins. They found that for low air approach velocity, typically around 1 m/s, the thermal performance is at least 20% better than straight-fin heat sinks. also found that for the bypass configurations that they tested, the flared heat sink performed better than the other heat sinks tested.

Micro Processor Cooling

Heat dissipation is an unavoidable by-product of electronic devices and circuits. In general, the temperature of the device or component will depend on the thermal resistance from the component to the environment, and the heat dissipated by the component. To ensure that the component does not overheat, a thermal engineer seeks to find an efficient heat transfer path from the device to the environment. The heat transfer path may be from the component to a printed circuit board (PCB), to a heat sink, to air flow provided by a fan, but in all instances, eventually to the environment.Two additional design factors also influence the thermal/mechanical performance of the thermal design. This will be discussed under the section attachment methods.For each interface between two objects in contact with each other, there will be a temperature drop across the interface. For such composite systems, the temperature drop across the interface may be appreciable This temperature change may be attributed to what is known as the thermal contact resistance Thermal interface materials (TIM) decrease the thermal contact resistance.

Attachment methods

As power dissipation of components increases and component package size decreases, thermal engineers must innovate to ensure components won't overheat. Devices that run cooler last longer. A heat sink design must fulfill both its thermal as well as its mechanical requirements. Concerning the latter, the component must remain in thermal contact with its heat sink with reasonable shock and vibration. The heat sink could be the copper foil of a circuit board, or a separate heat sink mounted onto the component or circuit board. Attachment methods include thermally conductive tape or epoxy, wire-form z clips, flat spring clips, standoff spacers, and push pins with ends that expand after installing.

Thermally conductive tape

Thermally conductive tape is one of the most cost-effective heat sink attachment materials. It is suitable for low-mass heat sinks and for components with low power dissipation. It consists of a thermally conductive carrier material with a pressure-sensitive adhesive on each side. This tape is applied to the base of the heat sink, which is then attached to the component. Following are factors that influence the performance of thermal tape

Surfaces of both the component and heat sink must be clean, with no residue such as a film of silicone grease.

Preload pressure is essential to ensure good contact. Insufficient pressure results in areas of non-contact with trapped air, and results in higher-than-expected interface thermal resistance. Thicker tapes tend to provide better "wettability" with uneven component surfaces. "Wettability" is the percentage area of contact of a tape on a **component.**

Thicker tapes, however, have a higher thermal resistance than thinner tapes. From a design standpoint, it is best to strike a balance by selecting a tape thickness that provides maximum "wettability" with minimum thermal resistance.

IV. CONCLUSION

In this survey paper discus the heat sink system is presented in this article. Different fin geometries having the same perimeter are compared from the point of views of heat transfer, drag force, and dimensionless total entropy generation rate. The square geometry is found to be the worst choice from the point of view of heat transfer and drag force and hence from the point of view of total entropy generation rate. Whereas, the circular geometry performs better from the point of view of the dimensionless total entropy generation rate for smaller perimeters, larger aspect ratios and lower Reynolds numbers. Heat sink is an electronic component or a device of an electronic circuit which disperses heat from other components (mainly from the power transistors) of a circuit into the surrounding medium and cools them for improving their performance, reliability and also avoids the premature failure of the components. The device transfers heat to the heat sink by conduction. The primary mechanism of heat transfer from the heat sink is convection, although radiation also has a minor influence. Here in this work, it review the different performance parameters of heat sink and also reviews the used of different use of heat sink.

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