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THERMAL ANALYSIS ON INTEL CORE I-7 MICROPROCESSOR HEAT SINK

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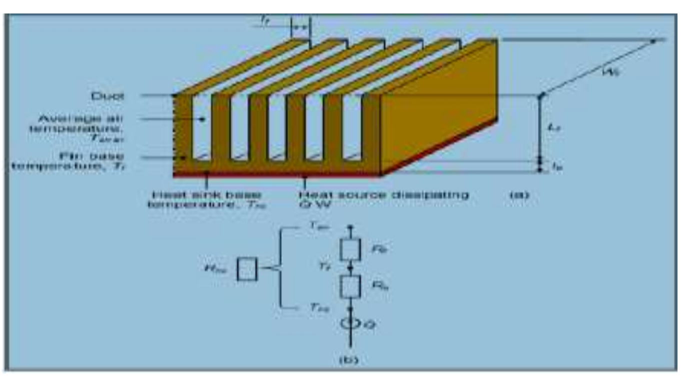
ABSTRACT
The Microprocessor is one of the major electronic components, which is subjected to high temperatures. In order to cool the microprocessor, heat sink is provided on it to increase the rate of heat transfer. By doing thermal analysis on the heat sink it is helpful to know the heat dissipation from the microprocessor. In the present paper thermal analysis is done on Intel i-7 microprocessor Heat sink, by analytically and through simulation. The simulation is carried out by Finite Element Method (FEM) in the ANSYS Workbench.

Keywords- *Microprocessor, Heat sink, Thermal Analysis, FEM, ANSYS etc.*

I. INTRODUCTION
Thermal analysis is a branch of materials science where the properties of materials are studied as they change with temperature. FEM method are commonly used for thermal Analysis.

It is known that central processing unit (CPU) is the heart of computer. As CPU processes it produces a large amount of heat which leads to its hardware failure. In order to avoid that heat sink is mounted on the processor to increase the rate of heat transfer. A heat sink is a heat exchanger that transfers the heat generated by an electronic or mechanical device in to a coolant fluid in motion. For an intel core i7 processor 130 watts heat is generated during its processing. The i7 processor withstands up to 373K without any failure. To maintain processor below this temperature there should be sufficient heat flow rate through heat sink to the surroundings. Ambient temperature is 298K. Steady state thermal analysis of heat sink is done by taking solid aluminium as material. Modelling of heat sink is done in Ansys Design modeller and analysis is performed in Ansys workbench.

II. THEORETICAL FOUNDATION
Heat sink consists of fins. The fin is a surface that extends from an object to increase the rate of heat transfer to or from the environment by increasing convection. The amount of conduction, convection, radiation of an object determines the amount of heat it transfers. Increasing the temperature difference between the object and the environment, increasing the convection heat transfer coefficient, or increasing the surface area of the object increases the heat transfer. Sometimes it is not economical or it is not feasible to change the first two options. Adding a fin to the object, however, increases the surface area and can sometimes be economical solution to heat transfer problems.



$$q = \frac{T_b - T_\infty}{R_{base} + R_{t,o}}$$

$$R_{base} = \frac{L_{base}}{kA_b}$$

$$R_{t,o} = \frac{1}{hA_t\eta_o}$$

The most common heat sink materials are aluminium alloys. Copper have better thermal properties than aluminium but it is three denser and costlier than aluminium.

III. HEAT SINK DESIGN AND ANALYSIS

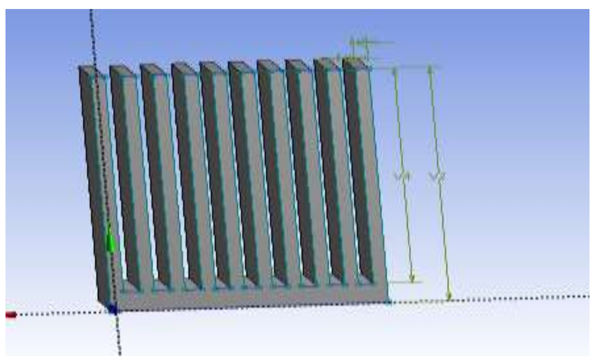
The design of heat sink is as shown in figure. The analysis is done by analytical and also by simulation. The dimensions of heat sink are:

For Fin:

Width w=0.045m

Thickness t=0.00021m

Length l=0.0055



For Base:

Width wb=0.045m

Length lb=0.042m

Thickness tb=0.0005m

Q=130W

T∞=298K

K=250 W/m•K

N=10

h=40 W*K/m^2

»Rbase=Lb/(k*Ab)=0.010582K/W

Also ,Maximum temperature is found to be 99.68300C.

Simulation

Generally simulations are based on FEM techniques. Finite Element Method is carried out by using Ansys Software. Any FEM technique has three phases they are:

1. Pre-processing
2. Solving and
3. Post processing.

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In the first phase, the defined aspects are to be geometry, material properties and meshing. In the second phase, boundary conditions have to be defined. Final stage is nothing but the interpreting the results.

Heat sink is modelled in Ansys DesignModeler.The material allocated is SOLID ALUMINIUM. The thermal properties of this material are follows:

Aluminum > Constants

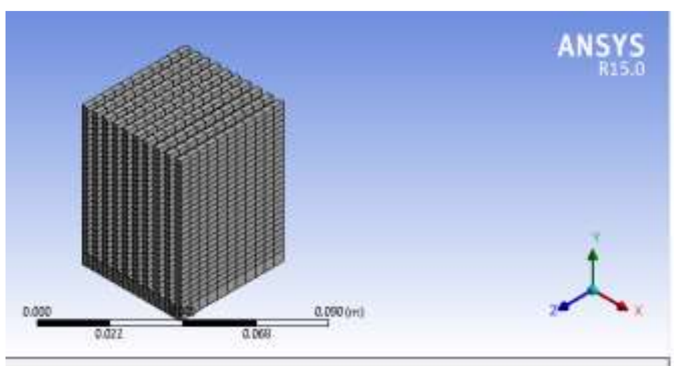
Thermal Conductivity	237.5 W m^-1 C^-1
Density	2689 kg m^-3
Specific Heat	951 J kg^-1 C^-1

After specifying the material properties and geometry, its

Properties	
Volume	6.1595e-005 m^3
Mass	0.16563 kg
Centroid X	-2.0889e-002 m
Centroid Y	2.7815e-002 m
Centroid Z	2.25e-002 m

Then next step is to perform meshing. Here Auto mesh is performed on Heat sink by Default program controlled setting.

After meshing the heat sink is as shown.



Here, coarse mesh is applied. The mesh details are as follows.

Statistics	
Nodes	22936
Elements	3069
Mesh Metric	None

Then in next step boundary conditions are defined. Here heat flow rate across the heat sink is 130watts. Also define the output result and plot the results.

Heat flux variation along the heat sink as shown:

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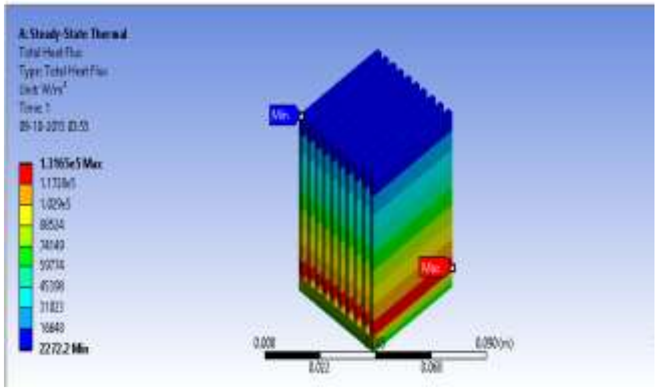

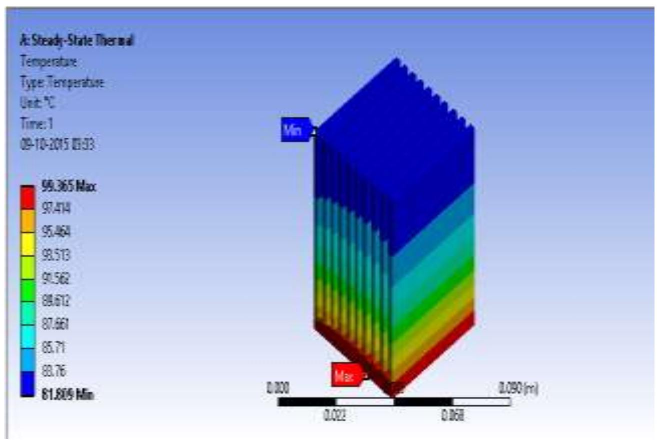

From the above plot it is observed that maximum and minimum temperatures on the heat sink.
Max temperature=99.3650C
» It is approximately equal to Max temperature in analytical process.

IV. CONCLUSIONS

The Heat sink-SOLID ALUMINIUM is having good heat transfer rate and it is suitable for intel core i7 processor. It can be optimized by varying materials and fin dimensions of heat sink for desired application

REFERENCES

1. *International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 8, August 2013 IJERTIJERT ISSN: 22780181*
2. *Paul W.Gill, James H. Smith, JR., and Eugene J. Ziurys., 1959, Internal combustion engines - Fundamentals, Oxford & IBH Publishing Company.*
3. *Dr. Kirpal Singh, 2004, Automobile engineering vol.II, Standard Publishers Distributors, Delhi.*
4. *Prof. R.B.Gupta, 1998, "Automobile engineering," Satya Prakashan, Incorporating, Tech India Publications.*
5. *Prof. R.K. Rajput, "Heat and Mass Transfer", S. Chand Publications. and V. P. Veiko, Laser Assisted Microtechnology, 2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998*