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Design and Thermal Analysis for Reducing the Heat Flux in Heat Sinks Used in CPU

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***Abstract**—The Central processing units (CPU's) are key component of the almost all electronic gadgets that are used in all sectors like hospitals, banking and industrial sectors etc. In the CPU's the cooling effect is obtain by the different heat sinks are mounted in that. The heat sinks are play a vital role on CPU's performance. The effectiveness of Heat sinks are depends on the heat transfers rate and different geometries of heat sink and their materials.*

In this work, four different heat sink model geometries are designed with using of 3D CATIA Modeling and these models are analyzed by using ansys by changing the three different materials (AL 6061, Bronze and copper) for increasing heat transfers rate from CPU to atmosphere. Based on the results, we found the optimum geometry and best materials for designing the heat sink.

Keywords— Include at least 5 keywords or phrases

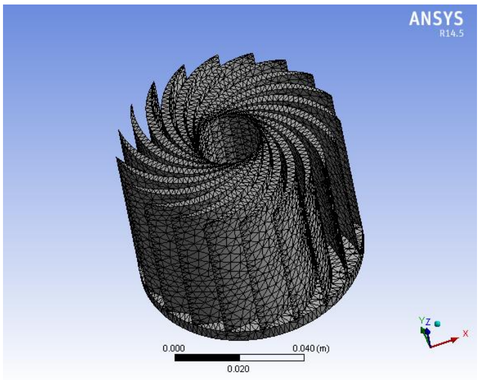
I. Introduction

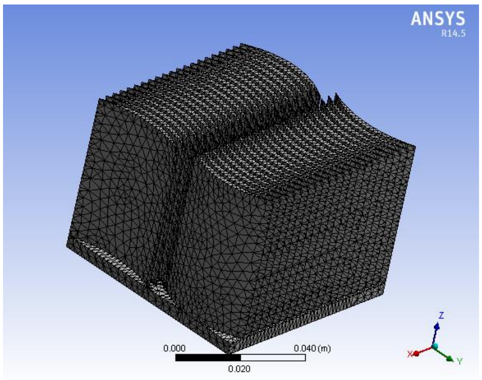
Modern life is almost completely interconnected with the electronic gadgets that are from toys to the high-power computers. Recently the increasing in processing of demands has been forced to the manufacturers to enhancing the functionality and performance of integrated circuit chips and to also minimizing their leading size to large power dissipation as a smaller package. For cooling purpose in many of the CPUs a fans or cooling devices are incorporates. The heat dissipation and succeeding rejection is potentially destructive of self-produced heat is a primary aspect for electronic equipment design. Generally, the generated is due to the resistance encountered in system components by electric current. Unless th proper cooling method is designed, the operating temperatures are exceeds the permissible limit. So that, the chances of failures may increased.

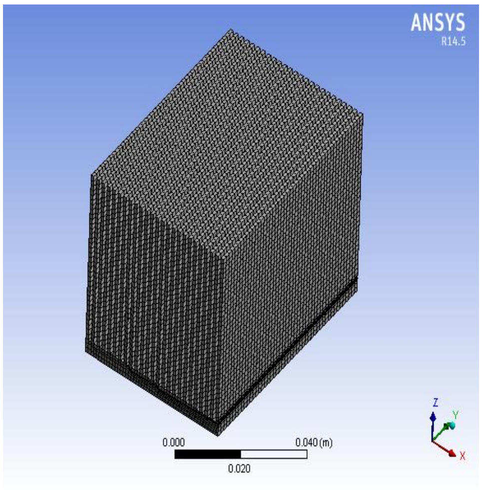
The Applications of finned surfaces are commonly seen in all the air-conditioning plants and refrigerating plants, aerospace sectors, chemical processing units, and in the electronic and electrical devices for thermal control. Now a day's various types of fins available in the industry. Among them, the square cross-sectional fins especially in compact heat exchangers due to its higher surface area. Generally the optimization is two categories that pertain to a single fin design. In that first one is to best profile determination and dimensions that are yield to minimum weight for a specified heat flow on the given fin shape (e.g. longitudinal fins, radial fins and pin fins. However, these kinds of optimization in fin shapes with sharp curved profiles which are difficult to manufacture or costly to fabricate. Therefore one alternative way is to fix a suitable simple profile (e.g. rectangular, triangular, parabolic, and trapezoidal, etc) after that determines the dimensions of fins to dissipate the more amount of heat for mass. This is second kind of optimization.

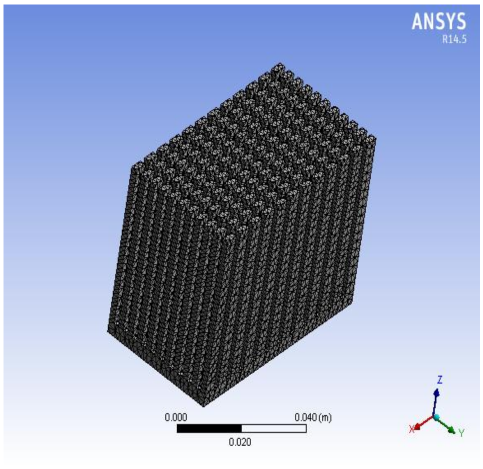
II. Study State Thermal Analysis Of Heat Sink

2.1. MESHED MODELS

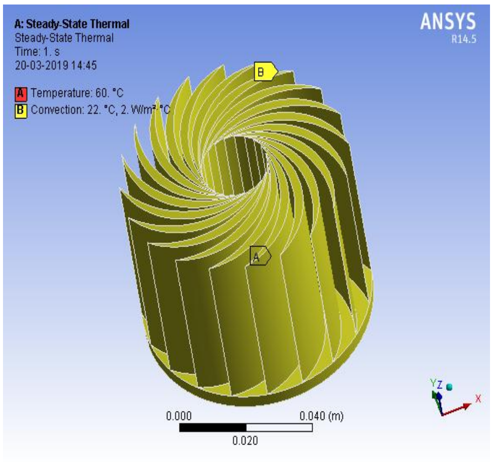


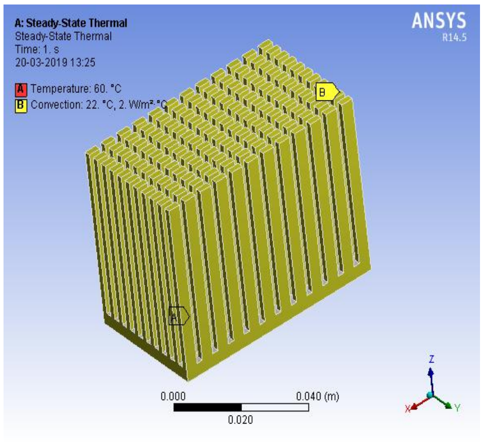


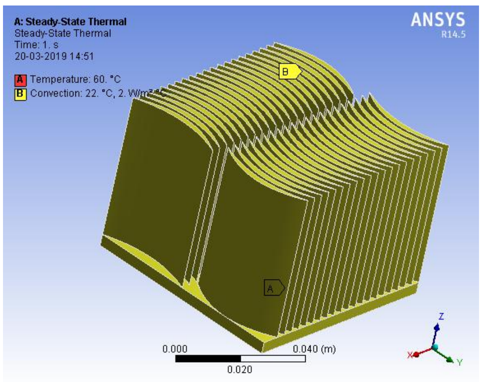


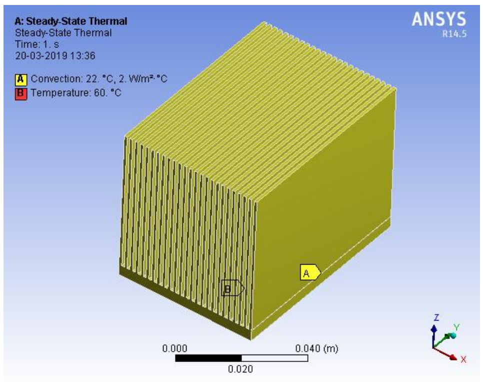


2.2. BOUNDARY CONDITIONS



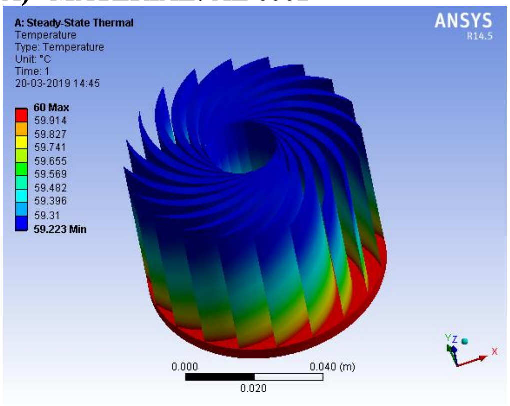






2.3. HEAT SINK MODEL: 1

A) MATERIAL: AL 6061



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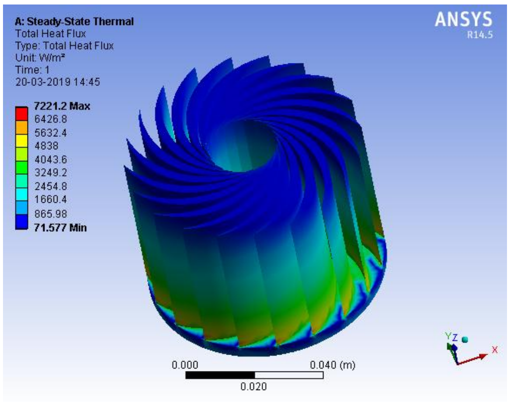

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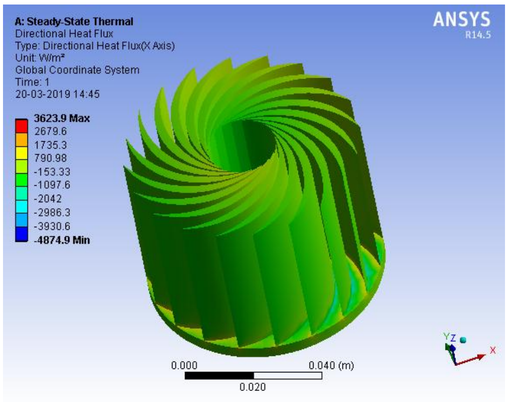

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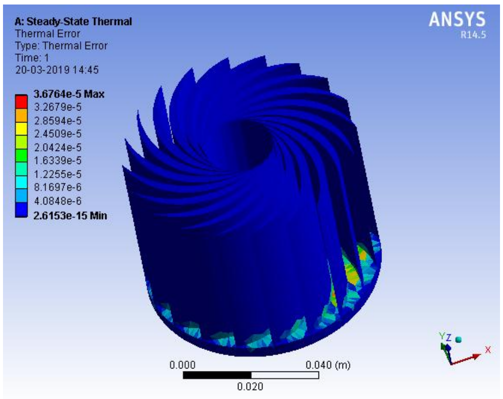
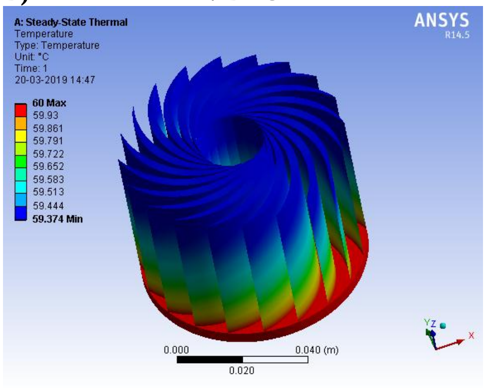


THERMAL ERROR

B) MATERIAL: BRONZE



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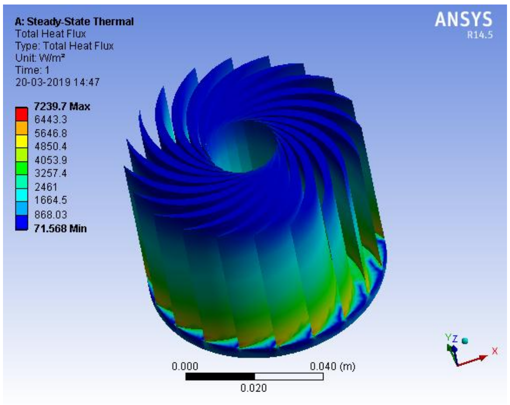

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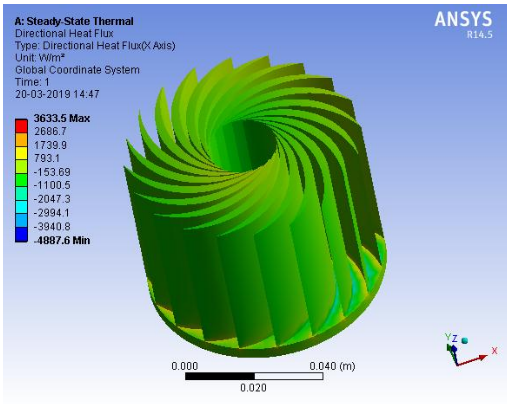

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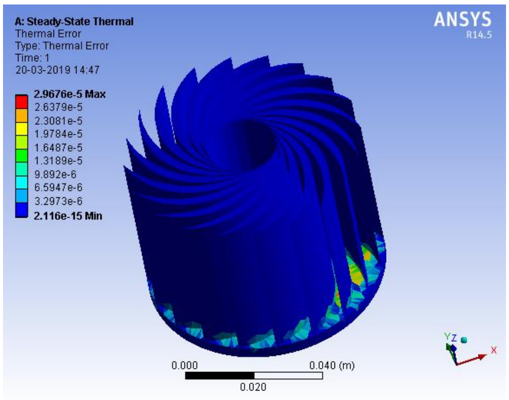

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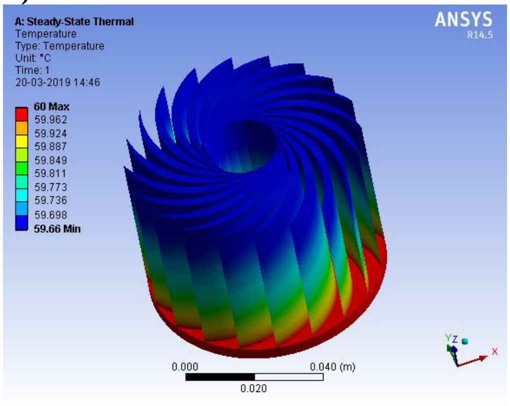

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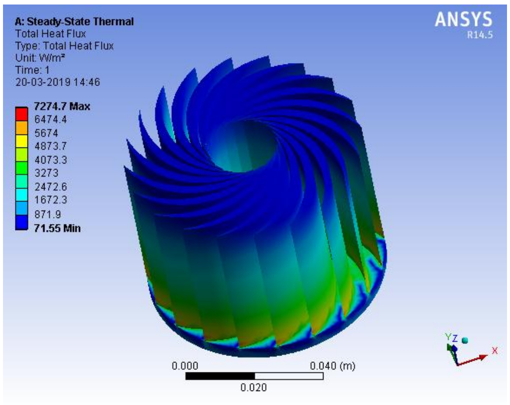

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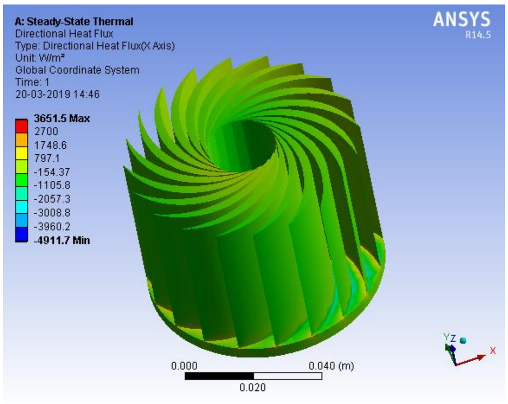

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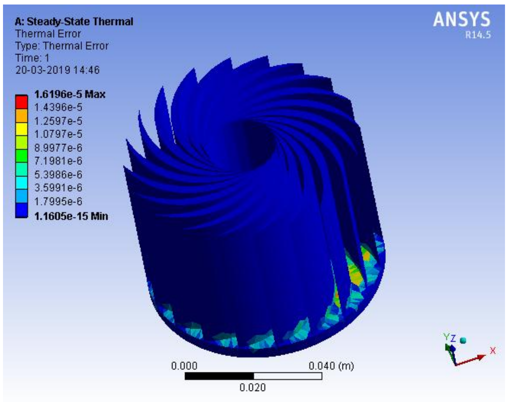

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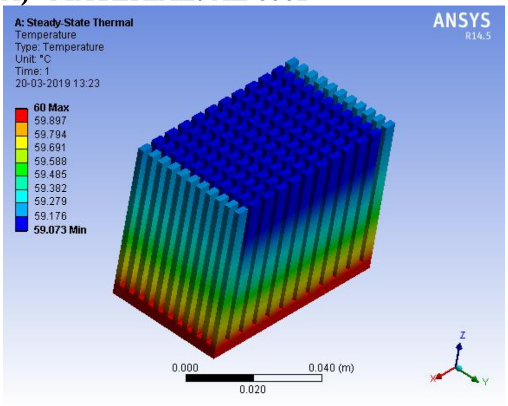
2.4. HEAT SINK MODEL: 2

A) MATERIAL: AL 6061



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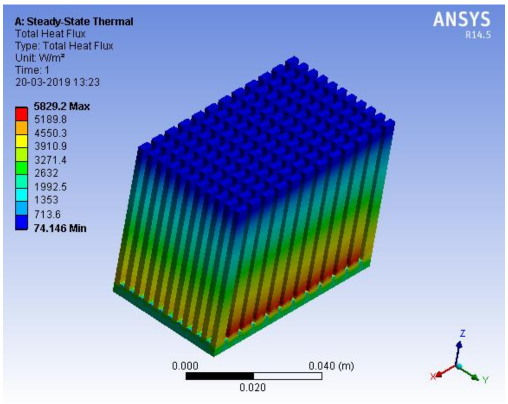

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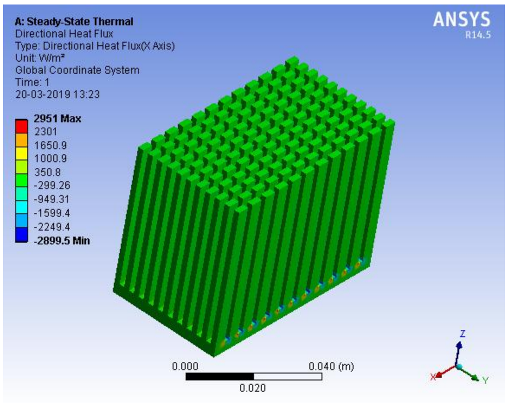

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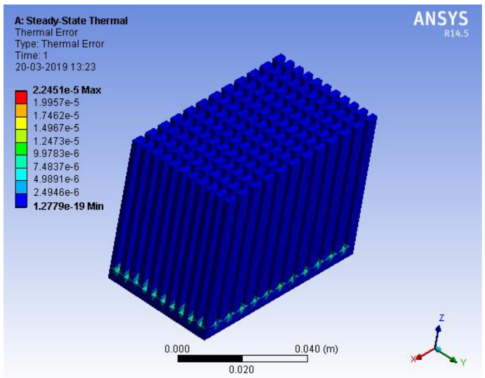
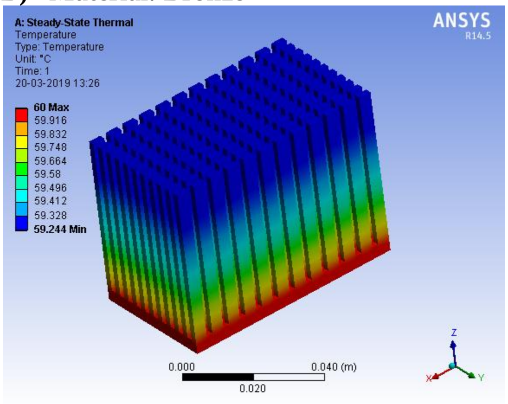


THERMAL ERROR

B) Material: Bronze



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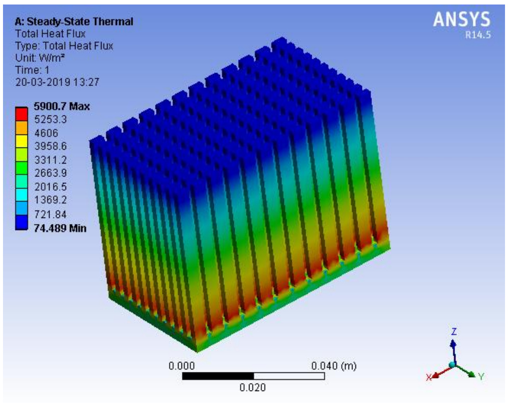

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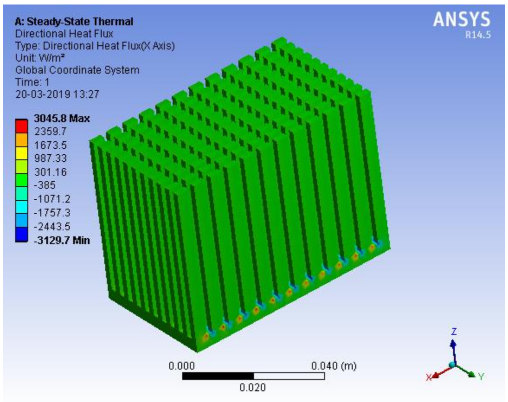

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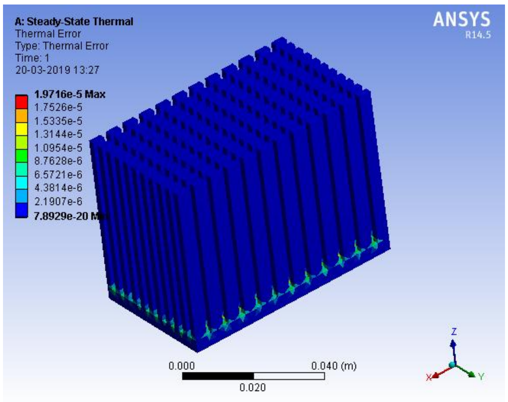

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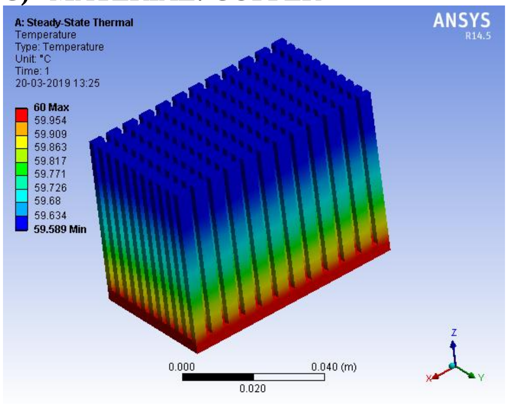

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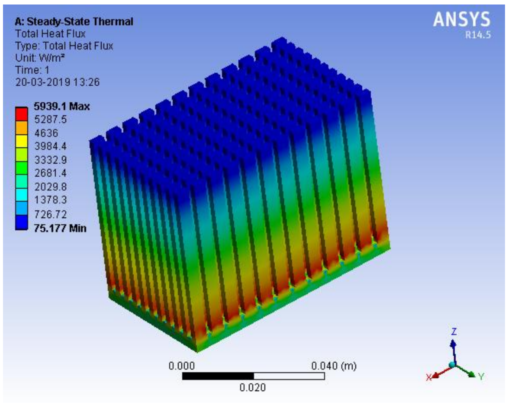

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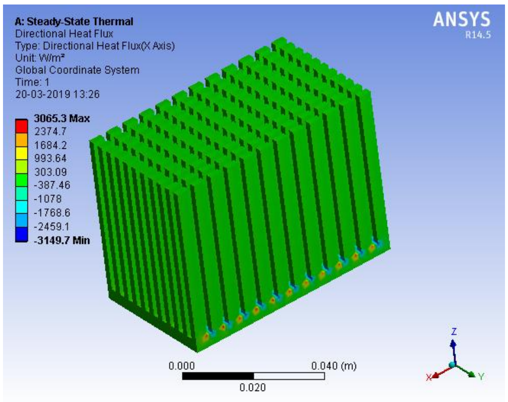

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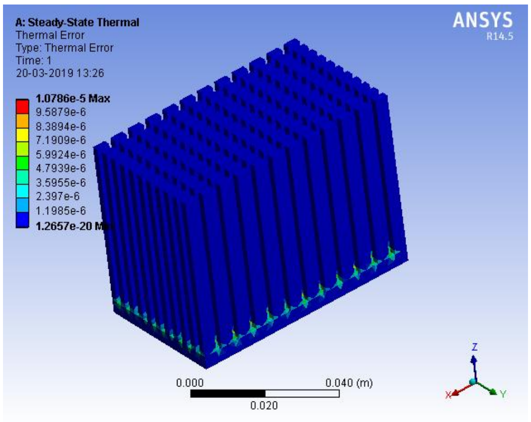
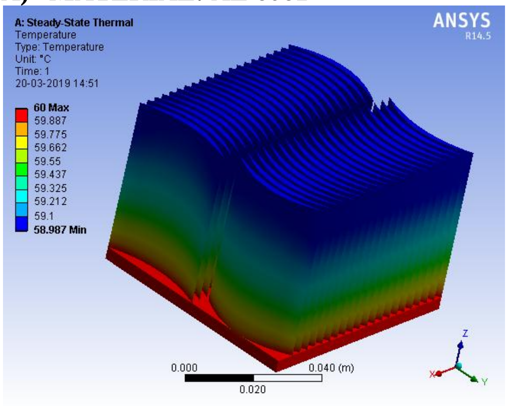


THERMAL ERROR

2.5. HEAT SINK MODEL: 3

A) MATERIAL: AL 6061



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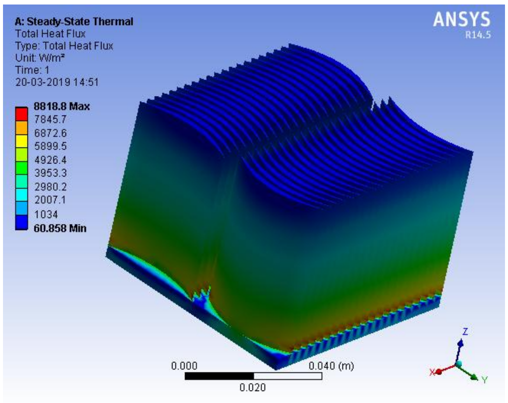

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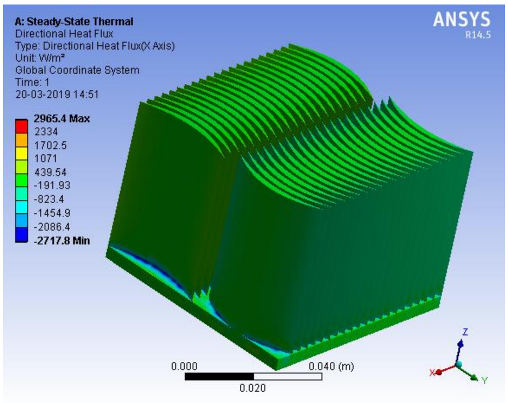

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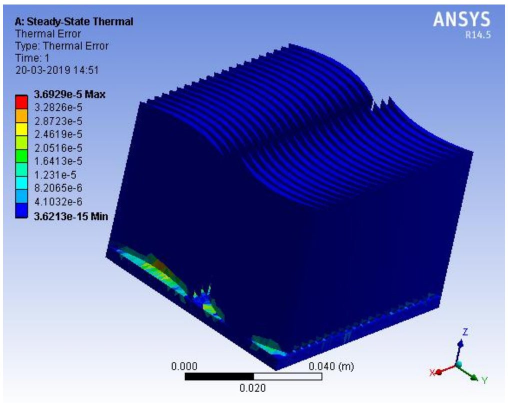

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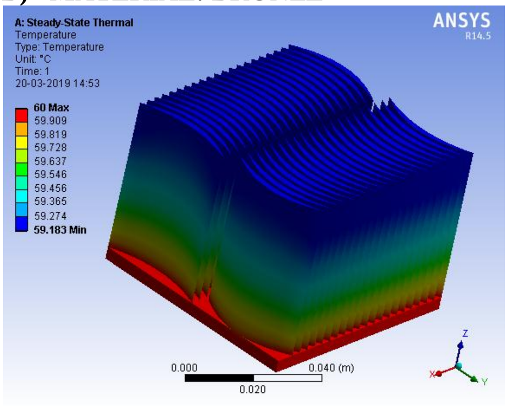
B) MATERIAL: BRONZE



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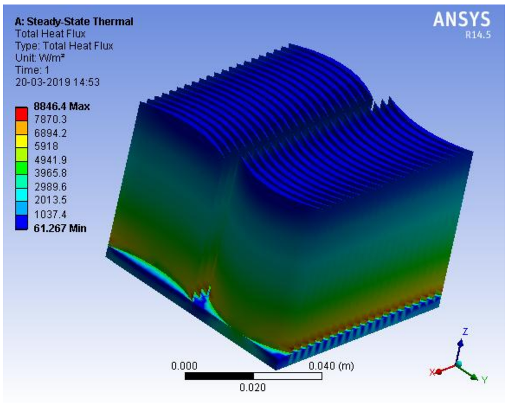

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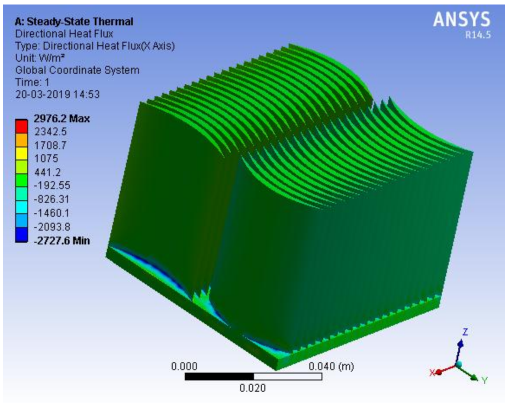

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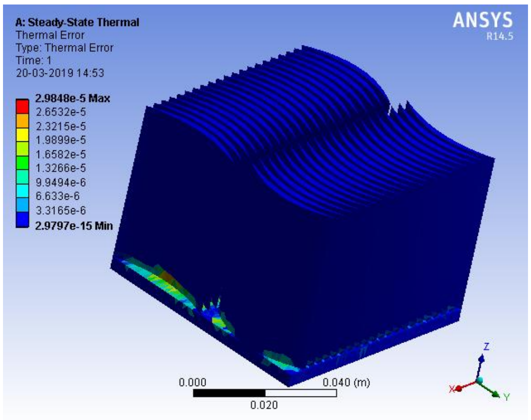

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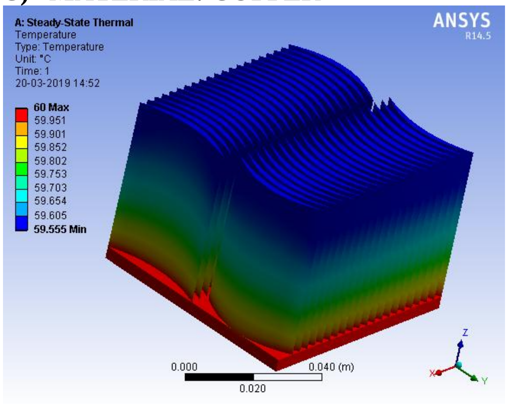

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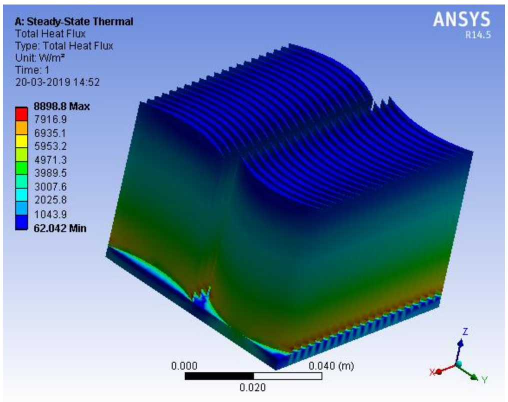

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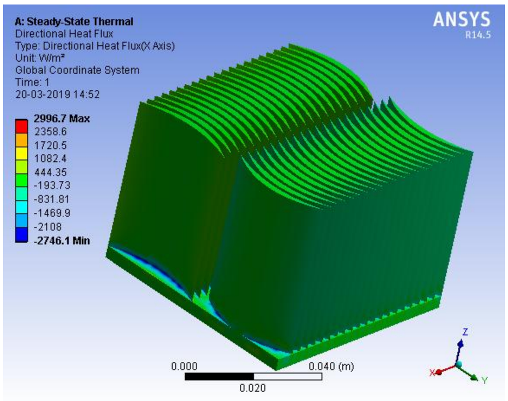

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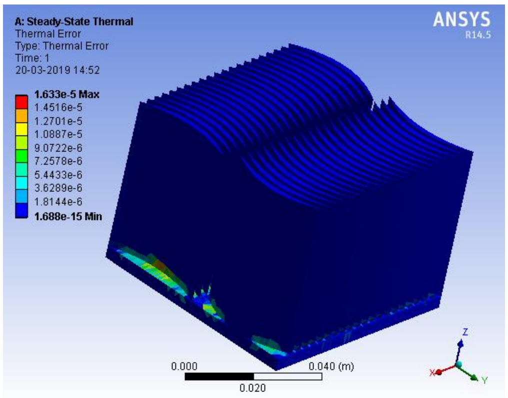
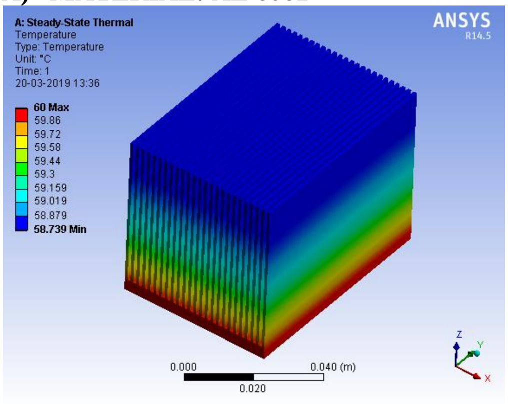


THERMAL ERROR

2.6. HEAT SINK MODEL: 4

A) MATERIAL: AL 6061



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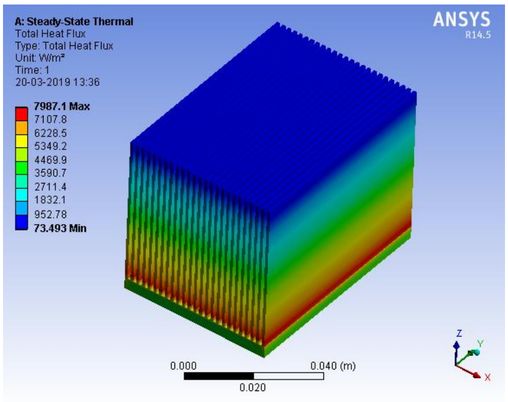

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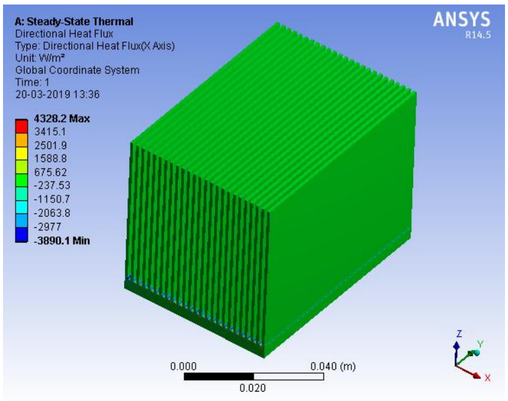

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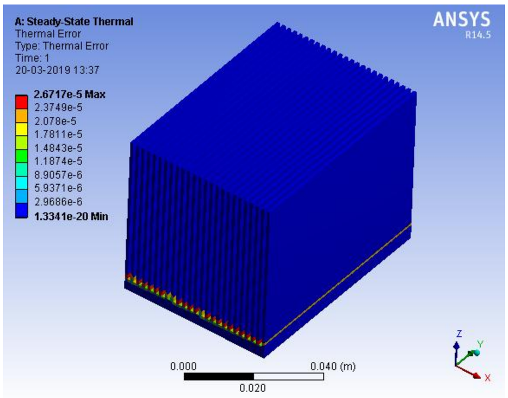

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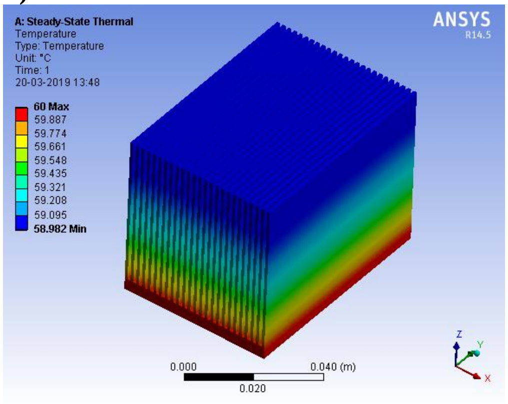

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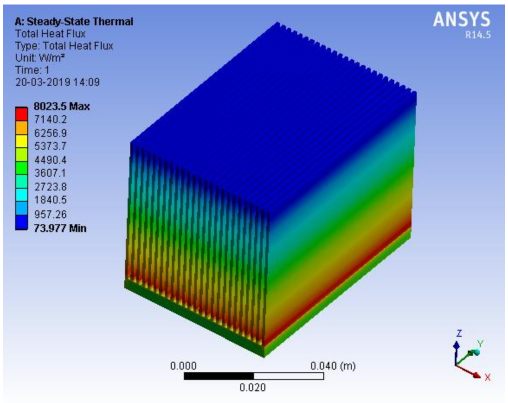
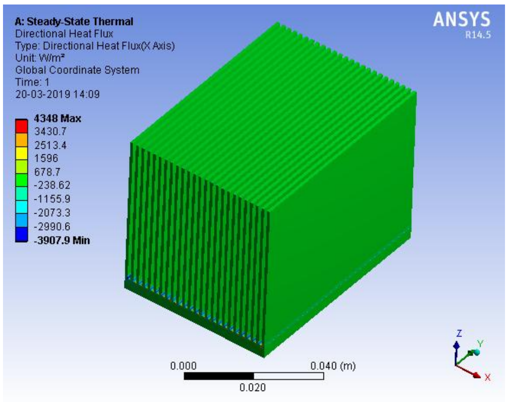


TOTAL HEAT FLUX



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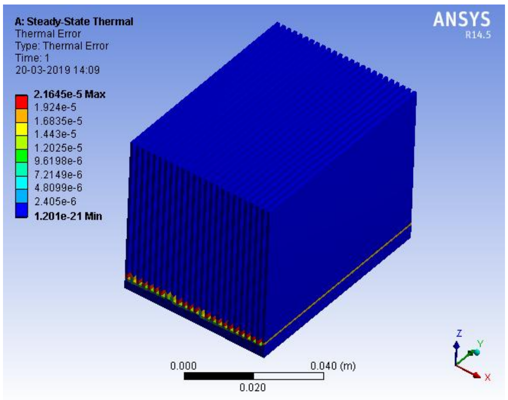

THERMAL ERROR

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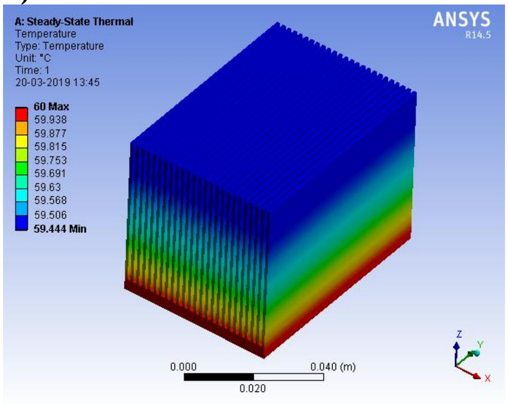

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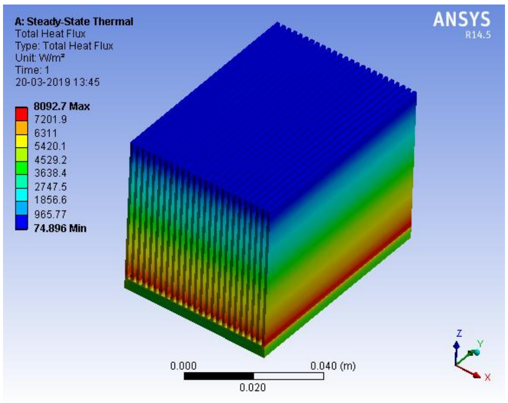

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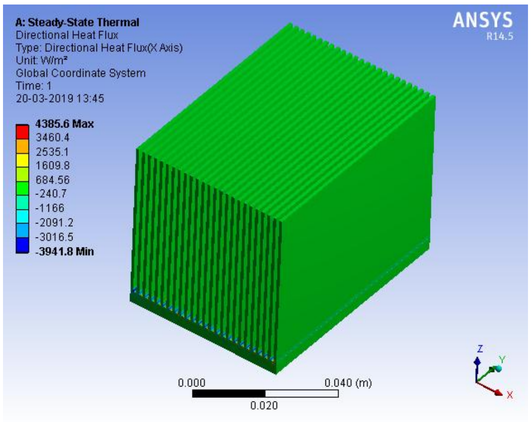

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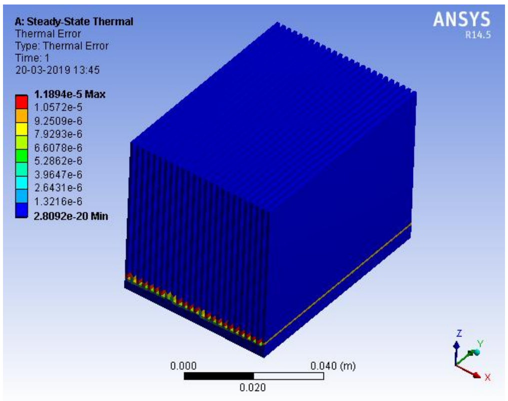
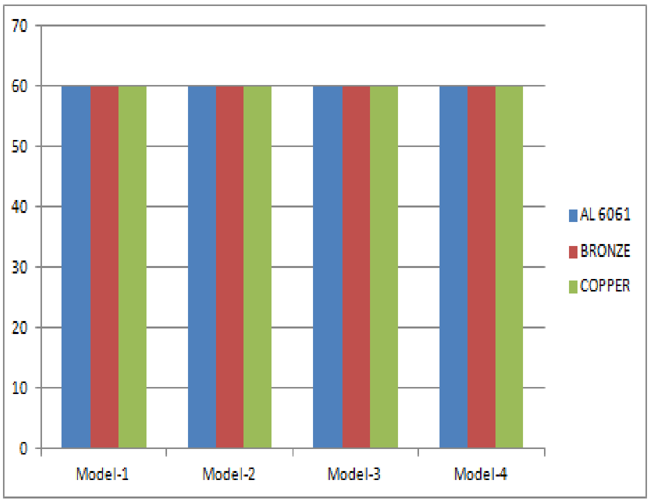


THERMAL ERROR

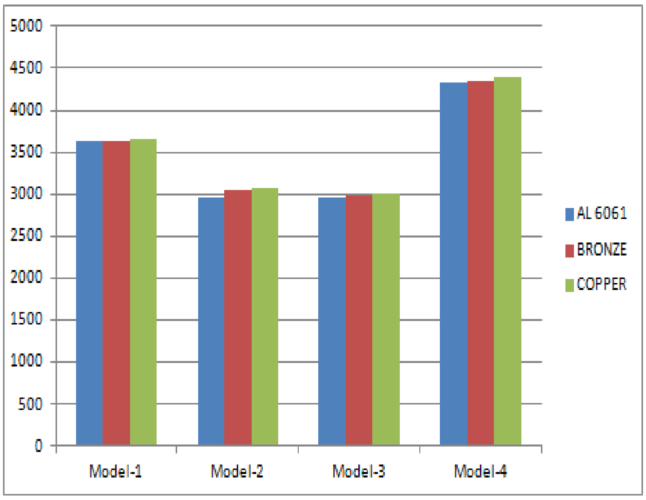
III. TABULATED RESULTS

Material	AL 6061				BRONZE				COPPER			
Model No	1	2	3	4	1	2	3	4	1	2	3	4
Temperature(*C)	60	60	60	60	60	60	60	60	60	60	60	60
Total heat flux (W/m^2)	7221	5829	8819	7987	7240	5901	8846	8024	7275	5939	8899	8093
Directional heat flux (W/m^2)	3624	2951	2965	4328	3634	3046	2976	4348	3652	3065	2997	4386
Thermal error	3.676	2.245	3.693	2.672	2.968	1.972	2.985	2.165	1.62	1.079	1.633	1.189

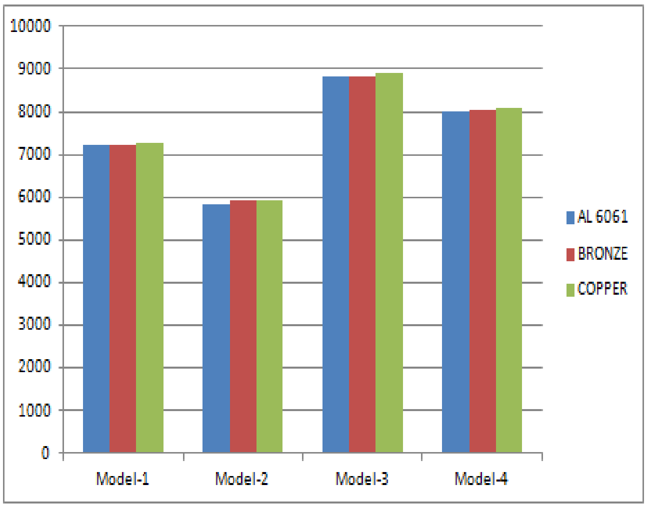
IV. GRAPHS



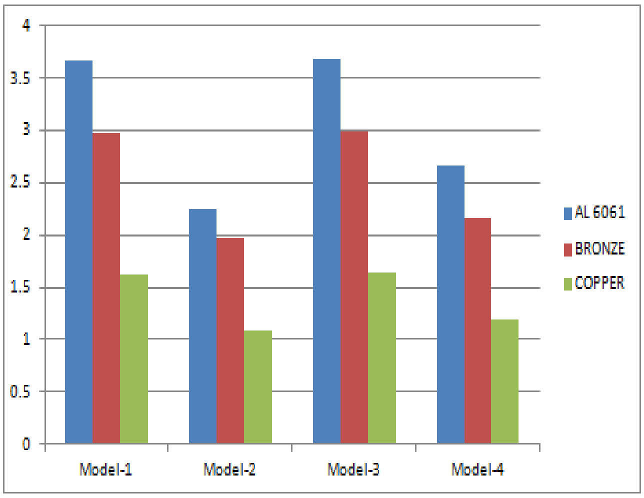
TEMPERATURE (^{O}C)



Directional heat flux (W/m^2)



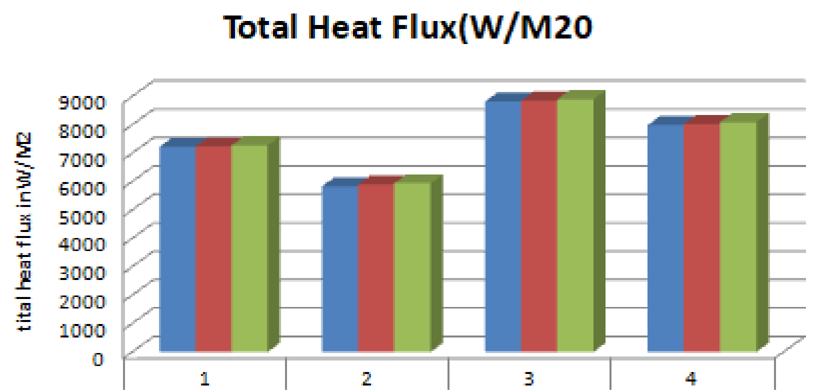
Total heat flux (W/m^2)



Thermal error

V. CONCLUSIONS

Here, the aim of this project is to enhance the forced cooling on Central Processing Units.
For that purpose, four different geometric models of heat sinks are designed by 3D molding software i.e., CATIA. And these four models are analyzed by changing the three different materials like AL 6061, Bronze and copper metals with help of ANSYS Study state heat transfer module.



	1	2	3	4
Al 6061	7221.2	5829.2	8818.8	7987.1
BRONZE	7239.7	5900.7	8846.4	8023.5
COPPER	7274.7	5939.1	8898.8	8092.7

Based on the above obtained Total Heat Flux result the model 3 is made with copper gives the best results. Hence, I conclude that if we will produce the model 3 type heat sinks the performance of the Central Processing Unit is increased because of increased heat transfer rate.

REFERENCES

1. Thermal modelling of a PC" by R.L.Linton and D. Agonafer, , in ASME Journal of Electronic Packaging, vol. 116, pp.134-137, 1994.
2. "Thermal and flow analysis of a heated electronic component. J. Yang, and L. M. Fu," International journal of heat and mass transfer.
3. C. W. Yu, and R. L. Webb, "Thermal design of a desktop computer system using CFD analysis", Seventeenth IEEE SEMI- THERM SYMPOSIUM, pp. 18- 26, 2001.
4. J. Y. Chang, "Identification of minimum air flow design for a Desktop computer using CFD modeling", "7th intersociety conference on thermal and thermo mechanical Phenomena in Electronic systems", vol. 1, pp.330-338, 2000.
5. D.Lober, "Optimizing the integration of an electronics system into an existing enclosure using CFD modeling techniques", International journal of microcircuits and electronic packaging, vol. 22, pp.146-151, 1999.
6. S. Subramanyam, and K.E.Crowe, "Rapid design of heat sinks for electronic cooling computational and experimental tools", IEEE Symposium, pp. 243-251, 2000.
7. J. H. Ryu, D. H. Choi, and S. J. Kim, "Numerical Optimization of the thermal performance of a micro channel heat sink", Int. J. Heat and Mass Transfer,
8. R. W. Knight, D. J. Hall, J. S. Goodling, and R. C. Jaeger, "Heat Sink Optimization with Application to Micro channels", IEEE Transactions on Components, Hybrids, and Manufacturing Technology, vol. 15, no. 5, pp. 832-842, 1992.
9. T. C. Hung,S. K. Wangi, and F. Peter, "Simulation of Passively Enhanced Conjugate Heat Transfer Across an Array of Volumetric Heat Sources" Communications in Numerical Methods in Engineering, John Wiley & Sons,Ltd.
10. Egan, Eric,Amon, and H. Cristina, "Thermal Management Strategies for Embedded Electronic Components of Wearable Computers", Journal of Electronic Packaging,