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Scope of Extraction Unit for Medical and Agricultural Application

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Abstract: *The circular pin fin heat sink are simulated for different alloys like Aluminium alloys i.e.6063-T83, 7075O(SS) and Copper alloys i.e. Chromium Copper. This study comparing the heat transfer rate with respect to different alloys under Natural Convection. The objective of this study was to maximize the thermal performance of heat sink with respect to different material such that it benefits to finding material selection, low cost material and good heat transfer rate for designing the heat sink. The performance of fine-and-tube heat exchanger is enhanced by modifying fin shape. Aluminum are the materials especially used rather than brass and iron. The utilization of pins in the heat sink rises the heat transfer area to reach the extreme rate of heat loss in a restricted space. Engineering innovative methods for example Computational Fluid Dynamics (CFD) are heavily used to solve, design and model complex industrial applications. Computational Fluid Dynamics (CFD) is an effective and powerful tool to simulate fluid flow and heat transfer numerically. Many different numerical methods have also been developed by researchers since decades to use this robust tool to simulate a wide range of complex flows and heat transfer problems. These methods can be categorized into two major clusters as "conventional methods" and "accelerated techniques".*

Keywords: Computational, transfer, performance, Dynamics

I. INTRODUCTION

Computational fluid dynamics or CFD is the analysis of systems involving fluid flow, heat transfer and associated phenomena such as chemical reactions by means of computer-based simulation. The technique is very powerful and spans a wide range of industrial and non-industrial application areas. Engineering advanced methods for example Computational Fluid Dynamics (CFD) are heavily used to solve, design and model complex industrial applications. They provide high accuracy however, the simulation time is too long and
this limit its generalized use dramatically as for control purposes. CFD tools and methods are often used to analyze the energy distribution and management in different industrial processes like hot rolling industries, furnaces and boilers as well as a number of areas where mixing and thermal management are of importance. Huge amounts of energy are often fed into such processes. A small amount of optimization can provide a very large energy saving. It is now an urgent need to have a tool like real-time CFD to analyze, control and optimize on-line various industrial processes. This tool or method can contribute to build efficient and sustainable energy systems. The scope of this work is to find alternative simulation techniques that can also address industrial applications and provide solutions within a decent accuracy and resolution. In this paper we provide a literature review of those methods that can be categorized as mesh based, mesh free and hybrid that are capable of providing appropriate results in some key areas of interest. Our prime objective is to obtain optimum heat transfer rate which will result in producing highly efficient fins. The main objective of this project is to present thermal analysis which is subjected to temperature variation on fins by varying temperature and materials. We know that by increasing the surface area we can increase the heat dissipation rate. This will help to determine better geometry and materials for fins to achieve better heat transfer coefficient. When any fluid flows through rectangular duct with heated object placed inside it, a respective pattern of flow carries heat through convection and radiation. Different profiled objects may give different rate of heat transfer. Hence the objects like pin fin with enhanced surface areas (Perforated) placed inside the duct, the heat transfer rate will be maximum.

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II. METHODOLOGY

Computational fluid dynamics (CFD) is a tool with amazing flexibility, accuracy and breadth of application. But serious CFD, the kind that provides insights to help you optimize your designs, can be out of reach unless you choose your software carefully. To get serious CFD results, you need serious software. Ansys CFD goes beyond qualitative results to deliver accurate quantitative predictions of fluid interactions and trade-offs.

These insights reveal unexpected opportunities for your product . Heating of a component under different working application is a big problem for today's engineering application, therefore fast heat transfer from heated surfaces, reducing cost and material weight has turned into major challenge for heat transfer. Pin fins are broadly utilized as a part of heat exchanging body which result in enhancing the heat exchange between the surface of the body and ambient fluid by doing thermal analysis on the fins, it is helpful to know the heat dissipation and rate of heat transfer in different types of fins. A fin is a surface that extends from an object to increase the rate of heat transfer to or from the environment by increasing convection. we know that by increasing the surface area of pin configuration we can increase the heat dissipation rate of this process. For the principle of conduction, convection, radiation which determines the amount of heat transfer increasing the temperature difference between the fin configurations

III.TYPES OF FINS AND MATERIAL USED

TYPES OF FINS

a. Square Fin:

It is square in shape and having square cross section in geometry to judge its heat dissipation capacity. Heat is conducted from the base in to the fin at its root and then while simultaneously conducting along the length of the fin, heat is also convected from the surface of the fin to the ambient fluid with the convective heat transfer coefficient of h in W/m2– Kelvin.

b. Spiral Fin:

It is spiral in shape and having spiral cross section in geometry to judge its heat dissipation capacity. Spiral fin provides higher air-side heat transfer performance and friction characteristics than those of the other kind of fins and mainly used *heating*, cooling and dehumidifying.

c. Circular Fin:

It is circular in shape and having circular cross section in geometry to judge its heat dissipation capacity. Circular fin is also called a radial fin or circumferential fin. In circular fin coefficient for surface convection to the ambient air and qr is the heat flux for conduction in the radial direction.

IV. MATERIALS USED IN FINS

a. Aluminum:

Aluminum material is used in square fin and thermal conductivity of aluminum is 205 w/m.k, the main properties of aluminum is light in weight for fin and its strength at low temperature. Pure aluminum is soft, ductile, and corrosion resistant and has a high electrical conductivity. By using this material in fin of square type geometry the heat transfer rate in both natural and forced convection results in optimum rate of heat dissipation capacity.

b. Copper:

Copper material is used in spiral fin and thermal conductivity of copper is 385 w/m.k, the main properties of copper is it has high melting point and it is malleable, ductile, and a good conductor of electricity and heat. By using this material in spiral type geometry the heat transfer rate in both natural and forced results a very good performance in heat dissipation capacity as compare to square and composite type of fin.

c. Composite:

Composite material is used in circular fin and thermal conductivity of composite is 295 w/m.k , the composite material is of aluminum and copper. the properties of copper in fin is it has high melting point and it is malleable, ductile, and a

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good conductor of electricity and heat while aluminum is light in weight for fin and its strength at low temperature. Pure aluminum is soft, ductile, and corrosion resistant and has a high electrical conductivity.

IV. COMPARISION OF THE MATERIAL

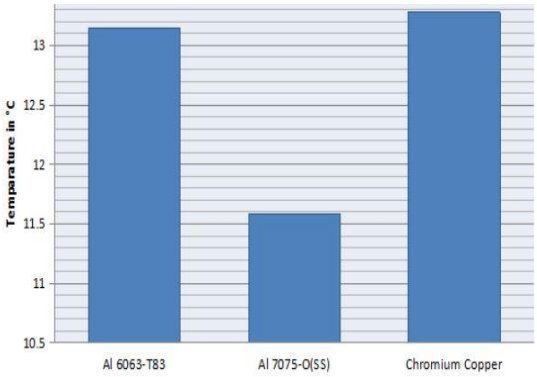

Figure 1: Temperature Comparison

V. PRICE OF MATERIAL

MATERIAL	PRICE
Al 6063-T83	200 Rs
Al 7075-O	500 Rs
Chromium Copper	750 Rs

VI. CONCLUSION

By observing CFD results, use of Circular pin fin heat sink with material Chromium Copper is better because temperature drop is more and good heat observing capacity Compare to Al 6063-T83, and Al 7075-O alloy.

By observing, cost of material Al 6063-T83 is less compare to other two materials. Temperature drop of Al 6063 is only 0.13°C lesser than Chromium copper.

Best material for manufacturing pin fin heat sink is Al 6063T83 because low cost and light weight compare to other two materials

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