

Effect of Porous Medium in Triple Concentric Tube Heat Exchanger

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Abstract

The performance of a triple concentric tube heat exchanger is studied experimentally under steady state conditions for two different flow arrangements, and for insulated as well as non-insulated conditions of the heat exchanger. The three fluids being considered are hot water, cold water and the normal tap water. Normal water flows in the innermost pipe, hot water flows in the inner annulus, and the cold water flows in the outer annulus. All fluids flow parallel to each other. Cold and normal water are interchanged in to arrangement keeping hot water flow unchanged. The results are presented in the form of the temperature variations of the three fluids along the length of the heat exchanger for their different flow rates. It is found that the temperature variation along the length of pipe differs substantially for the two arrangements. Temperature of cold water increases rapidly in the non-insulated condition of arrangement. Cross over points are found for higher volume flow rates of the three fluids.

Keywords:-Porous medium, Annular tube, Heat Transfer Improvement Performance factor; CFD.

Introduction

The warmth move through the warmth sinks present in stream channel can be expanded by utilizing change in uninvolved surfaces, for example, broadened surfaces with geometrical alterations. These procedures are having wide application, for example, cooling turbine aero foils, electronic cooling frameworks, biomedical instruments, and warm the exchangers. The pin balance innovation is broadly utilized in numerous applications, for example, PC mother board heat sink over chip.

The setup of gainful cooling frameworks is crucial for strong execution of high force thickness devices. Different frustration frameworks in electronic contraptions, for instance, between metallic advancement, metal development, and void course of action, are related to warm effects. Truth is delineated for, the pace of such disappointments about sets with each 10°C augmentation over the working temperature

(80°C) of high force equipment [1]. Other than the damage that excess thermally can achieve, it constructs the advancement of free electrons within semiconductors, making a development in sign disturbance [2]. In this manner, devices warm organization is of basic hugeness as is reflected in the business area. Warm organization things show an improvement from about \$7.5 billion out of 2010 to \$8 billion out of 2011, and it is required to create to \$10.9 billion out of 2016, a compound yearly advancement rate augmentation of 6.4%. Warm organization hardware, for example fans and thermally sinks, speaks to around 84% of the total business division. Other essential cooling thing segments, for example programming, interface materials, and substrates, each record for some place around 4% and 6% of the business area, independently. This power dissipating makes heat, which is a by-thing in various planning applications. This unfortunate by-thing can reduce the execution of the structures since skirting on each building system is proposed to work within a particular temperature limits. Overheating in order to outperform these limits, could provoke Starting at now, the warm disasters of impact electronic devices are extending. Meanwhile, their sizes are lessening.

Subsequently, warm sinks need to disperse higher thermally transitions in each new layout. In like manner, imagining capable cooling answers for meet these challenges is of crucial essentialness and effect guileful influences the execution and relentless nature of electronic and power electronic devices.

The frameworks used as a piece of the cooling of high force thickness electronic devices change for the most part, dependent upon the application and the necessary cooling limit. The glow made by the

electronic parts needs to experience an astounding arrangement of warm protections from the earth. Confined cooling systems are commonly preferred for electronic and power electronic contraptions since they give low-worth, calm, and burden free plans. Some dormant cooling procedures include: heat channels, trademark convection air cooling and warm accumulating using stage change materials (PCM). Warmth channels can capably trade heat from thermally sources in high force thickness converter portions to a glow sink considering stage change of a working fluid [4, 5]. Air-cooling moreover is seen as a basic technique in the warm arrangement of electronic packs, considering the way that other than its availability, it is protected, doesn't dirty the air and doesn't include vibrations, disturbance and dampness to the system in which it is used [6]. Such segments of trademark convection invigorated critical investigation on the improvement of overhauled finned heat sinks and fenced in territories [7, 8, and 9]. Using adjusts is a champion among the least expensive and ordinary ways to deal with disperse unfortunate thermally and it has been adequately used for some planning applications. Equalizations come in various shapes, for instance, rectangular, indirect, pin sharp edge rectangular, pin balance triangular, etc. See Fig. 1 and 2, dependent upon the application. Rectangular adjusts are the most notable equalization sort taking into account their low creation costs and high warm ampleness. Regular convective warmth move from vertical rectangular blades appeared in Figure 3.



Figure 1 Different type of fins

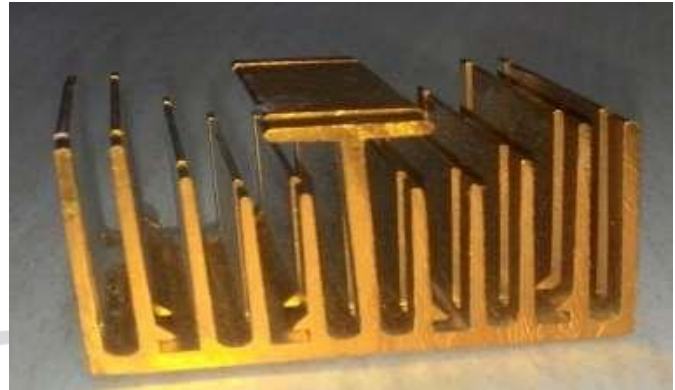


Figure 2 Different types of cooling fins



Figure 3 Heat sink with continuous rectangular fin

2. Literature Review

H. Dange and Patil et al. [1], they have done the preliminary and CFD examination for warmth trade on round sharp edge by obliged convection. They have done the examination by changing the speed. The results exhibited that the glow trade coefficient increases with development in speed of fluid.

Dhumne and Farkade et al. [2], they have done warmth trade assessment of cylinder molded punctured cutting edges in astonished game-plan. The punctured adjusts of different sizes were used for the assessment. The results showed that Nusselt number additions with decrease in breathing space extent and bury balance isolating. The disintegration variable additions with decreasing in cover balance scattering.

Singh, B. Ubhi., et.al. [3], they have made and separated the glow trade through cutting edge development in plate adjusts. They found out about various geometries, for instance, rectangular, trapezium, triangular, and round extensions in

plate adjust. The results showed that plate sharp edge with increases offered 5% to 13% more warmth trade than balance without extensions. The sufficiency of rectangular increase plate balance is more than interchange sorts of development.

D.D Palande and Walunj et. al [4], they have done exploratory assessment of evaluation dainty plate edges heat sink under basic convection. They have examined cutting edges concerning viewpoint extent and particular radiator information wattage the result showed that ordinary convection heat trade increases with warmth data. The convective warmth trade increases with perspective extent.

M. Reddy and G. Shivashankaran et al. [5], they have done numerical entertainment of obliged convection heat trade overhaul by porous pin fins balance at rectangular channel. They had found out about round, long roundabout and short bended pin sharp edge heat sink by changing inlet speeds for example 0.5m/s, 1m/s, 1.5m/s and 2m/s using ANSYS CFD natural programming. The result showed that the glow move efficiencies in porous pin balance are around half higher than solid pin balance.

M. Ali, Tabassum et.al. [6] Performed warm and water driven assessment of rectangular offset displays with different gap size and number. They changed puncturing from 0 to 2, and contrasted opening broadness structure 0mm to 3mm. The results showed that glow trade and weight drop extended with extension in Reynolds number for all adjusts.

K. Dhanawade and Sunnapwar et.al. [7] They have done the warm assessment of square and indirect punctured sharp edge bunch by compelled convection. They have changed the range of gap for the assessment for example 10mm square, 8mm square, and 6mm square and for indirect puncturing 10mm, 8mm, 6mm estimation. The result got exhibited that the Nusselt numbers extended with extension in Reynolds number, warm contact extended with development in puncturing and usage of punctured equalization assemble the glow trade besides there is diminishment in weight, saving of material that finally decays the utilization on balance material.

K. Chaitanya and G. Rao et al.[8] they have done the transient warm assessment of drop shaped pin sharp edge

group using CFD. They have done the close to concentrate between round shape pin sharp edge and drop formed pin balance. The results showed that the glow trade extended due to development in contact surface zone in fluid and the equalization. There was extension in the weight drop for drop shaped pin offsets appeared differently in relation to indirect pin adjusts.

3. Research Objective

There are following objective are to be expected from the present work

1. To predict the heat transfer rate from existing design in computer system
2. To optimize the heat sink design from the basis of heat transfer rate.
3. To maximize the heat transfer rate from the CPU heat sink
4. To design heat sink cost effective with maximum heat transfer rate.

4. Software Description

Transient thermal analyses verify temperatures and different thermal quantities that fluctuate over time.

4.1 Transient Thermal analysis

The variety of temperature dissemination after some time is of enthusiasm for some applications like with cooling of electronic bundles or an end examination for heat treatment mutually of intrigue are the temperature appropriation winds up in thermal stresses which can cause disappointment. In such style of cases the temperatures from a transient or precarious state thermal investigation is utilized as data sources or starting stipulation to an auxiliary examination for thermal stress assessments. Transient thermal investigations are performed abuse the ANSYS or same as issue solver.

Many heat move applications for example heat treatment issues, electronic bundle vogue or style, spouts, motor squares, weight vessels, liquid structure connection issues, at that point on include transient thermal examinations.

4.2 Point Tore member

A transient thermal examination is either direct or nonlinear. Temperature subordinate material properties (thermal conductivity, heat or thickness), or temperature subordinate

convection coefficients or radiation impacts could end in nonlinear partner lyses that require an unvarying system to accomplish right arrangements.

4.3 Preparing the analysis

Ordinarily, a relentless state thermal investigation rasps or incorporates a few stages.

- Create Analysis System
- Define or referencing Engineering information
- Attach geometry
- Define half Behaviour
- Define Connections or connection
- Apply Mesh Controls/Preview Mesh
- Establish Analysis Settings
 - Define Initial Conditions
 - Apply loads of and Supports
 - Solve
 - Review Results

4.4 Finite Part analysis

It's a method for assessing yet an item responds in globe all through powers, heat and liquid stream, vibration and distinctive physical impacts. It to boot substantiates whether or not an item will fall flat or work the manner in which it had been planned. Inside the blessing work Transient thermal examination is performed for Dell PC heat sink with the assistance of seat of ANSYS 19.2.

4.5 Transient Thermal Analysis for Actual Style Of engine

Thermal investigation may be a technique inside that a property of the work is observed against the time and in a passing definite locale conditions. The thermal investigation grants discovering that however compound procedures that unit related with heating or cooling. Transient thermal investigation is utilized to make sense of temperature appropriation and diverse thermal parameters which can fluctuate over the time. The technique of transient thermal investigation is remarkably a lot of practically identical as consistent state thermal examination the chief refinement is that for the premier connected loads of for the transient thermal examination

are a work of it moderate.

4.6 CAD Geometry

In The Gift Work the CAD Geometry of Engine is made with the Help of Automobile CAD Discoverer Software System Package with Actual Dimension, Then Foreign in ANSYS Work Bench for Any Transient Thermal Analysis. CAD Geometry in three dimensional scans of Heat Sink.

5. Result and Discussion

The condition of movement of the heat sink is unravelled utilizing the FEM device (ANSYS- Thermal transient) as the condition of movement for heat sink is hard to imagine in this manner some FEM apparatus is the main arrangement technique for breaking down thermo physical qualities of heat sink. The ANSYS 19.2 finite component program was utilized natural convection in differentially heated nooks. For this reason, the key focuses were first made and afterward line portions were framed. The lines were consolidated to make a surface. Finally, this surface is given thickness model is made. The heat sink was discredited into 76031 elements with 33876 hubs. Heat sink limit conditions can likewise be (gave in the work area through naming the bit of demonstrated sink i.e Base, Base Top, Fins, Interior. Following advances demonstrate the rules for completing thermal transient analysis.

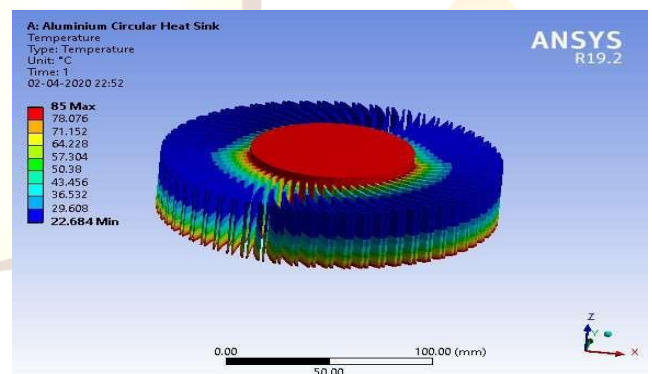


Figure 4 Circular flared heat sink temperature result

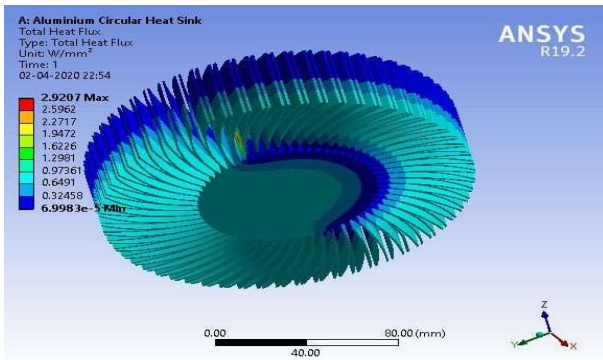


Figure 5 Circular flared heat sink heat flux result

Conclusion

For Optimization and evaluation of a heat sink with forced convection and Fin with various setup for example triangular, trapezoidal. Employing Perforated fins Using composite material for making fin using artificial roughness.

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