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REVIEW: EXAMINING CONE-SHAPED AND ELLIPTICAL INTERNAL RIBS TO DETERMINE TEMPERATURE DISTRIBUTION AND NUSSELT NUMBER

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ABSTRACT

A fin is a thin component or appendage attached to a larger body or structure. Fins typically function as foils that produce lift or thrust, or provide the ability to steer or stabilize motion while traveling in water, air, or other fluids. Fins are surfaces that extend from an object to increase the rate of heat transfer to or from the environment by increasing convection. The amount of conduction, convection, or radiation of an object determines the amount of heat it transfers. Increasing the temperature gradient between the object and the environment, increasing the convection heat transfer coefficient, or increasing the surface area of the object increases the heat transfer. Internal shaped fins with different shapes have received increasing attention during the past decades due to potential advantage over conventional overhead forced heat transfer system.

Keywords: Computational Fluid Dynamics, Mass Flow Rate, Internal Shaped Fins, Temperature Distribution, Nusselt Number, Friction Factor.

I. INTRODUCTION

Fins typically act as foils, providing lift or thrust as they move through water, air, or other fluids, or providing the ability to control or stabilize movement. Ribs are also used to increase surface area for heat transfer purposes or simply as an ornament. Fins first evolved into fish as a means of locomotion. The fish`s fins are used to generate thrust and subsequently control its movement. Other aquatic animals such as fish and whales use their pectoral and caudal fins to actively propel and steer. When swimming, they use other fins, such as the dorsal and anal fins, to ensure stability and refine their maneuvers. A fin is a surface that extends from an object to increase the rate of heat transfer to or from its surroundings by increasing convection.

The amount of conduction, convection, or radiation from an object determines how much heat is transferred. Therefore, adding fins to an object increases its surface area and may be an economical solution to heat transfer problems.

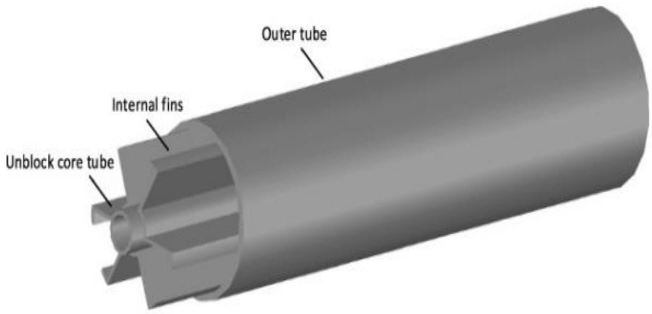

Figure 1: Schematic diagram of internal fin tube

Heat transfer through fins

Fins are extensions on the outer surface of an object that increase the rate of heat transfer to or from the object by increasing convection. This is achieved by increasing the surface area of the body, which increases the heat transfer coefficient significantly. Another possibility is that either the heat transfer coefficient (depending on the type of material used and the conditions of use) or the temperature gradient (depending on the conditions of use) can be increased, so this is an efficient way to increase speed.

Fins are therefore a very popular solution for improving heat transfer from surfaces and are widely used in many objects.

The material of the fins should preferably have a high thermal conductivity. In most applications, the fins are surrounded by a moving liquid that heats or cools rapidly due to their large surface area, and then the high thermal conductivity of the fins allows the heat to rapidly transfer to and from the body. Obtaining optimum heat transfer performance at minimal cost requires calculating the fin dimensions and shape for a specific application, known as fin design. A common way to do this is to create a model of the fin and simulate it under the desired operating conditions.

Principle of Heat Transfer Phenomena by Extended Surface

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 100% 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. [2][3]To understand the principle of a heat sink, consider Fourier's law of heat conduction. Fourier's law of heat conduction, simplified to a one-dimensional form in the x-direction, shows that when there is a temperature gradient in a body, heat will be transferred from the higher temperature region to the lower temperature region. The rate at which heat is transferred by conduction, {\display style q_{k}} q_{k}, is proportional to the product of the temperature gradient and the cross-sectional area through which heat is transferred.

II. LITERATURE REVIEW

Lufang Duan et al. [1] investigated the turbulence and heat transfer properties of double-tube structure inner fin tubes and flower-shaped inner fins. A sample containing three flower-shaped lamellae was investigated experimentally and numerically at six different air flow rates and a constant air inlet temperature. The Reynolds number on the air side varied from 3255 to 19580. The simulation results obtained are in good agreement with the experimental data. We subsequently analyzed the effect of geometric finned-tube structures (different number of fins and different core tube diameters) on thermal behavior. As a result, we found that increasing the number of fins resulted in a more uniform distribution of the temperature and velocity fields. The heat transfer performance of the inner finned tube with 3 and 4 petal-shaped fins was similar and both were significantly higher than the inner finned tube. With two flower-shaped fins. An optimal ratio of (do/Tu 0.28) existed, resulting in better cost-effectiveness. Compared to corrugated fins, petal fins are more suitable for operating conditions with tight pressure drop limits, especially in waste heat recovery systems.

M.J. Lee et al. [2] In this paper, he experimentally investigated a new type of smooth plate fins with 12 delta winglet vortex generators around each tube of the finned-tube heat exchanger proposed by the authors. To compare the overall properties of the proposed fins with circular corrugated fins, tests are performed on four full-scale heat exchanger surfaces. Two corrugated finned tube heat exchangers (short 10 corrugation and 12 corrugation) with 6 rows of tubes with 2.54 mm or 2.117 mm fin spacing. and two proposed finned-tube heat exchanger surfaces with five tube rows with equal fin spacing (10-LVG and 12-LVG, respectively). The air-side inlet velocity varies from 1.5 m/s to 7.5 m/s, and the water-side flow velocity is fixed at a constant value at each air inlet velocity. Experimental results show that the heat transfer coefficient and pressure penalty of the heat exchanger surface with the proposed five-row tube fins are almost the same as those of the corrugated heat exchanger surface with six-row tubes. . The correlation between the Nusselt number Nu on the air side and the coefficient of friction f is obtained. Perform entropy analysis to reveal the thermal amplification mechanism. Mohammed.

Sikindar Baba et al.[3] Internal fins in heat exchanger tubes are an excellent way to improve heat transfer. In this article, we report an experimental study of forced convection heat transfer in a double-tube counterflow heat exchanger with multiple internal vertical fins using Fe_3O_4-water nanofluids. Enhanced convective heat transfer and pressure drop for nanofluids flowing in horizontal circular tubes with internal vertical fins under turbulent conditions (5300 and with volume concentrations of Fe_3O_4 nanoparticles in the range 0<49200. studied. φ<0.4%. The results show that the heat transfer coefficient of the finned tube heat exchanger is 80-90% higher than that of the bare tube heat exchanger due to the higher volumetric concentration of nanofluid. The Nusselt number ratio of the Fe_3O_4-water nanofluid to the base fluid (water) increases with Reynolds number. The coefficient of friction decreases with increasing Reynolds number and the pressure drop is higher in finned tube heat exchangers than in bare tube heat exchangers due to the effect of the fin geometry resisting flow. The Wilson plot method is used to generate His Nusselt number correlations for the flow of His Fe_3O_4-water nanofluid through a finned tube heat exchanger.

Swastik Acharya and Sukanta K. Dash [4], By solving continuity, momentum and energy equations, three-dimensional numerical simulations were performed to predict the flow and temperature fields around a horizontal cylinder with internal fins of natural convection. Varying fin height, fin spacing or number of fins, and cylinder length at different Ras, predicting heat loss from a finned cylinder yielded interesting insights. Short Cylinder Heat Loss (L/D < 1> 1) At all fin heights and fin spacings, the maximum heat loss point vanishes. A table was created showing the optimum configuration of fin height and number of fins for maximum heat loss. We found that the mean Nu of ribbed cylinders decreased with H/D, L/D and increased with Ra. From the extensive numerical simulations performed in this study, general correlations of L/D, H/D, rib number, N, and Nu as a function of Ra were developed with an accuracy of ±6%. This is beneficial to the industry. and practical designer.

CFD

Computer primarily based simulation is mentioned during this chapter. procedure simulation is technique for examining fluid flow, heat transfer and connected phenomena like chemical reactions. This project uses CFD for analysis of flow and warmth transfer. CFD analysis accepted go in the various industries is employed in R&D and producing of craft, combustion engines and in powerhouse combustion similarly as in several industrial applications.

Why computational simulation

Three-dimensional (3D) numerical analysis of whorled coil tubes is dispensed by victimization business CFD tool ANSYS 18.2. this can become troublesome and time overwhelming, if this analysis is dispensed by experimentation. Experimental setup is extremely expensive that's why in my work I take facilitate of CFD to create it easier and fewer time overwhelming.

Computational fluid dynamics

Computational fluid dynamics, because the name implies, could be a subject that deals with procedure approach to fluid dynamics by means that of a numerical resolution of the equations that cause the fluid flow and though it's known as procedure fluid dynamics; it doesn't simply wear down the equations of the fluid flow, it's conjointly generic enough to be ready to solve at the same time along the equations that direct the energy transfer and similarly the equations that verify the chemical process rates and the way the chemical process takings and mass transfer takes place; of these things may be tackled along in a regular format. So, this define permits America to wear down a really complicated flow circumstances in fairly quick time, specified for a specific set of conditions, associate degree engineer would be ready to simulate and see however the flow is happening and what quite temperature distribution there's and what quite product area unit created and wherever they're fashioned, in order that {we can|we will|we area unit able to} build changes to the parameters that area unit below his management to switch the approach that these items are happening. So, therein sense procedure fluid dynamics or CFD becomes a good tool for a designer for associate degree engineer. it's conjointly a good tool for associate degree associate degreealysis for associate degree examination of a reactor or an instrumentality that isn't functioning well as a result of in typical industrial applications, several things is also happening associate degreed what a designer has had in mind at the time of fabricating or coming up with the instrumentality won't be really what an operator of the instrumentality introduces into the instrumentality at the time of operation, perhaps once 5 years or 10 years changes might need taken place in between; and in such a case, the presentation of the instrumentality won't be up to the quality and you'd wish to modify it in such some way that you just will restore performance. So, the question is then, what this can managed to the autumn within the performance associate degreed what quite measures we are able to build while not creating an overall adjustment within the finish of apparatus. Is it potential to urge improved performance from the equipment? Is it potential to extend the productivity? If you wish to appear on of these analysis, then procedure fluid dynamics is employed.

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III. METHODOLOGY

Design procedure of Internal Blossom Shaped Fins

The procedure for solving the problem is

- Modeling of the geometry.
- Meshing of the domain.
- Defining the input parameters.
- Simulation of domain.

Finite volume analysis of Internal Blossom Shaped Fins.

Analysis Type- Fluent.

Preprocessing

Preprocessing include CAD model, meshing and defining boundary conditions.

IV. CONCLUSION

The aim of this analysis is the detailed examination of the flow and heat behavior of tubes with different fins. The use of internal fins is studied and compared with the reference case of the empty tube. The analysis is carried out for different inlet fluid temperatures and different mass flow rates to study the system under different operating conditions.

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