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Experimental Study of Heat Transfer Enhancement for Hot Water with Finned Surface Tube Heat Exchanger in Laminar Regime

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Abstract – *The objective of this paper is to study of heat transfer enhancement with a finned surface tube heat exchanger. In this experiment the heat exchanger tubes are separated by using a finned surface which decreases the loss of heat between two fluids. In the study of heat transfer, 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. Here I used Ansys CFD to determine the heat distribution in Heat Exchanger.*

***Key Words*: Finned surface, Conduction, Convection, Radiation, Heat exchanger, Ansys CFD.**

1. INTRODUCTION

In our study the inner tube in the heat exchanger is surrounded by a finned surface to increase the heat transfer rate. So when there is a flow of hot fluid inside the inner tube of heat exchanger and covered by a finned surface it increase heat transfer rate.

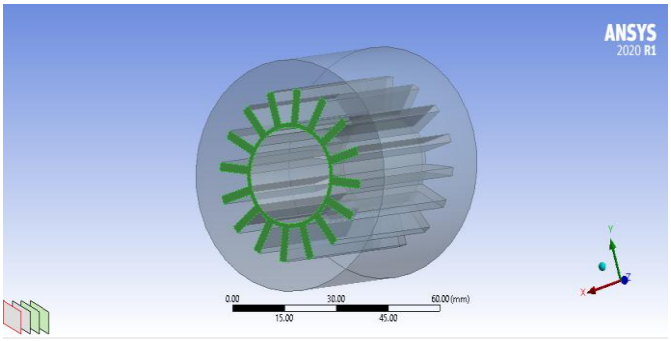

Fig 1 : Finned surface between two fluid domains

1.1 Modeling

The modeling of the heat exchanger is done using Ansys Design Modular.

The heat exchanger is built with a length of 200mm.The heat exchanger internal tube diameter is of 23mm and external diameter is of 55mm.The finned plate of 2mm thickness is place above the inner tube.The finned surface is carried along the length of heat exchanger with a width of 2mm and thickness of 8.5mm.

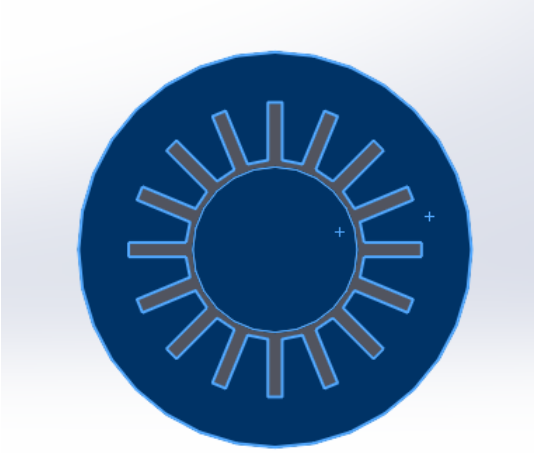

Fig 2 : Front view of heat exchanger

1.2 Analysis

The analysis of heat loss is calculated in heat exchanger between Hot water(H2O) and Fuel-oil liquid(c19h30<l>).The temperature of water is 400K and Fuel-oil liquid is 300K.The outer fuel-oil flows opposite to inner hot water. The inlet velocity of fuel-oil and water is 0.001m/s.

The Finned surface is made of Aluminium with density 2719 kg/m3.

The meshed surface of the heat exchanger is shown below

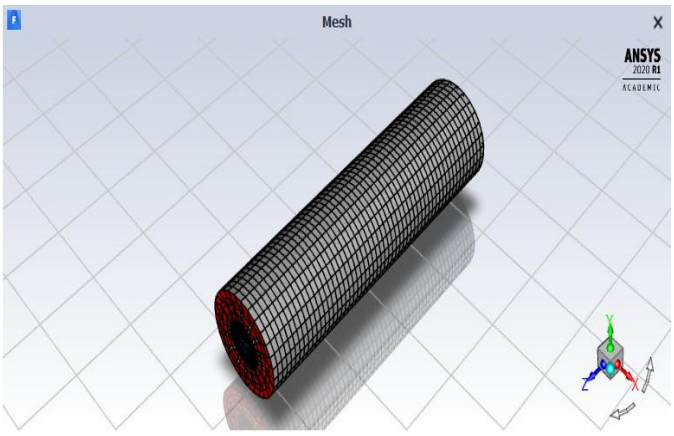

Fig 3 : Meshed Heat exchanger

2. Analysis Results

Below shown are the temperature distribution results of the heat exchanger.

The left side column shows the values of temperature at different zones along the heat exchanger.

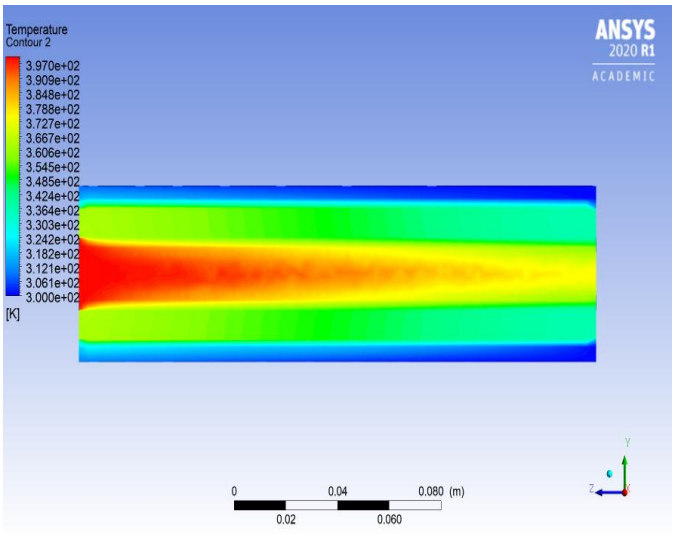

Fig 4 : Sectional Temperature contour along the center of Heat exchanger

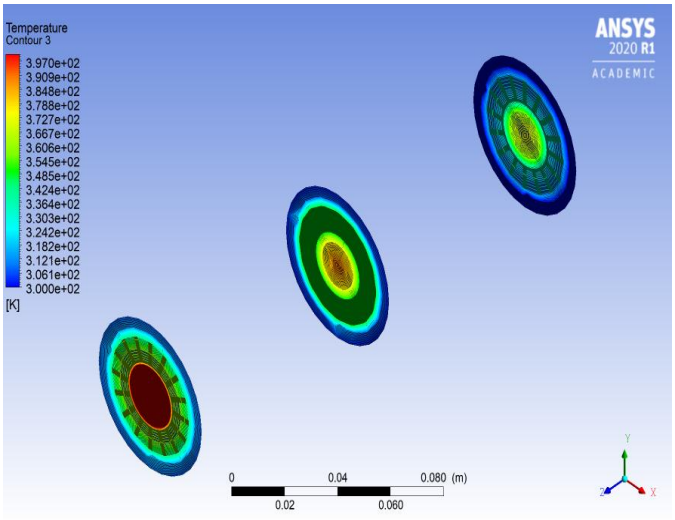

Fig 5 : Temperature distribution across the heat exchanger at different zones.

From the above analysis we can say that the heat loss is low due to the presence of fins.

The stream flow along the heat exchanger is shown below.

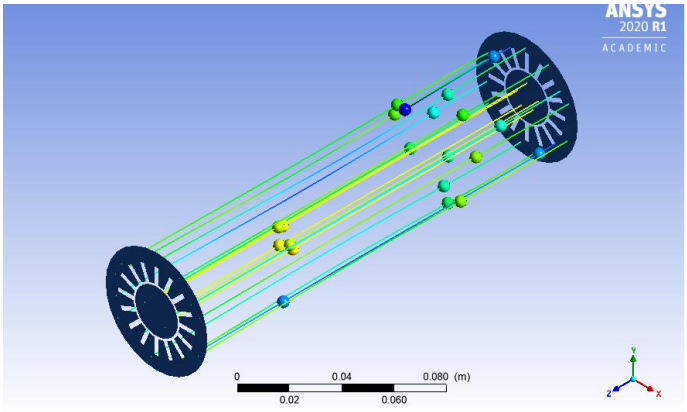

Fig 6 : Stream flow along the Heat exchanger

The graphical representation of temperature across the Heat exchanger is shown below.

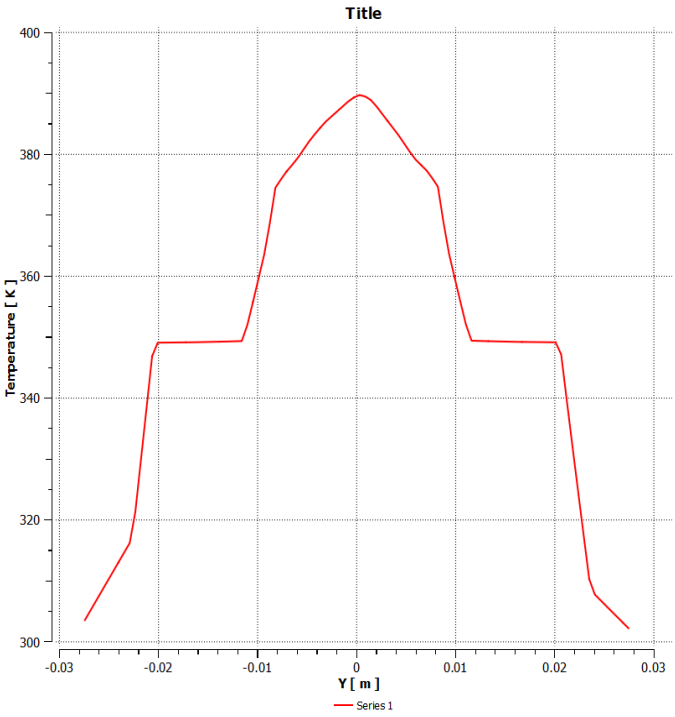

Chart 1 : Temperature vs Y axis

The above chart shows that that the temperature as reaching the outer surface it is decreasing gradually and maximum at the center of inner tube.

3.1 Advantage

The main advantage is we can increase the heat transfer rate using fines surface.

3.2 Disadvantage

The disadvantage is that design and manufacture of there kind of heat exchanger is complicated.

4. Conclusion

So from our analysis we can conclude that the heat transfer rate can be increased in an heat exchanger by using fin surface as the medium.

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