Issue 1 vol 4 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERINGAPPLICATIONS AND TECHNOLOGY

TITLE

MODELLING & ANALYSIS OF DIFFERENT GEOMENTRY OF STRIPS A REVIEW

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Abstract

The heat transfer enhancement is very important many engineering and other applications to increase the performance of heat exchangers. There are two type of technique i.e. active and passive technique. In active techniques external power like surface vibrations and electrical fields etc and the passive techniques are those which does not required any external power but the inserts are required to disturb the flow like geomentry inserts etc. literature survey says passive techniques gives more heat transfer rate without external power requirement by keeping different geomentry inserts. CFD tool is very important and effective tool to understanding heat transfer applications. Computational heat transfer flow modelling is one of the great challenge. By incorporating the inserts the heat transfer enhancement is increased due to its importance in different applications.

Index Terms: Heat transfer, parallel flow heat exchanger, CFD Analysis, Passive technique, Reynolds no.Twisted strip insert.

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1. INTRODUCTION

In this paper we have study the modelling of different geometry of strips to increase convective heat transfer coefficient and it's CFD ANALYSIS. Heat exchanger is equipment built for efficient heat transfer from one medium to other. Condensers, evaporators, boilers condetionation heat pump and refrigeration etc. are different applications of heat exchanger. In automobile Heat exchanger is used as radiators and coolers. It is also use in chemical and process industries. We will consider only the more common types here for discussing some analysis and design methodologies. In industrial and engineering applications heat exchangers are mostly used .CFD is the use of computer-based simulation to analyze systems involving fluid flow, heat transfer. A numerical model is first constructed using a set of mathematical equations that describe the flow. These equations are then solved using a computer programme in order to obtain the flow variables throughout the flow domain. Since the advent of the digital computer, CFD has received extensive attention and has been extremely used to study various aspects of fluid dynamics. For development and application of CFD have undergone considerable growth, and as a result it has become a powerful tool in the design and analysis of engineering and different processes. In the early computers became sufficiently powerful for general-purpose CFD software to become available.

Plain Twisted Strip

Behabadi et al. experimental investigated the heat transfer coefficients and pressure drop during condensation of HFC-134a in a horizontal tube fitted with TT. The refrigerant flows in the inner copper and the cooling water flows in annulus.

Also empirical correlations were developed to predict smooth tube and swirl flow pressure drop.

Sharma and shyam sundam investigated the thermo physical properties like thermal conductivity and viscosity of Al_2O_3 nanofluid is determined through the experiments at different volume concentrations and temperatures. From the result it is observed that, heat transfer coefficients and 'f' is higher when compared to water in a plain tube. Also a generalized regression equation is developed with the experimental data for the estimation of 'f' and 'Nu'.

Modified Geometry Twisted Strip

Wei Liu Et al.investigated numerically the HTE and 'f' is the characteristics of laminar flow in a tube with short-width and CCT. It's given that CCT is good technique in lamina flow and the heat transfer can be enhanced with a change in central clearance ratio.

Wongcharee and Eiamsa-ard. experimentally investigated HTE, 'f' and 'g' characteristics of CuO/water nanofluid and modified 'TA'. The use of nanofluid with the TA provides considerably higher 'Nu' and 'g' than that of nanofluid with the PTT.

Murugesan et al. investigated experimentally the 'HTE', 'f' and 'g' characteristics of tube fitted with the VTT. From the results show that the mean Nusselt number and the mean 'f' in the tube with 'VTT' increases with in decrease 'y

215% was found with use of double helical strip inserts with helix angle 9* at high Reynolds number. It was also shown that, as the inserts widths increased, the heat transfer characteristics improved.

Modelling and analysis

Using CATIA V5 software heat exchanger is modelled. It is an assembly of all the parts. A concentric tube heat exchanger (with twisted strip), heat exchanger (without any inserting twisted strip) is modelled according to the dimensions of practically available heat exchanger. Heat exchanger with twisted strip.

Fig.1 Heat exchanger with twisted strip

Specifications of Heat exchanger

Outer diameter of the outer tube	: 35mm
Inner diameter of the outer tube	: 30mm
Outer diameter of the inner tube	: 22mm
Inner diameter of the outer tube	: 17mm
Length of the heat exchanger	: 300mm

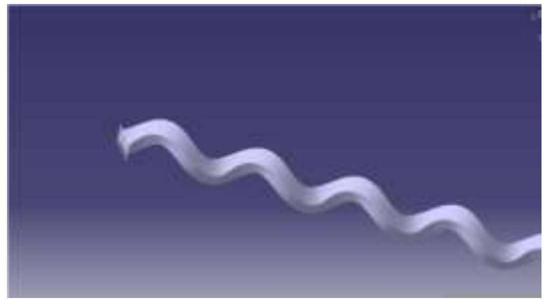

Fig.2 Twisted Strip

Specification of Twisted Strip

Length of the twisted strip	: 300mm
Pitch of the twisted strip	: 35mm
Cross section of twisted strip	: rectangular (6*4)

Heat exchanger without twisted strip

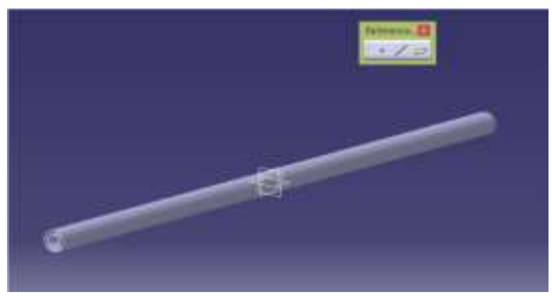

Fig.3 Heat exchanger without twisted strip

Specifications Heat exchanger

Outer diameter of the outer tube	: 35mm
Inner diameter of the outer tube	: 30mm
Outer diameter of the inner tube	: 22mm
Inner diameter of the outer tube	: 17mm
Length of the heat exchanger	: 300mm

Meshing

The designed heat exchanger is imported into the ANSYS Worktable.by using mesh module it is meshed. Meshing is done as discussed in the previous units. In this regard 3D amorphous meshing is used to mesh the object. The following figure shows the meshing parts.

ISSN: 2321-8134

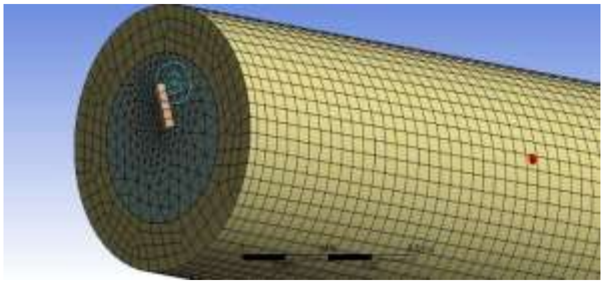

Fig.4 Meshed heat exchanger with twisted Strip

Analysis

After the completion of meshing process the design is opened in ANSYS Fluent. In fluent boundary conditions are given as per requirement and the solution is initialized and calculations are repeated. After the calculation is converged the contours are to be plotted.

Boundary conditions:

Fluid domain is to be specified
Temperature
At inlet
Hot fluid – water (335k)

Cold fluid – water (300k) at normal pressure

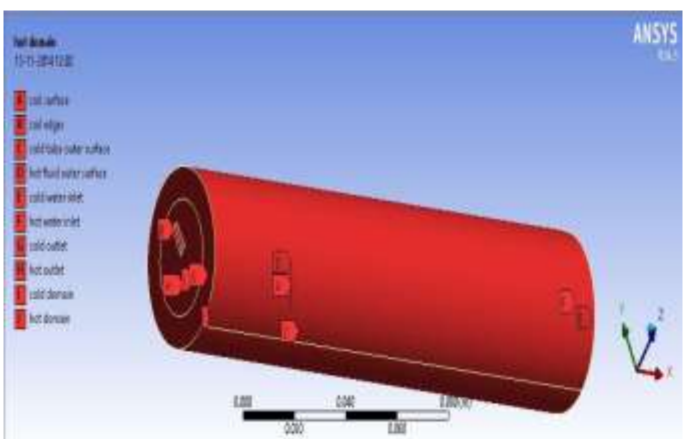

Fig.5 Boundaries of the heat exchanger

In the analysis report the mainly Reynolds number, pressure, velocity, temperature contour to be viewed.

Boundary specifications

Coil surface	: wall
Coil edges	: wall
Cold tube outer surface	: wall
Hot tube outer surface	: wall
Cold water inlet	: velocity inlet
Hot water inlet	: velocity inlet
Cold water outlet	: pressure outlet
Hot war outlet	: pressure outlet
Cold domain	: mass flow
Hot domain	: mass flow

Reynolds number variation

Heat exchanger with twisted Strip

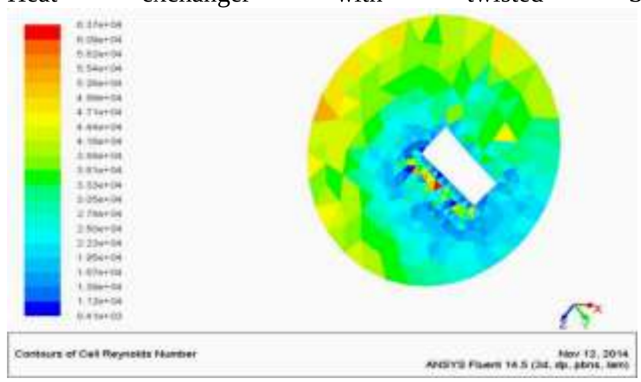

Fig.6 Reynolds number at inlet in heat exchanger with twisted Strip

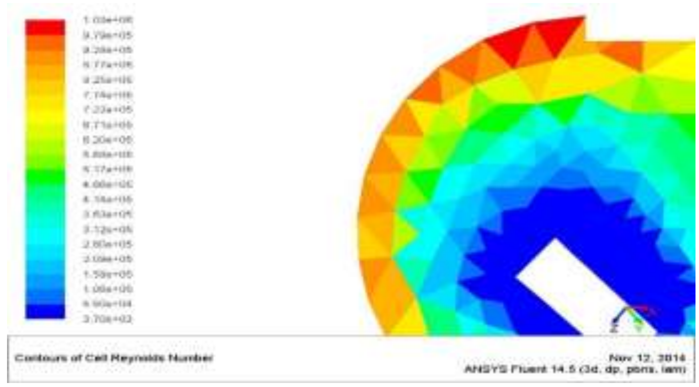

Fig.7 Reynolds number at out in heat exchanger with twisted Strip

In the above figures we can conclude that the Reynolds number is increasing from inlet to the outlet of the heat exchanger. This is because of the reason that, during the flow of fluid over the twisted Strips a disturbance is created in the flow, thus turbulence is created .This results in the increase of the Reynolds number.

Heat exchanger without twisted Strip

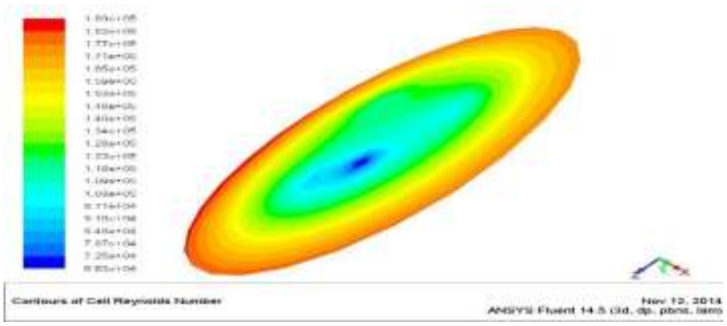

Fig.8.Reynolds number at inlet in heat exchanger without twisted Strip

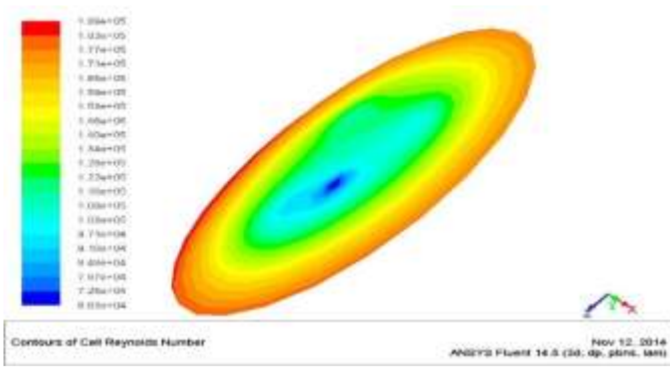

Fig.9 Reynolds number at outlet in heat exchanger without twisted Strip

Above fig. shows the Reynolds number of the hot fluid at the inlet and outlet of the heat exchanger. We observe that there is not much difference in the values, they remain almost constant. This is due to no turbulance in the flow.

Conclusion

CFD analysis is carried out by taking double pipe heat exchanger with cold and hot fluids with different edge conditions by incorporating helical Strip inserts .It can be decided as follows: By using (allowing something to happen without reacting or trying to stop it) ways of doing things that is by inserting helical Strip inserts the heat move from one place to another improvement increased by 10-15% with the cost of economical allowable pressure drop .In this report we achieved enhancement of heat transfer effectively.

Future work may be extended to:

- Material should be changed to Aluminium to copper or which is having high thermal ability to electicity flow
- Material Combination ways of doing things may be used to improvement of heat transfer coefficient by compound techniques.
- Reduce the width of helical Strip inserts with low Reynolds number.
- By changing low Reynolds numbers check the Heat transfer enhancement coefficient

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