ISSN: 2277-5528
Impact Factor: 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

FINITE ELEMENT ANALYSIS OF SHELL AND TUBE HEAT EXCHANGER WITH AND WITHOUT BAFFLES.

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ABSTRACT

In current days, Shell and Tube Heat Exchanger is the most well-known type heat exchanger generally utilized as a part of oil refinery and other substantial synthetic procedure, in view of its higher Heat Transfer capacity. In this research paper on the effect of baffles in pressure, and temperature and comparatively analysis without baffles in which thermal constraints are apply and not it.CFD is an option strategy which expends less time and gives fast solution.CFD is additionally fetched capability since it has disposed of the need of model for the advancement of (CFD) models. The motivation behind the project is to do CFD investigation of a single shell and single tube heat exchanger and deciding the effect of baffle on pressure and temperature heat exchange utilizing finite element method. So endeavors were made to analyze the impacts of baffle on the heat exchange attributes of a shell-and-tube heat exchanger.

INTRODUCTION

Heat exchangers are devices that facilitate the exchange of heat between two fluids that are at different temperatures while keeping them from mixing with each other. This device used to transfer heat between two or more fluids that are at different temperatures and which in most of the cases they are separated by a solid wall. Heat exchangers are used in power plants, nuclear reactors, refrigeration and air conditioning systems, automotive industries, heat recovery systems, chemical processing, and food industries. Different heat exchangers are named according to their applications. For example, heat exchangers being used to condense are known as condensers; similarly heat exchangers for boiling purposes are called boilers. Shell and tube heat exchangers (STHXs) have been most widely used equipment in the industrial fields including: petroleum refining, power plant, steam generation etc. Performance and efficiency of heat exchangers are measured through the amount of heat transferred using least area of heat transfer. Baffle Angle, Number of Baffle, Baffle Spacing, Tube Diameter and Number of Tubes These are the main factors affecting heat transfer of Heat exchanger. The optimization of shell-and-tube heat exchangers requires a good knowledge of the local and average shell-side heat transfer coefficients which is complicated by a shell diameter, baffle angle, baffle spacing, tube diameter, pitch, arrangement.

SOFTWARE ANALYSIS

In this perusing, a little heat exchanger is chosen with a specific end goal to build the model detail and to mention strong objective facts about the stream inside the shell. The material of the shell and tube is Mild Steel with a heatconductivity .

CFD Calculations

CFD is a complicated computationally-based design and analysis technique. CFD software gives you the power to simulate flows of gasses and liquids, heats and mass transfer, moving bodies, multiphase physics, chemical reaction, fluid- structure interaction and acoustics during computer modeling. This software can also build a virtual prototype of the system or device earlier than can be apply to real-world physics and chemistry to the model and the software will provide with images and data, which forecast the performance of thatdesign.

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CASE I (Without Thermal Constraints)(Without Baffles)Velocity in X Direction: 10 m/s and -10 m/s

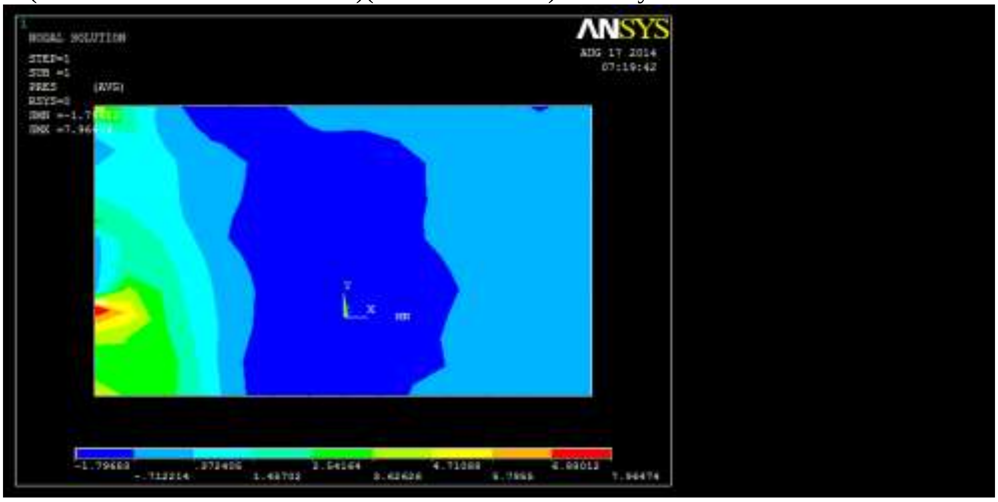

Fig.1. Pressure Profile

CASE II (Without Thermal Constraints) (With 6 Baffles)Velocity in X Direction: 10 m/s and -10 m/s

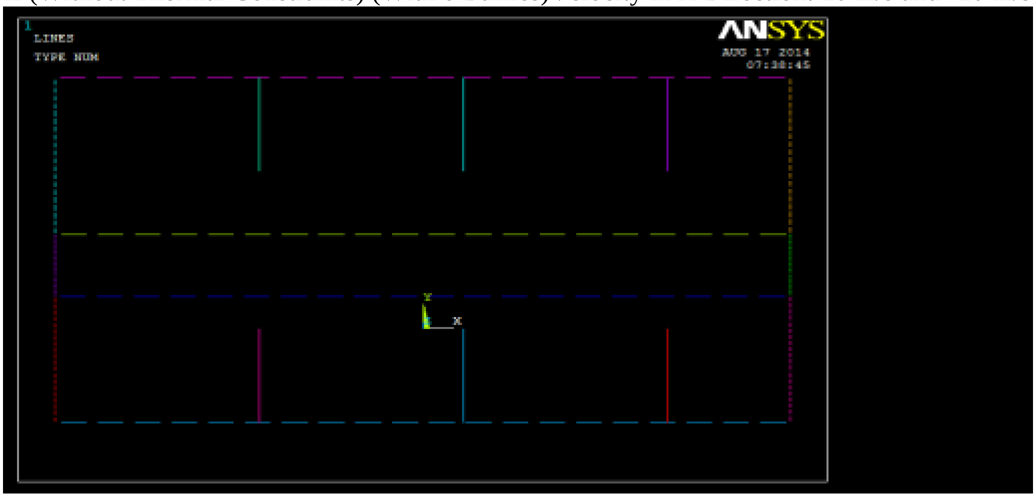

Fig.2.Heat Exchanger

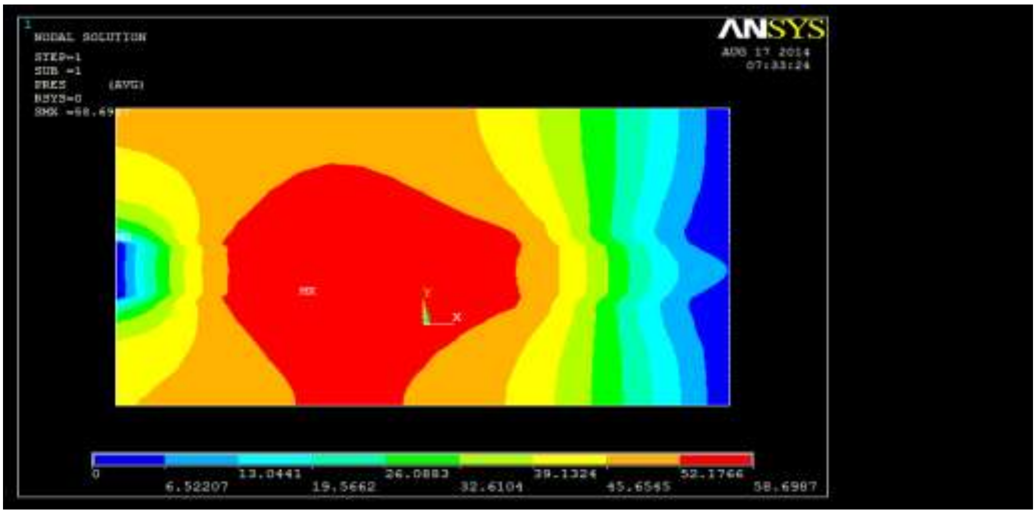

Fig.3.Pressure Profile

CASE III (With Thermal Constraints)(Without Baffles)Velocity in X Direction: 10 m/s and -10 m/s.
Inlet Fluid Temp: 100 ^{0}C
Outlet Fluid Temp: 500 ^{0}C

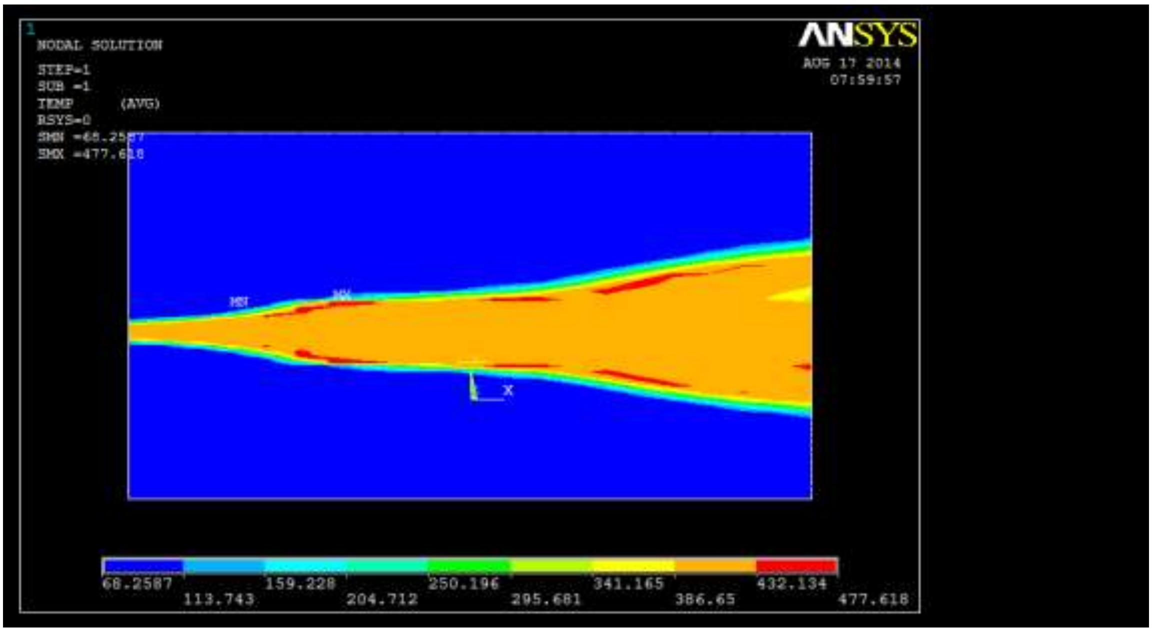

Fig.4.Temperature Profile

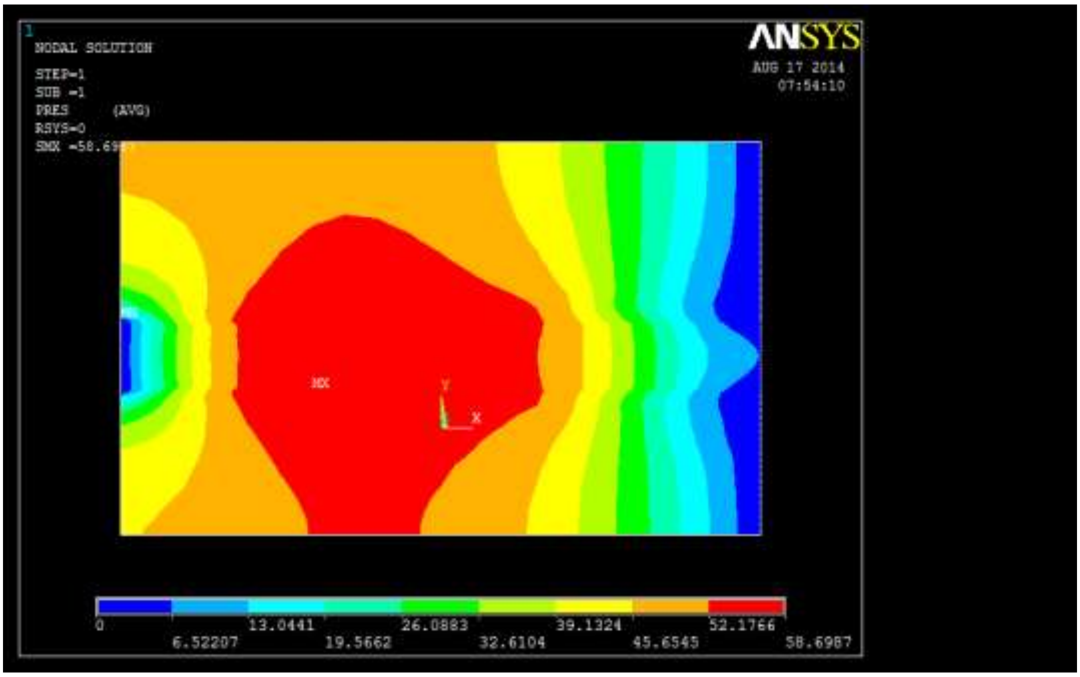

Fig.5.Pressure Profile

CASE IV (With Thermal Constraints)(With Baffles)Velocity in X Direction: 10 m/s and -10 m/s
Inlet Fluid Temp: 100 ^{0}C
Outlet Fluid Temp: 500 ^{0}C

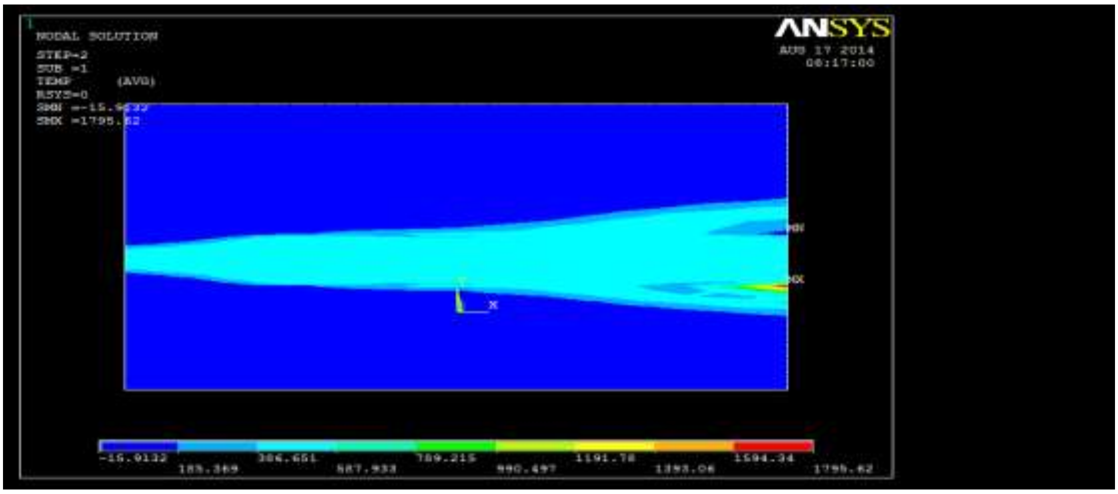

Fig.6.Temperature Profile

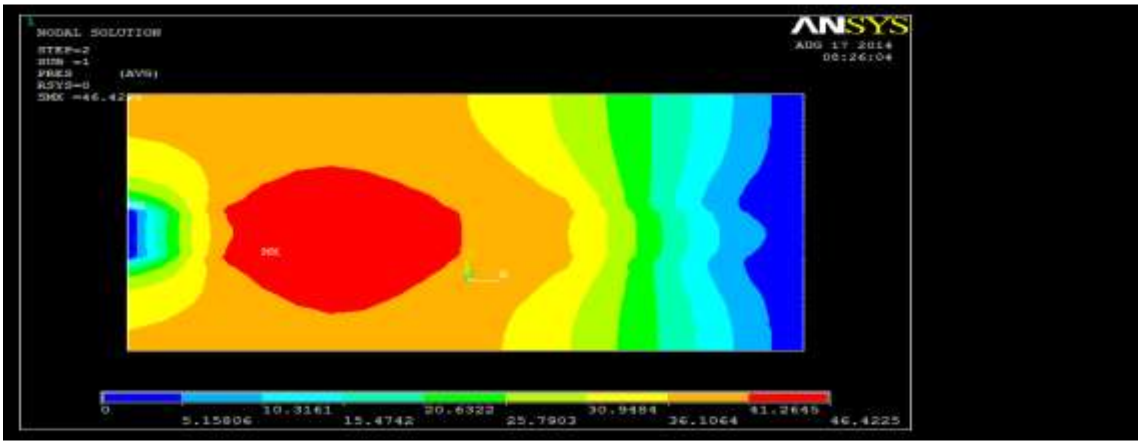

Fig.7.Pressure Profile

Table 1. Summary of CFD Analysis in Pressure & Temperature

S.No.	Case	Minimum Pressure (Pascal)	Maximum Pressure (Pascal)	Minimum Temperature (^{0}C)	Maximum Temperature (^{0}C)
1.	Without thermal constraints without baffles	1.79	7.96	-	-
2.	Without thermal constraints with six baffles	0	58.69	-	-
3.	With thermal constraints without baffles	0	58.69	68.258	477.6
4.	With thermal constraints with seven baffles	0	46.42	15.91	1795.62

RESULTS & DISCUSSION

In given this table the effect of baffles in pressure and temperature are shown it. The pressure are drop it we can used in thermal constraints with baffles as compared to without baffles & these effect the heat transfer coefficient increases in pressure drop. Next step in these result also find the effect of temperature in shell and tube heat exchanger using baffles with and without thermal constraints & these effects show the increases the heat transfer coefficient then increases the temperature.

CONCLUSION

Recent years, heat exchanger is often used for the request of knowledge. But the relevant design is not providedby the actual standards. This work presents the improvements to the Kern method for the shell and tube heat exchanger. It is found that among the all method, the Kern technique gave a straightforward strategy to calculate heat transfer coefficient. By this experimentation it is clear that heat transfer coefficient and different heat parameters can be calculated and analyzed up to higher accuracy as compared to the other methods. After this project it is to be said that the shell and tube heat exchanger has been given the considerable respect among all the classes of heat exchanger because of their more like relatively huge proportions of heat exchange region to volume and weight and some more. In addition very much outlined techniques are accessible for its planning and examination.

From the above analysis we have found that when the baffles are present the pressure drop is more than in the case when there are no baffles. Also the heat transfer is more in case when the baffles are present. This is evident from the thermal plots of both the cases of heat exchanger with baffles and without baffles. A higher temperature difference is attained in the case when the baffles are present. The results are validated with experimental results. Analysis is done on the basis of theoretical calculation as well as CFD calculations. Baffles are present in tube the heat transfer coefficient is increases as compared to without baffles. These following conclusions are drawn from the present study:-
(a) From the theoretical analysis it was found that the heat transfer coefficient is more in case of using baffles as compared to without baffles,
(b) From this CFD analysis results were found in similar pattern to increases temperature and decreases pressure drop then using in baffles as compared to without baffles.

FUTURE SCOPE

Computational Fluid Dynamics is now an established industrial design tool, offering obvious advantages. In this study, a full 360° CFD model of shell and tube heat exchanger is considered. By modeling the geometry as accurately as possible, the flow structure and the temperature distribution inside the shell are obtained. With the help of CFD, the effect of baffles with and without thermal constraints was obtained successfully. So it was realized that analysis can be increased more by considering the Corrosion impact on Heat Transfer.CFD is still a developing art in prediction of erosion/ corrosion due to lack of suitable mathematical models to represent physical process. New flow modeling strategies can be developed for corrosion simulation in shell and tube heat exchanger.
In these project we can use in baffles at different inclination positions and find the effect of these condition in same heat exchanger in CFD and theoretical analysis.

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