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Numerical Analysis of Shell and Tube Heat Exchanger with Square Cut Baffle in Segmental Double Segmental and Helical Baffle

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A B S T R A C T

A heat exchanger is a heat transfer device that transfers heat between two or more connecting fluids. For usage in steam power plants, designed planning plants, building warmth and cooling structures, transportation power systems, and refrigeration units, various types of heat exchangers have been developed. The heat exchanger is intended to give the necessary measure of thermal energy required for one or the other heating or cooling a liquid stream all the while. The steady heat move is significant for the determination of a specific sort of heat exchanger for assessment of shell and cylinder heat exchanger, thermal execution and pressure drop are considered as main considerations. Both thermal execution and pressure drop are reliant upon the way of liquid stream and sorts of baffles in various directions individually. Increasing the complexity of baffles improves heat transfer while also causing higher pressure drop, implying that additional siphoning power is required. This diminishes the framework proficiency. This shows the impact of baffle on pressure drop in shell and cylinder heat exchanger. Segmental baffle show the arrangement of dead zones where heat move can't occur adequately. Double segmental baffles diminish the vibrational harm when contrasted with segmental baffle. The utilization of helical baffle shows a reduction in pressure drop because of the end of dead zones. The less free space brings about good movement of fluid. Smaller siphoning power is a result of the lower pressure drop, which increases overall framework proficiency. The near outcomes show that helical baffle is more worthwhile when compared with double segmental and helical.

Keywords: Job Satisfaction, Sustainable Development, Policy For Higher Education

1. INTRODUCTION

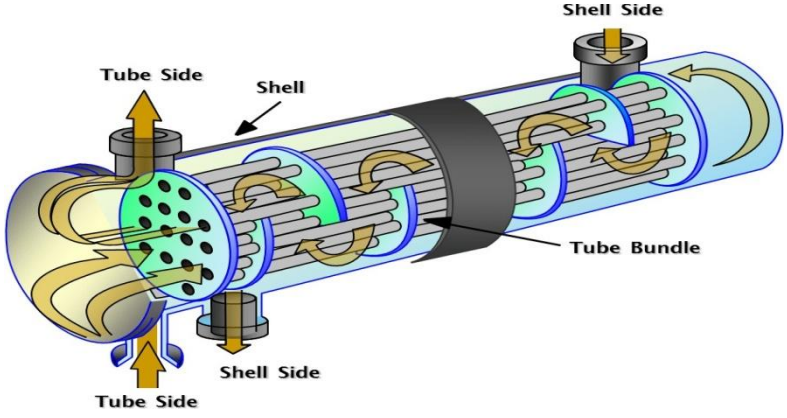

Figure 1 Shell and tube heat exchanger

This is a structure that transfers heat between two fluids. Warmth exchangers are used for both cooling and heating. To preventmixing, the fluids may be separated by a solid separator, or they may be in direct touch. They're widely employed in space heating, refrigeration, and cooling, as well as

power plants,engineering plants, petrochemical facilities, petroleum preparation plants,combustible gas handling, and sewage treatment. An interior consuming engine has a noteworthy delineation of a warmth device in which a flowing fluid known as engine coolant travels via radiator twists and wind flows past the circles, cooling the coolant and warming the moving toward air

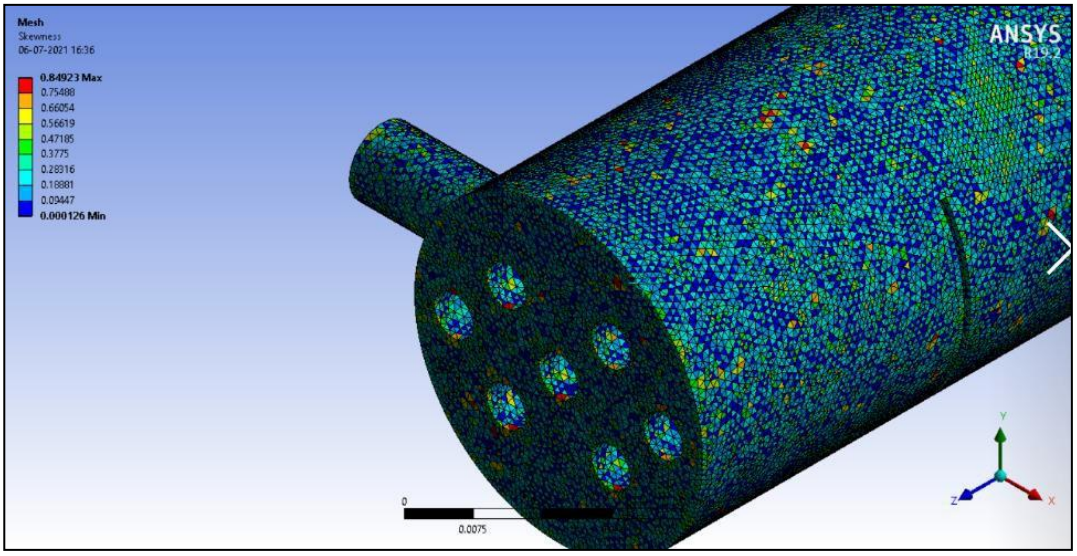

FIGURE 2.7 Tetrahedral mesh

The element size of 0.00082 is maintained and number of nodes and elements are kept for average skewness and average orthogonal quality and for medium smoothing and element quality is also considered.

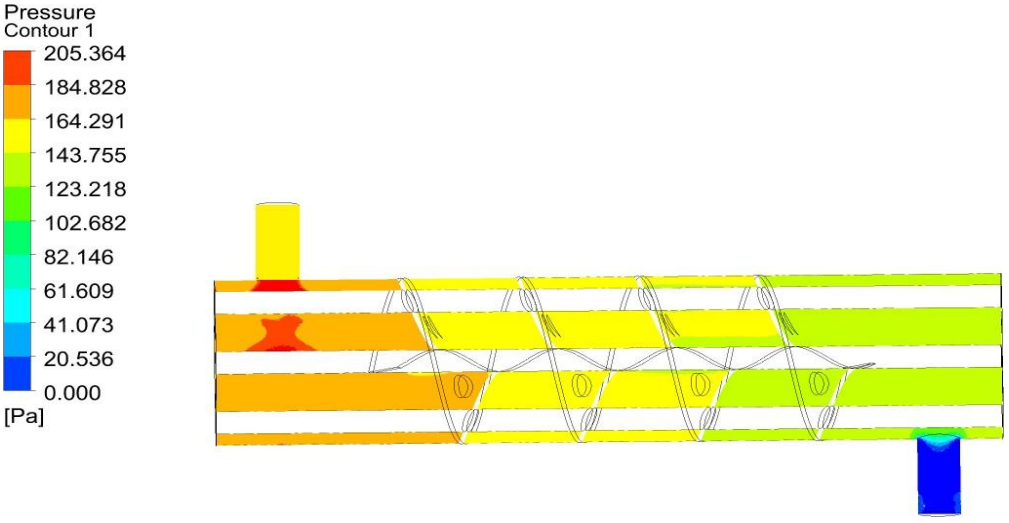

FIGURE2. 13 Validated helical baffle

Figure 2.13 is the validated model with the pressure contours of helical having continuous baffle for mass flow rate of 0.032kg/s inlet pressure is seen as 155 Pa and outlet pressure is 0 Pa considered for shell side flow with working fluid as water and 500-1000 iterations for different mass flow rates and in this fluid follow continuous and proper mixing offluidtakesplacefollowingcircularmovementbutvibrationiseliminatedcomparedwithotherbaffle anddeadzone isalso eliminated and pressure decreases which requires lesspump work and efficiency is increased

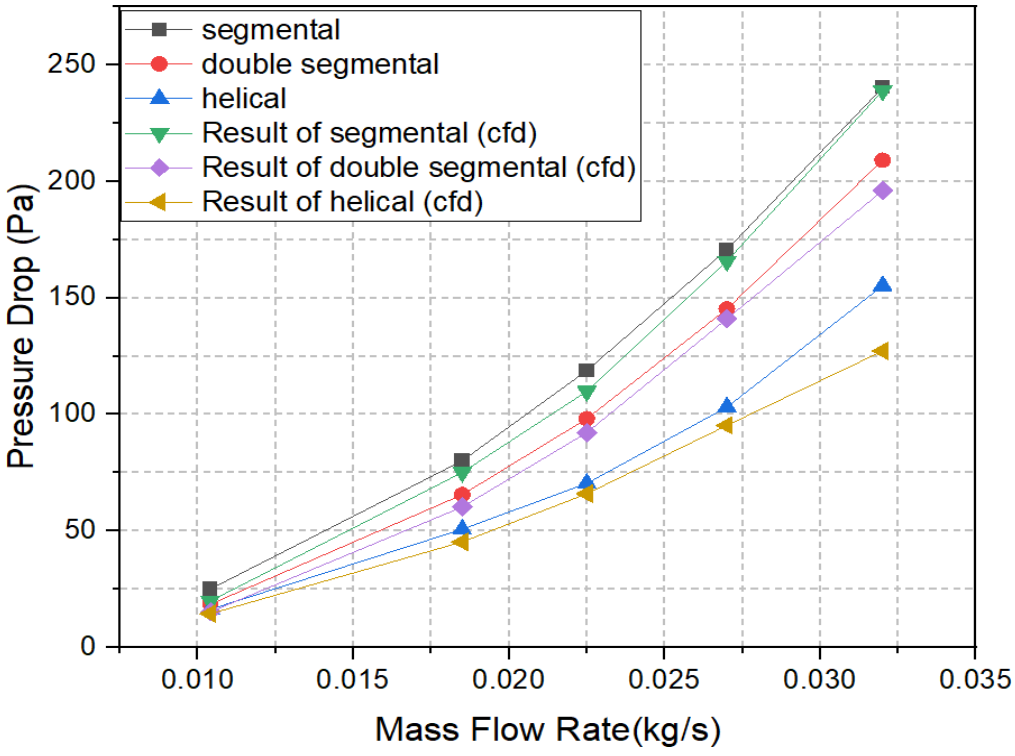

FIGURE2.14 Shell side pressure drop vs Mass flow rate

2. LITERATUTR REVIEW

The subject of baffle in shell and tube heat exchanger has a wide assortment of cycles. Countless works has been distributed in regards to which portrays different variables influencing the thermal productivity of the shell and tube heat exchanger. Based on that a concise rundown is investigated as follows

- Serna et.al [1] Development of framework with the thoughts of Serna and Jimenez, appropriately have acquainted a negligible definition with relate The film coefficient and the shell-side tension decrease were both subjected to the full Bell Delaware procedure. In any event, to ensure amore modest enunciation on the shell side, they have developed a lower tension drop condition for the cylinder side stream, which handles both straight strain drops and the return of adversities. They've demonstrated how little details can be incorporated into a reasonable arrangement estimation. They have devised a strategy for carrying out the recommended estimations over the complete mathematical scope of a single stage, as well as the necessary framework.

- Lei, Yong-Gang, et.al[2].the consequences of bewilder propensity point on liquid stream and warmth movement with helical confound, where the helical astound is disengaged into internal and exterior sections along the twisting heading of the shell. While both the inner and outer helical bewilders reliably, effectively, and delicately puzzle the stream and direct it in a helical style to increase heat transfer rate and reduce pressure drop and impact vibrations, the outside helical bewilder is easier to create due to its relatively large internal edge estimation.

- Lutcha, J et.al [3] they development frameworks should apply helical confounding for assessing the stream field plans created by various helix foci, which is required to rot stress at the shell side and measure heat transfer through and through.

3. OBJECTIVE

- Create a 3D model of the Combustion chamber outer case using catia v5 software and it is converted into para solid file and import into ANSYS to do finite element analysis
- Perform thermal analysis on the Combustion chamber outer case for thermal loads.
- Perform static analysis on the existing model of the Combustion chamber outer case for pressure loads and thermal loads to find deflections and stress, optimized if enquired.

- Dynamic analysis to find six modes and natural frequency, From the Modal analysis results, the natural frequencies, mode shapes and their mass participations of the
- Combustion chamber outer case are plotted and checked if any natural frequencies are present in the operating range of the Combustion chamber router case and critical frequencies are identified.
- Life estimation of outer casing of aircraft turbo engine

4. RESEARCH METHODOLOGY

The scope of this study is to create a 3D model of the combustion chamber outer case and use finite element analysis to analyze the structural, dynamic, and thermal behavior of the Combustion chamber outer case. CATIA V5 3D modelling software following was used for modelling, and ANSYS software was used for analysis

. • The CATIA V5 software is used to create a 3D model of the combustion chamber outer casing, which is then converted into a parasolid file and imported into ANSYS for finite element analysis.

• For thermal loads, perform a thermal analysis on the Combustion chamber outer case.

• Perform a static analysis for pressure and thermal loads on the model of the Combustion chamber outer case to identify deflections and stress

• Perform a modal analysis to find natural frequencies.

• The natural frequencies, mode shapes of the Combustion chamber outer case are plotted using the Modal analysis results, and critical frequencies are determined if any natural frequencies are present in the working range of the Combustion chamber outer case.

• Material selected as TMS-196 the range of temperature with stand 400 to 11000C and have ultimate tensile strength is 1195MPa

5. FINITE ELEMENT ANALYSIS (FEA)

The finite element method is a powerful tool to obtain the numerical solution of wide range of engineering problem. The method is general enough to handle any complex shape or geometry, for any material under different boundary and loading conditions. The generality of the finite element method fits the analysis requirement of today's complex engineering systems and designs where closed form solutions of governing equilibrium equations are usually not available. In addition, it is an efficient design tool by which designers can perform parametric design studies by considering various design cases, (different shapes, materials, loads, etc.) and analyze them to choose the optimum design. The method originated in the aerospace industry as a tool to study stress in a complex airframe structures. It grows out of what was called the matrix analysis method used in aircraft design. The method has gained increased popularity among both researchers and practitioners. The basic concept of finite element method is that a body or structure may be divided into small elements of finite dimensions called "finite elements". The original body or the structure is then considered, as an assemblage of these elements connected at a finite number of joints called nodes or nodal points. Applications of FEM:

The finite element method was developed originally for the analysis of aircraft structures. However, the general nature of its theory makes it applicable to wide variety of boundary value problem in engineering. A boundary value problem is one in which a solution is sought in domain or region of a body subject to the satisfaction of prescribed boundary conditions. Finite element method is the best tool in investigation of aircraft structures involving static analysis of wings, structures of rockets and missiles, dynamic analysis, response to random loads and periodic loads. In mechanical design, stress concentration problems, stress analysis of pressure vessels, dynamic analysis of mechanical linkages can be effectively dealt using finite element method. The specific application of the finite element method in the three major categories of boundary value problems, namely equilibrium of steady state or time independent problems, Eigen value problems, and propagation or transient problems. In the equilibrium problems steady state displacement or stress distribution is found for a solid mechanics problem, temperature or heat flux distribution in the case of heat transfer problem. Referring to Eigen value problems in solid mechanics or structural problem, natural frequencies, buckling loads and mode shapes are found, stability of laminar flows is found if it is a fluid mechanics problem and resonance characteristics are obtained if it is an electrical circuit problem, while for the propagation or transient problem, the response of the body under time varying force is found in the area of solid mechanics. Finite element method finds its application in the field of civil engineering in carrying out the static analysis of trusses, frames and bridges. The dynamic analysis of the structure is to obtain natural frequencies, modes and response of the structures to periodic loads. Nuclear engineering also uses finite element method concept in the static and dynamic characterization of its systems such as nuclear pressure vessels, containment structure and dynamic response of reactor component containment structures. Even the Biomedical engineering applies finite element method, for impact analysis of skulls. Finite element method can be applied to analysis of excavation,

Finite element Method based upon discritization of component into Finite number of blocks (elements), Finite element method (FEM) is a numerical technique for finding approximate solutions to boundary value problems for partial differential equations. It uses subdivision of a whole problem domain into simpler parts, called finite elements, and variational methods from the calculus of variations to solve the problem by minimizing an associated error function.

STEADY-STATE THERMAL ANALYSIS

Steady-state thermal analysis to determine temperatures, thermal gradients, heat flow rates, and heat fluxes in an object that are caused by thermal loads that do not vary over time. A steady-state thermal analysis calculates the effects of steady thermal loads on a system or component. Engineers often perform a steady-state analysis before performing a transient thermal analysis, to help establish initial conditions. A steady-state analysis also can be the last step of a transient thermal analysis, performed after all transient effects have diminished. A steady-state thermal analysis can be performed using the ANSYS

6. CONCLUSION

In the current audit numerical model is used to measure and take a gander at the shell side fluid execution of shell and cylinder heat exchanger. Numerical diversions are done on different puzzles for instance segmental, two fold segmental and helical astound which show the effect of confuse on pressure drop in shell and cylinder heat exchanger. Growing the quantity of puzzle past certain number gives real ramifications for pressure drop. So by changing the sorts of confound without hampering various estimations suggested that lone segmental bewilder show the most outrageous tension drop while it diminished when helical confuse are used. Single segmental perplex show the course of action of no man's lands where warmth move can't occur effectively. This issue is tended to by utilization of twofold segmental astound. It in like manner diminishes the vibrational mischief when stood out from single segmental confound. Regardless, the use of helical perplex over other two cuts down the strain drop which in this way fabricates the in everyday structure capability. So it is shown that helical confound are more gainfull than other two sorts of astounds.

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