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EXPERIMENT STUDY ON THERMAL TRANSPORT PHENOMENON OF NANOFUIDS AS WORKING FLUIDS IN HEAT EXCHANGER

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ABSTRACT:The Marnoch warm temperature engine (MHE) is a brand new shape of electricity generation device this is below studies and improvement at the University of Ontario Institute of Technology. In this thesis, the temporary warm temperature transfer behaviour of the deliver warm temperature exchanger of the Marnoch warmth engine is studied, and its operation for laminar and turbulent flows is modelled. In this thesis, super nano fluids combined with base fluid water are analyzed for their normal overall performance in the warm temperature exchanger. The nano fluids are magnesium oxide for 5 volume fractions 0.25, 0.35, zero. Forty five, 0.5 and zero. Sixty five Theoretical calculations are achieved determine the houses for nano fluids and people homes are used as inputs for assessment. 3d model of the warmth exchanger is finished in creo parametric software software. Cfd evaluation is achieved at the shell and tube warmth exchanger for all nano fluids and amount fraction and thermal evaluation is performed in ansys for two substances aluminum and copper.

Keywords : Nanofluids, nanoparticle , convective heat, transfer Nusselt number, zeta-potential

I INTRODUCTION

Heat exchangers are one of the usually used device in the way industries. Heat Exchangers are used to update warm temperature amongst method streams. One can recognize their utilization that any method which include cooling, heating, condensation, boiling or evaporation should require a warmth exchanger for the ones motive. Process fluids, usually are heated or cooled in advance than the approach or undergo a segment alternate. Different heat exchangers are named in keeping with their software program. For example, warmth exchangers getting used to condense are

known as condensers, further warmth exchanger for boiling capabilities are known as boilers. Performance and regular performance of heat exchangers are measured through the amount of heat transfer the use of least area of warmth transfer and pressure drop. A better presentation of its normal general average overall performance is completed via the use of calculating over all warmth switch coefficient. Pressure drop and vicinity required for a brilliant quantity of warmth switch, gives an perception about the capital rate and strength requirements (Running

charge) of a warm temperature exchanger. Usually, there is lots of literature and theories to format a warm temperature exchanger constant with the requirements.

Heat exchangers are of types:-Where each media among which warmth is exchanged are in direct contact with each different is Direct touch warm temperature exchanger, Where each media are separated through the use of the use of way of a wall thru which warmth is transferred sincerely so they in no manner aggregate, Indirect touch warm temperature exchanger.

TUBULAR HEAT EXCHANGERS

A tubular warm temperature exchanger can every encompass a smaller-diameter tube set up inner a bigger diameter tube (“double-pipe exchanger”, see Figure 1) or, extra normally, a tube bundle deal inner a shell (“shell-and-tube exchanger”, see Figure 1.1). Thus, warm temperature transfer surfaces are plain or higher tubes. Additionally, shell-and-tube heat exchangers can contain multiplepass tube bundles, i.E., for double-skip we’ve got got had been given a package deal deal of U-tubes, for triple-bypass the tubes inside the bundle bend instances, and plenty of others. Multiple-bypass shells are common as nicely. Baffles, every segmental or doughnut and disc ones, present inside the shell direct fluid go along with the waft in shell-aspect, useful resource the tubes, and restriction viable tube vibrations.



Figure 1 :Countercurrent double-pipe heat exchanger

Plate Heat Exchangers

In plate warmness exchangers fluids go with the glide alternately among stacked easy or pass-corrugatedPlates that may be sealed and held collectively in particular strategies. Either gasket are locatedNear the plate edges as tested in Figure .Three and the stack is held collectively thru way of a frame orThe plates are brazed or welded for this reason forming a unmarried element. Spiral warm temperature exchangers (seeFigure being fundamentally same, commonly encompass simplest coiled plates.

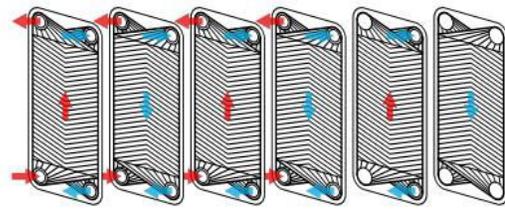


Figure 2 : Gasketed plates; drift commands of heat and cold fluids are marked through arrows.

II. LITERATURE SURVEY

L. B. Mapa , Sana Mazhar.,” warm temperature switch in mini warm temperature exchanger the use of nanofluids”, January 2005

Nanotechnology is involved with the materials and systems whose systems and additives exhibit novel and extensively superior physical, chemical, and natural houses, phenomena, and strategies due to their nanoscale duration. Workforce development is crucial to gain the advantages of nanotechnology improvement together with generation transfer. The emphasis want to be on hands-on educational critiques thru manner of the use of growing nano-tech laboratory demonstration experiments that could be adaptable and integrated into gift courses in

engineering and engineering generation. This paper describes a layout which have emerge as superior at Purdue University Calumet to demonstrate heat transfer the use of nano fluids in a mini warm temperature exchanger the use of commercially to be had system. Theoretical warm temperature transfer prices have been calculated using modern-day-day relationships in the literature for classic fluids and nano fluids. Experiments were executed to determine the real warmth switch expenses underneath operational conditions the usage of nanofluids and the warmth transfer enhancement determined in assessment to fluids without nanoparticles.

Ashish kadam, atul padalkar and s. Martínez-ballester “experimental take a look at on thermal shipping phenomenon of nanofluids as strolling fluid in warmness exchanger” march 2014

This paper dreams to have a take a look at the convective warmth switch conduct of aqueous suspensions of nanoparticles flowing through a horizontal tube heated beneath constant warmth flux state of affairs. Consideration is given to the outcomes of particle attention and Reynolds quantity on warm temperature switch enhancement and the opportunity of nanofluids due to the truth the jogging fluid in severa warm temperature exchangers. It is located that (i) large enhancement of heat switch common overall performance due to suspension of nanoparticles inside the round tube go together with the go with the waft is placed in evaluation with natural water because of the fact the running fluid, (ii) enhancement is intensified with an boom within the Reynolds range and the

nanoparticles consciousness, and (iii) outstanding amplification of heat transfer performance isn't attributed in easy terms to the enhancement of thermal conductivity because of suspension of nanoparticles.

III SOFTWARE USES

INTRODUCTION TO CAD

Computer-aided format (CAD) is the usage of pc structures (or workstations) to useful resource inside the creation, exchange, assessment, or optimization of a layout. CAD software program application is used to increase the productivity of the fashion designer, decorate the excellent of layout, decorate communications via documentation, and to create a database for production. CAD output is regularly inside the form of digital documents for print, machining, or certainly one of a kind production operations. The time period CADD (for Computer Aided Design and Drafting) is likewise used.

INTRODUCTION TO CREO

CREO is a one of the global's principal excessive-give up CAD/CAM/CAE software program software software program applications. CREO (Computer Aided Three dimensional Interactive Application) is a multi-platform PLM/CAD/CAM/CAE business software program software software software suite superior via Dassault Systems and advertised worldwide-vast thru IBM.CREO is written in the C++ programming language. CREO offers open improvement form via using interfaces, which may be used to customize or growth packages. The software application software program software program programming interfaces supported Visual Basic and C++

programming languages. Commonly known as 3-D Product Lifecycle Management (PLM) software application suite, CREO enables multiple tiers of product improvement. The degrees range from conceptualization, thru format (CAD) and production (CAM), till assessment (CAE). Each workbench of CREO V5 refers an each level of product improvement for specific merchandise. CREO V5 functions a parametric strong/ground-based definitely totally package deal which makes use of NURBS because the middle floor instance and has severa workbenches that provide KBE (Knowledge Based Engineering) aid.

The Different Modules in CREO

- Sketcher
- Part Design
- Assembly Design
- Drafting
- Sheet metal

3D MODEL OF HEAT EXCHANGER

- Tube outer dia. = 23 mm
- Tube inner dia. = 20 mm
- Number of tube = 9
- Shell inner dia. = 136 mm
- Shell outer dia. = 142 mm
- Number of baffles = 5
- Diameter of baffles = 136 mm
- Distance between baffles B = 300 mm

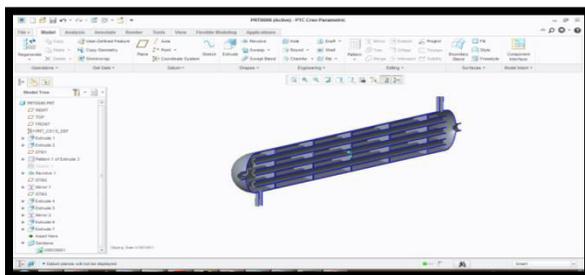


fig 3: 3d Model Of Heat Exchanger

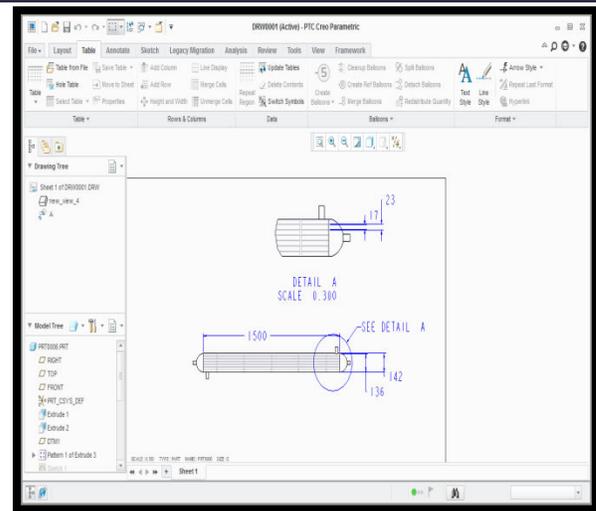


Fig 4: 2d Model Of Heat Exchange

INTRODUCTION TO ANSYS

ANSYS is famous-cause finite detail evaluation (FEA) software program software software software program package deal deal. Finite Element Analysis is a numerical method of deconstructing a complex system into very small portions (of purchaser-one in every of a type period) referred to as elements. The software program implements equations that govern the behaviour of these factors and solves they all; growing a comprehensive clarification of approaches the tool acts as an entire. These effects then can be supplied in tabulated, or graphical bureaucracy. This shape of evaluation is commonly used for the layout and optimization of a device an extended way too complicated to analyze via the usage of manner of hand. Systems that may fit into this elegance are too complicated because of their geometry, scale.

INTRODUCTION TO CFD

Computational fluid dynamics, typically abbreviated as CFD, is a department of fluid mechanics that makes use of numerical strategies and algorithms to treatment and

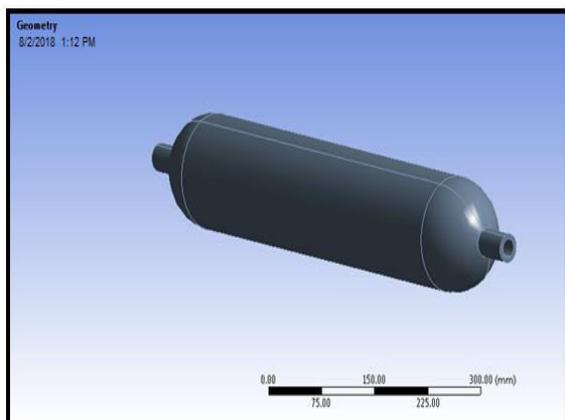
examine problems that consist of fluid flows. Computers are used to perform the calculations required to simulate the interplay of beverages and gases with surfaces defined with the useful resource of boundary conditions. With excessive-tempo supercomputers, higher answers can be completed. Ongoing research yields software program program software program that improves the accuracy and tempo of complex simulation eventualities together with transonic or turbulent flows. Initial experimental validation of such software program software software program is finished the use of a wind tunnel with the very last validation coming in entire-scale trying out, e.G. Flight exams. e, or governing equations.

IV SYSTEM ANALYSIS

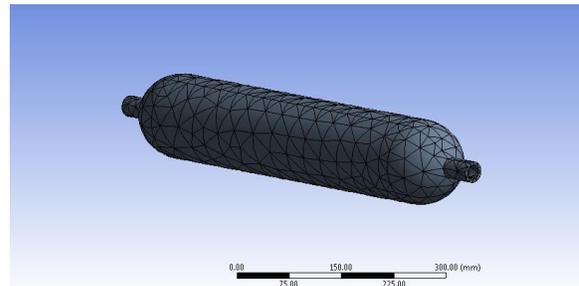
THERMAL ANALYSIS OF SHELL AND TUBE HEAT EXCHANGER MATERIALS- ALUMINUM ALLOY, COPPER ALLOY

Open work bench 14.5>select **steady state thermal** in analysis systems>select geometry>right click on the geometry>import geometry>select **IGES** file>open

IMPORTED MODEL



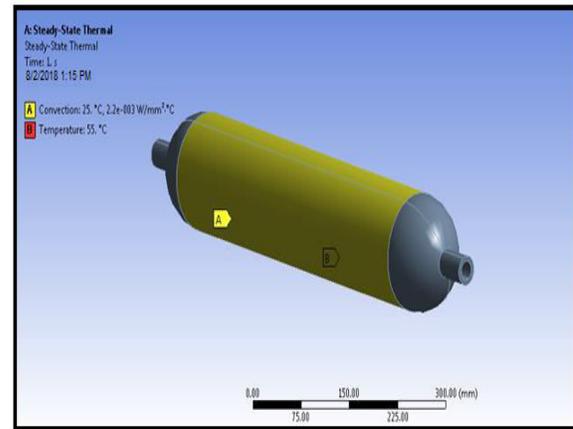
MESHED MODEL



BOUNDARY CONDITIONS

$T_1 = 55C$ $T_2 = 25C$

Select steady state thermal >right click>insert>select convection> enter film coefficient (from CFD analysis



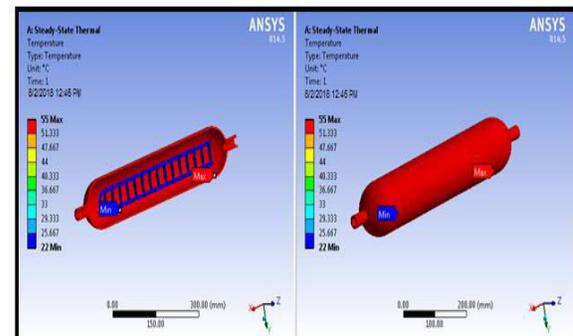
Select steady state thermal >right click>insert>select heat flux

Select steady state thermal >right click>solve

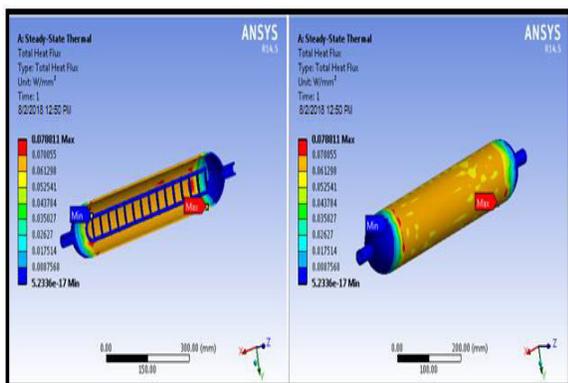
Solution>right click on solution>insert>select temperature

MATERIAL-ALUMINUM ALLOY

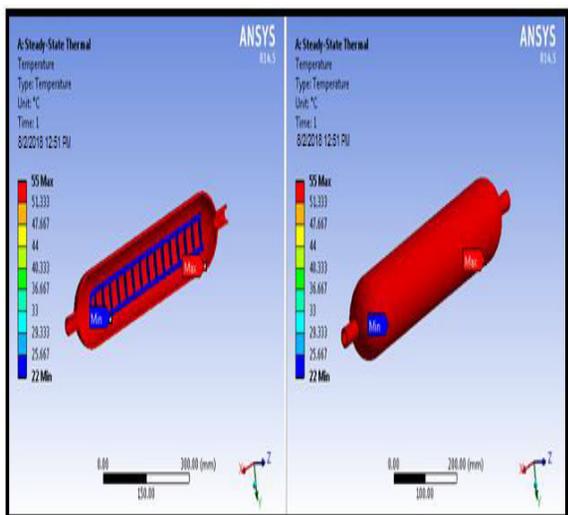
TEMPERATURE



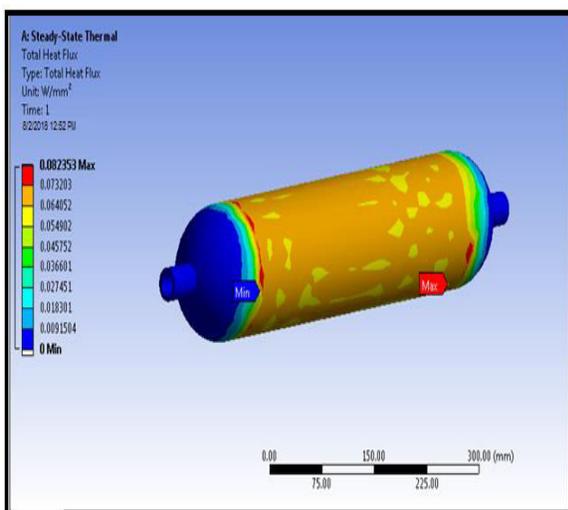
HEAT FLUX



MATERIAL-COPPER TEMPERATURE



HEAT FLUX



V RESULTS

CFD results

| Fluid | Pressure (pa) | Velocity (m/s) | Heat transfer co-efficient (w/mm ²) | Mass flow rate(kg/s) | Heat transfer rate(w) |
|----------|---------------|----------------|---|----------------------|-----------------------|
| Water | 1888796.58 | 2.42 | 312 | 100.01 | 114868 |
| Mg(0.25) | 2.2125+06 | 2.48 | 349 | 108.35 | 1312058 |
| Mg(0.35) | 1.47+07 | 2.46 | 456 | 130.489 | 12872431 |
| Mg(0.45) | 1.38+05 | 2.47 | 600 | 152.61 | 12643921 |
| Mg(0.55) | 4.11+05 | 2.45 | 815 | 174.74 | 12376302 |
| Mg(0.65) | 1.26+07 | 2.49 | 972 | 173.652 | 280116504 |

THERMAL ANALYSIS

| Material | Temperature (°C) | Heat flux(W/m ²) |
|----------|------------------|------------------------------|
| Aluminum | 55 | 0.078811 |
| Copper | 55 | 0.082353 |

V I CONCLUSION

In this thesis, precise nano fluids combined with base fluid water are analyzed for their commonplace overall performance within the shell and tube warmness exchanger. The nano fluids are magnesium oxide zero.25,0.35,zero.Forty 5,0.Fifty five and zero.Sixty 5 Theoretical calculations are performed decide the residences for NANO fluids and those houses are used as inputs for assessment.3-D version of the e heat exchanger is completed in CREO parametric software program. CFD evaluation is finished in ANSYS software program software. By looking on the CFD assessment the warm temperature transfer rate will boom for magnesium oxide at extent fraction 0.Sixty five while look at with aluminum oxide and water.

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