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Thermal Analysis of Jaquar Core Unit

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Abstract:
Electronic devices reaching into every aspect of modern living, are becoming more and more sophisticated. This tends leads to high heat density flux by Electric current .For large scale system high heat flux is also becoming a concern due to raise in power density .In order to provide effective cooling system and avoid the malfunctioning of electronics sustainable work has been done to explore effective system in cooling. Here we need to do thermal analysis for Jaquar core EW unit and analyze the performance of cooling sytems at different varients in jaquar core EM unit.
Here we have designed the Jaquar Core unit with the help of CREO-2 software .The Jaquar analysis is carried in FEA by using FLOEFD software

Keywords: *Jaquar, cooling system , high heat flux, Heat sink . Temperature, pressure, density*

1. Introduction

In the year July 2009, a upgrade of Jaquar XT5 system has been upgraded from 2.3 GHz 4-core Barcelona AMD processor to 2.6 GHz 6- core processor Istanbul AMD. This approach provided a platform to the development of the Jaquar XT5 platform and reducing the impact to the users .An upgradation has been done in Jaquar core XT5 to 2,332 TF with improved bandwidth

In the year 2004 the series of Quad core processor which included 6.4 Trillion floating points per second in Cray X1.This system has been upgraded to 18.5 TF in 2005 Cray X1e, There are further developments finally the latest development was in the year 62 TB of memory in the year 2008.Below are some of the references which are take into considerations

- Issam Mudawar , Desikan Bha Dorathan , Kenneth Kelly, and Sreekant Narumunchi {1} Renewable Energy Laboratory (NREL) which is a part of U.S departmental Energy is currently leading a national effort to develop next generation cooling system techniques for hybrid vehicle electronics .The potential is defined as Spray cooling in 2009
- Mudawar I {2} Explores the recent research development in heat flux thermal management .Some cooling schemes like cool boiling , detachable heat sinking , jet impenjet , Sprays are discussed and compared rrelative to heat dissipation .the fundamental electronic cooling system has been developed from last decades in 2001
- Richard C, Ch. Robert ,E.Simmons Michael ,J.Ellosworth Roger ,R.SchwidtVincent {4}This paper Explained about the cooling systems provided in computer systems and large servers for many years tis cooling technology has played acrucial role in performance and effiency in each generation of computers .He has also explained about future arised problems in technology method in2004
- J .Darabi , K Ekula {5} An computational investigation has been carried out in order to provide direct cooling to the high heat flux devices. The main concept being used here is electrodynamic Principle mainly carry outs the principle of pump and form a layer over heated surface which requires the cooling .Here the major role is played by applying the electrode in order to form a thin layer and remove the heat dissipated on the surface in the form of evaporation method 2003
- Mudawar .I {6} Here new cooling system has been introduced where primary working fluid flowing through micro channel heat sink is pre cooled using the method of indirect cooling system in 2008
- Tiejun Zhang , John T.Wen ,Yoav Peles ,juan catano, Rongliang zhou, Michael k .Jensen {7} .In this the two loop refrigeration system are being explored for two-phase cooling of ultra high power electronic components this paper explains about the transient analysis and active control of pressure drop instabilities various imposes heat loads

2. Modeling of Jaguar Core Unit Using CREO-2.0

Creo is a family or Suite Design software supporting product design for discrete manufacturers and its developed by PTC. PTC Creo is a scalable, interoperable suite of product design software that delivers fast time to value .It helps teams to create analyze , view, and leverage product design downstream utilizing 2D & 3D CAD parametric and direct modeling

PTC Creo parametric provides the broadest range of powerful yet flexible 3D CAD capabilities to accelerate the product development process .By automating the tasks such as creating the engineering drawings ,we are able to avoid our significant time & errors .The Software lets us performance analyze create renderings ,animations and optimize the productivity across a full range of mechanical design tasks ,including a check for how well our design conforms our best practices .PTC Creo helps us to create the high Quality products and also us to communicate more efficiently with the manufacturing suppliers

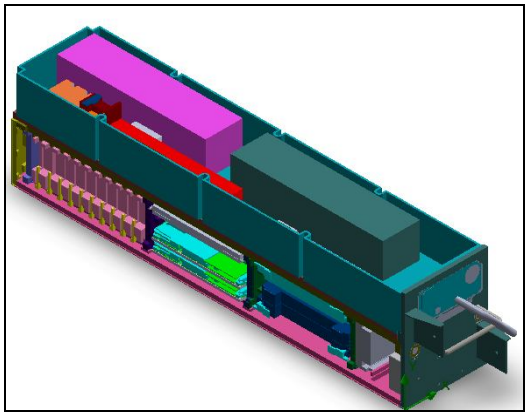

Figure: 1 Jaquar Core Unit

The above Figure.1 Which gives us clear view about the design structure of Jaquar core unit which is done using the CREO-2.0 Software .As discussed above this software which gives Quality design structure and product where we can easily communicate to manufactures

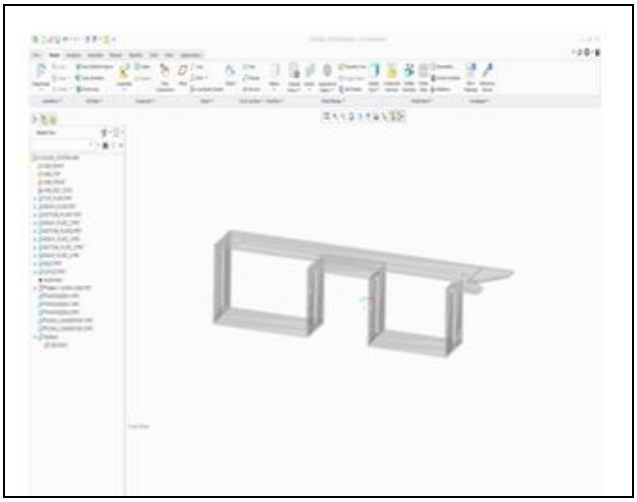

Figure 2: Jaquar Core Unit Cooling System

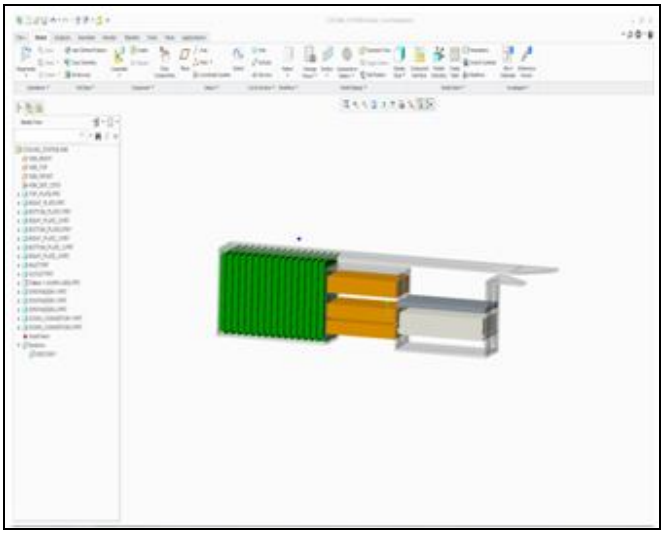

Figure 3: Cooling System assembled with heat sources

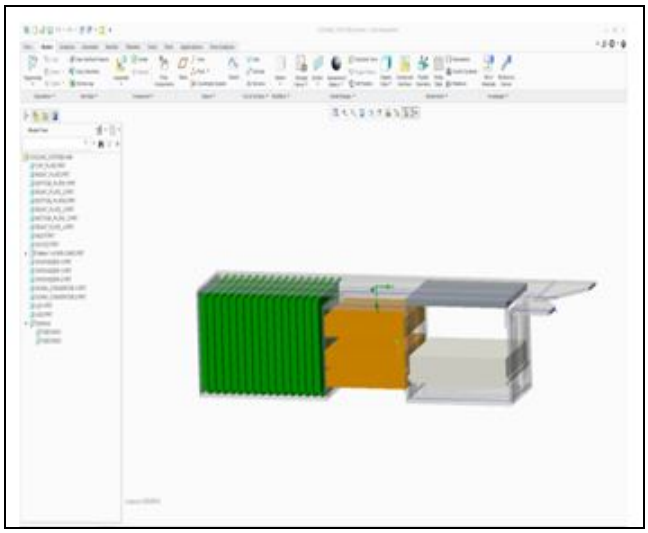

Figure 4: Cooling System assembled with heat sources

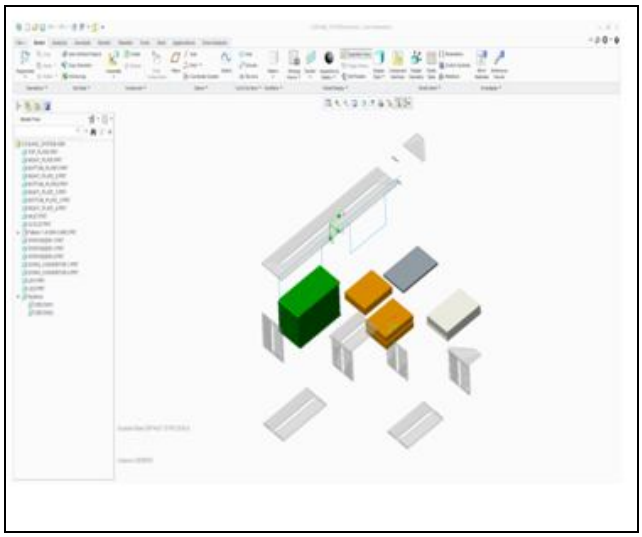

Figure 5: Exploded view of Jaquar core unit
(Modification in position of heat sources)

3. Computational Fluid Dynamics

The purpose of the project is to use the open-source CFD software is to simulate the heat transfer in a heat exchanger and pressure loss .To validate and simulate with the actual experimental results Different solvers and different models of turbulence used to determine the most precious model which used for predicting the heat transfer in this type of compact fin, pressure loss & tube heat exchanger

For analyzing the simulation in fluid flow ,heat transfer and such phenomena such as chemical reactions CFD is being utilized (Computational fluid Dynamics).Examples of application areas :aerodynamic lift and drag (aeroplanes or wind mill wings)power plant combustion, chemical reaction heating /ventilation ,even in bio medical engineering (simulating blood flow through arteries and veins).In this project the main purpose of using CFD is off to find out the analysis of flow and also heat transfer .CFD is carried out in many industries like aircraft manufacturing, combustion engines , R&D as well as many industrials

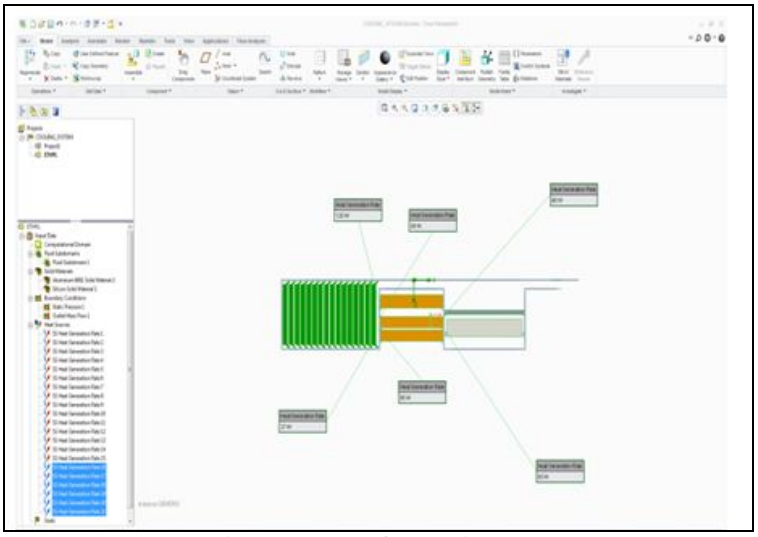

Figure 6: Heat Generation Rate

Here for analysis is being done using the CFD software in 4 cases below are the cases being explained .Here we will have a over view of cases we will discuss about the influence over temperature, density & pressure

Case.1: Water used as coolant in Existing model

Here in the below analysis the coolant used for heat dissipation is water. This analysis is done without variation of model .Finally we can observe changes in Temperature in Figure7

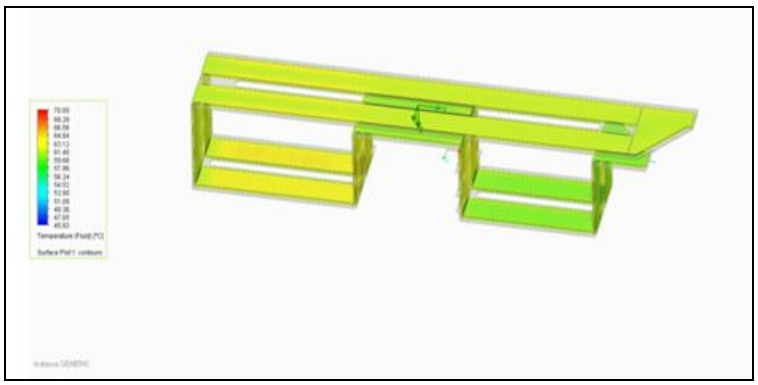

Figure 7: Temperature variations in Fluids

In the above Figure we have noticed changes in temperature similarly below is another case where we have used coolant as water without variation in model .we can observe the changes in the Figure8

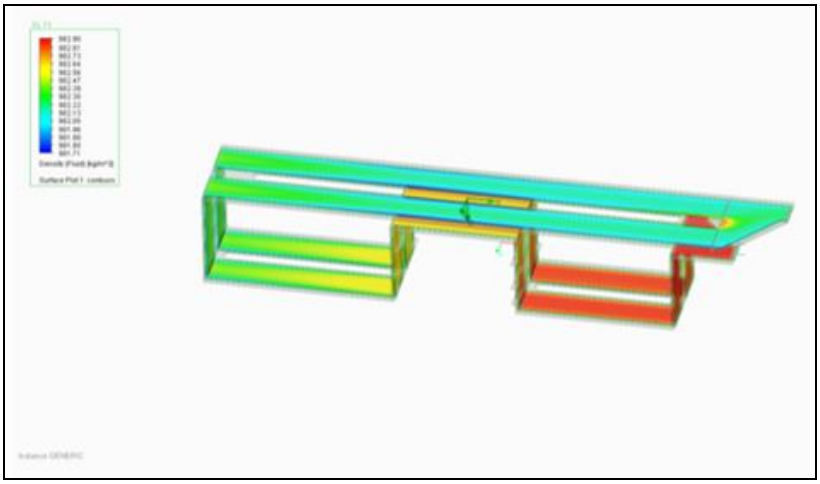

Figure 8: Density Variations in Fluid

In the above Figure we can clearly observe the changes in the density .Similarly below is the another case where we used coolant as water for the existing model .We will Observe the changes in the Figure9

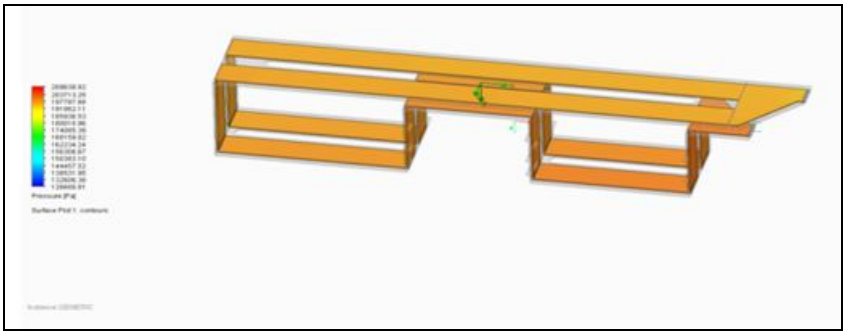

Figure 9: Pressure Variations in fluid

Here in the above figure.9 we can clearly observe the changes in pressure here the water is arranged as coolant for existing model
Case .2 : Refrigerant (R-134a) used as a cooling medium here without changing the model .
Case.3: water is being used as a coolant medium in modified model .Here we used parameters Temperature ,density & pressure as used similar in case1 & case 2
Case.4: Here Refrigerant (R-134a) is being used as an coolant with the modified model below are the changes which are being observed

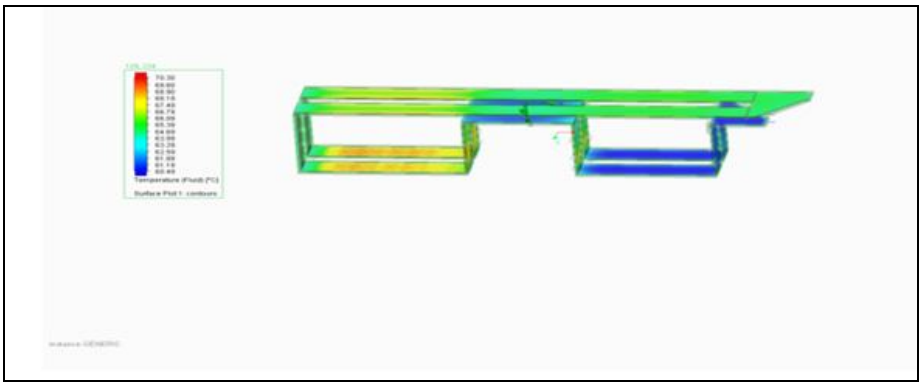

Figure 10: Temperature variation in fluids

Here in this case, the Figure10 shows us clear view about the change in the temperature .In this type the refrigerant (R-134 a) is used as coolant and this is a modified model above figure gives us clear view.

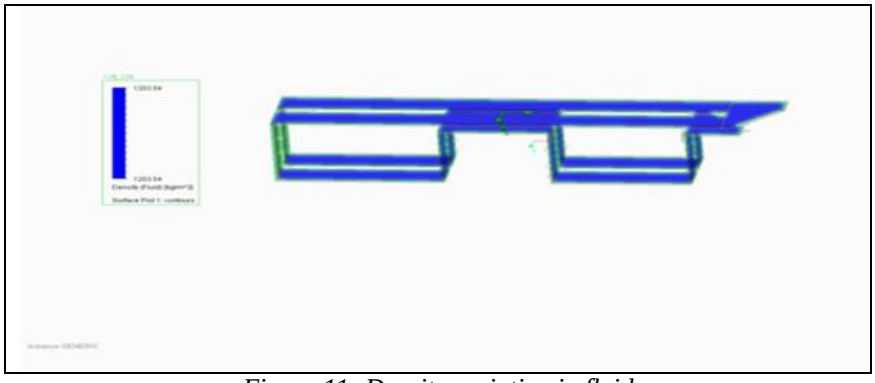

Figure 11: Density variation in fluid

Here in the above Figure11 we can observe the density variation in the fluid .Here we used refrigerant (R-134a) as a coolant and here the model is been modified when compared with the case 1 .We can observe the changes in above Figure

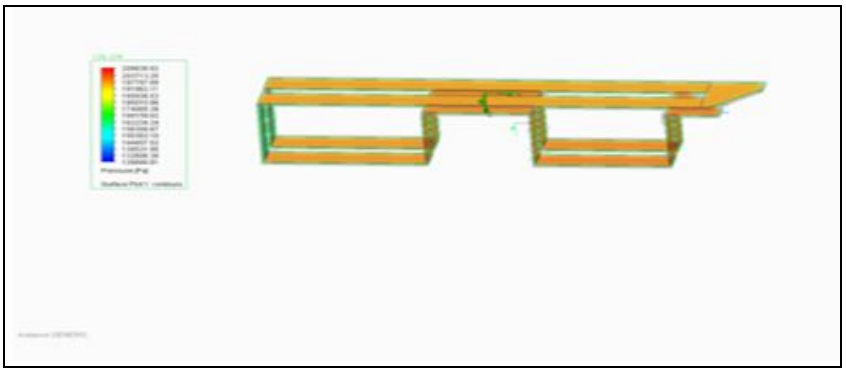

Figure 12: Pressure variations in Fluid

Here in the above Figure12 we can observe the variation of pressure in the fluid .In this analysis Refrigerant used is (R-134a) which is acts as a coolant and here the model has been modified when compared with
Above case 1 & Case 2 the model is been modified and the change is been seen in the above figure .12
Below are three Graphs represents the Temperature variation graph & Density variation graphs have been shown clearly and the variations have been can observed in graphs with the different set of points as shown in the above graphs in case.4 .Similarly we can have graphs for remaining cases also

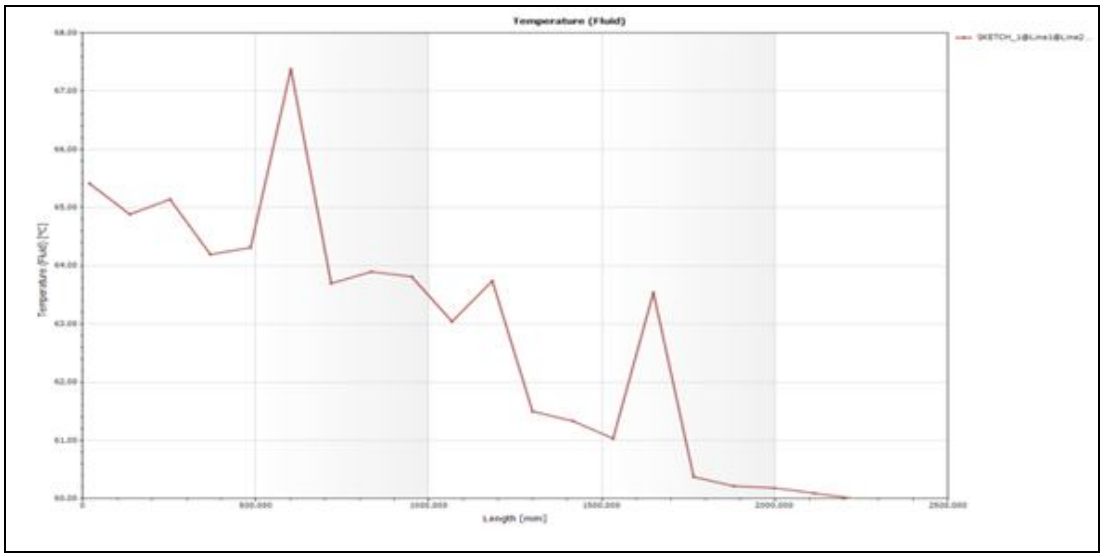

Figure 13: variation of Temperature in Graph

The above Graph (Figure13) represents the variation of temperature of fluid with respective length (mm) on X-axis and temperature of fluid (^{o}C) on Y-axis

Below is the table which gives us clear view about the bounded values where the graph is been represented

Temperature (Fluid) (°C)	
Length (mm)	SKETCH_1@Line1
18.92592888	65.41325785
135.3408008	64.8836641
251.7556726	65.14211332
368.1705445	64.19508146
484.5854164	64.31083277
601.0002883	67.37652493
717.4151601	63.69603999
833.830032	63.89727807
950.2449039	63.81217943
1066.659776	63.04260078
1183.074648	63.73915707
1299.48952	61.49788852
1415.904391	61.33291401
1532.319263	61.03305374
1648.734135	63.53978709
1765.149007	60.3732553
1881.563879	60.21471103
1997.978751	60.18303134
2114.393623	60.0923201
2230.808495	60.00004267

Table 1: Representation of Graph values

The above Table 1 gives us clear view about the variation of values in different length

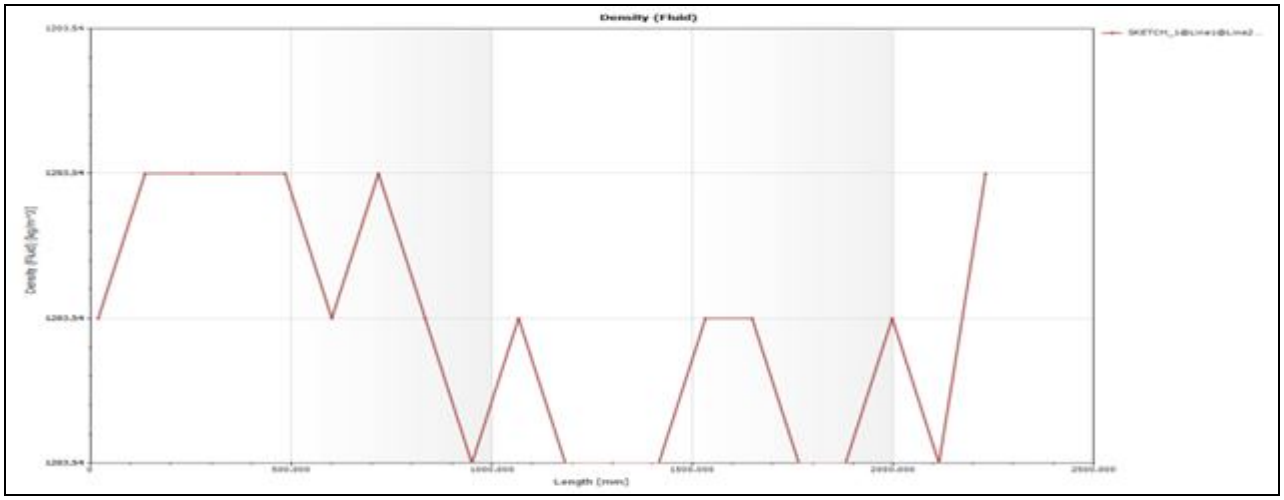

Figure 14: represents the variation of density in graph

Below is the another representation of graph which explains us about the density variations .Graph represents the variation of density of fluid with respect to the length (mm) on axis and density of fluid (kg/m^3) on the y-axis

Density (Fluid) (kg/m^3)	
Length (mm)	SKETCH_1@Line
18.92592888	1203.53511
135.3408008	1203.53511
251.7556726	1203.53511
368.1705445	1203.53511
484.5854164	1203.53511
601.0002883	1203.53511
717.4151601	1203.53511
833.830032	1203.53511
950.2449039	1203.53511
1066.659776	1203.53511
1183.074648	1203.53511
1299.48952	1203.53511
1415.904391	1203.53511
1532.319263	1203.53511
1648.734135	1203.53511
1765.149007	1203.53511
1881.563879	1203.53511
1997.978751	1203.53511
2114.393623	1203.53511
2230.808495	1203.53511

Table 2: Representation of Graph values

Below is the Table 2 which gives us clear view about the bounded values where the graph is been represented

4. Conclusion

Results Regarding case studies:

CASES	COOLANT	MODEL	TEMPERATURE OUTLET
CASE 1	Water	Existing	61.68 c
CASE 2	Refrigerant	Existing	65.41 c
CASE 3	Water	Modified	65.33 c
CASE 4	Refrigerant	Modified	70.41 c

Table 3: represents the case study values

The above Table 3 which represents us about the values of outlet temperature which is obtained at different cases

The Purpose of the Project is to analyze the performance of the cooling system at different scales of Jaquar core unit .Here we had designed the Jaquar core unit using the CREO-2.0 Software and analyzed using FEA with help of FLOEFD software

As a overall review regarding the four cases .The primary case1 here the water which is used as a coolant and the model is same we obtained an outlet temperature of 61.68 ^{o}C .Similarly in case 2 as we observe here the coolant which is used is refrigerant (R-138a) during this case the outlet temperature is 65.41^{o}C here the model had not been modified in both cases

Regarding the case three the mode of cooling system where the coolant is being sent is been modified in the cases 3& case 4 .Below is study of case 3 .In this case here water is used as a coolant after using the water as coolant here the outlet temperature has been changed to 65.33^{o}C.when compared with the case.1 model here the model has been modified and the water which is being utilized here as a coolant performed similar performance as in case3 where here refrigerant been used .Similarly in case4 here the coolant which is been used is refrigerant

(R-134a) here the outlet temperature has also improved when compared with the remaining cases .The major change in outlet Temperature is due to the change in the model and refrigerant being used Comparing the above results ,heat dissipation to refrigerant from electronic system is more when compared with the heat dissipation to water

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