Numerical Analysis of Automobile Radiator

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Abstract: Nowadays, the demand for automobile vehicles is on top. Therefore, it is a great challenge for the automotive industries to contribute a powerful and efficient engineer. Impact of an engine's performance with different systems like fuel supply system, transmission system, lubrication system, cooling system etc. Therefore, it becomes necessary for an engine model to improve the engine's performance in the account. The cooling system is one of the important systems. It also increases the heat transfer and the economy of fuel which increases the signal to perform an engine. Liquids are mostly internal combustion engines (radiator) run through the cold heat exchanger from the air, either cooled using a liquid or air coolant. Various research papers have been studied and have been finalized that various coolant (nanofluids), tubes, fans and cores, have applied to change the efficiency of the radiator at different mass flow rates. From the literature study, it has been observed that the methods of radiator efficiency have been enhanced through a variety of ways, which is used to improve the radiator efficiency by modifying the radiator fan and radiator tube out of the radiator fan. Goes. This research focuses about CFD analysis to improve Automobile Radiator performance. Various research papers have applied various tools, meshing and numerical solutions for different method and modeling. Various results suggest that the CFD concept has proved to be very effective in reducing production time and cost. CFD results have high correlation levels with actual experimental results. This paper shows an analysis of radiator and shows change in temperature and pressure.

Keywords*: Radiator, CFD, Temperature, Pressure.*

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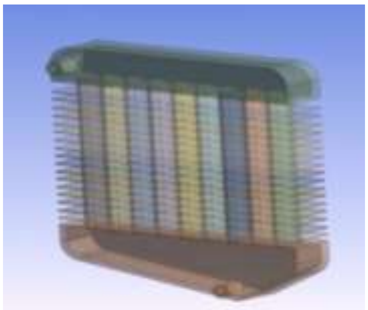
1. Introduction

Automobile radiator is used to cool the motor vehicle engine If the radiator works properly the cooling system will work properly in turn will increase engine performance. The design of the new radiator includes: As the air flow optimization, it comes in different panels (radiator covers, feathers, cores, grills, etc.), which occur in the middle of the air flow path, by design a very important parameter in the heat transfer When the radiator assembly through the air flow through the atmosphere, therefore the amount of air which is more suction, the radiator core to create air flow optimization, the design of the radiator core Through the air recirculation and by reducing the air leak to flow through it to suck more air, the design fan blade can be made bearing round shape, the total size of the radiator core, vertical horizontal or In the direction of flow of fluid working in the radius outward, etc.

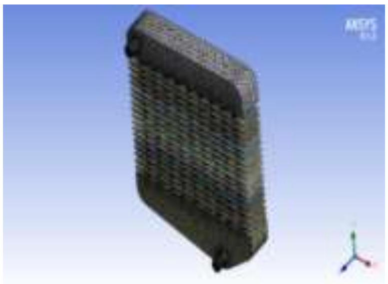
The wedge shaped frontal area of the radiator, the wings and the tube, the wings and the tube size, the number of tubes, The size of the eye and tube, the coolant mass flow rate, the wing material, the tube and the panel are their physical and thermal properties, on which the middle distance is the dependent air entry temperature which can be reduced by establishing the intercooler in front of the radiator core, these Possible design parameters that can be kept in mind are designed to make a better automobile radiator. The role of CFDs is very important today as a design tool. CFD simulations are available in the market for various commercial software. If the modelling is done by CAD then the complete discretization model is resolved in small cells by discretization. Apply equation controlling discrete element and solve them by CFD solver.

2. CFD Analysis and Discussion

2.1 Modelling of Radiator. After performing simple calculation, the modelling has been performed in Ansys Design Modeller and then after the analysis work has been performed on the ANSYS15.0 version.



Figure(1) Model of Radiator



Figure(2) Meshing Model of Radiator

ISSN: 2321-8169
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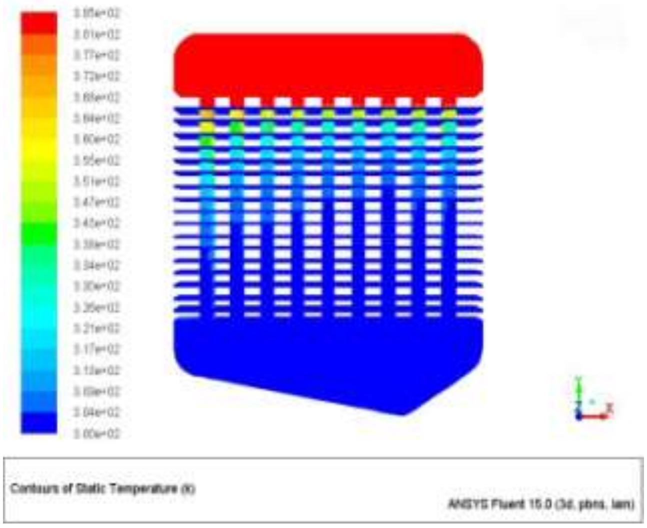
Initial Conditions	Values	Units
Radiator Size	133×120	mm
Thickness	36	mm
Cooling flow rate	50,75	l/m
Air flow rate	4	m/s
Tube Size	15×1	mm
Fin size	20×1	mm
Number of Tubes	9	No unit
Number of fin	17	No unit
Core Size	49	mm

3.2 CFD Analysis

Result

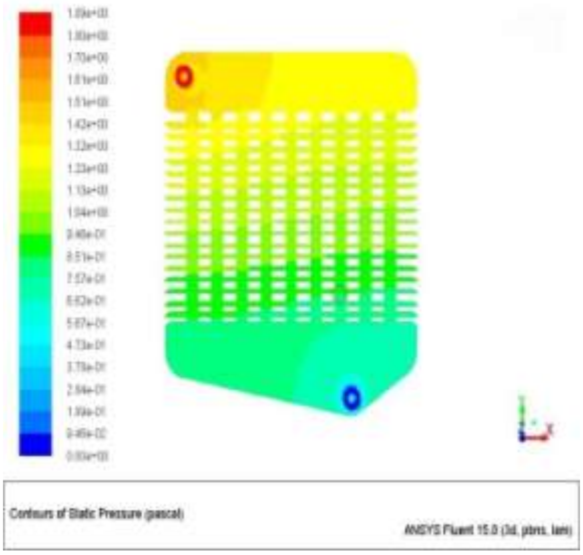


Figure(3) Static Temperature

Discussion

As from the above contour it is clearly seen that temperature is drop from 385 to 360 Kelvin so the total temperature drop is of 25 Kelvin. Above Analysis shows the temperature drop of water inlet and water outlet and from this analysis due to large temperature drop heat transfer rate will also increase. It is clearly visible that up to some point temperature drop is varying but after that there will not be any temperature drop and it remains constant.

Result



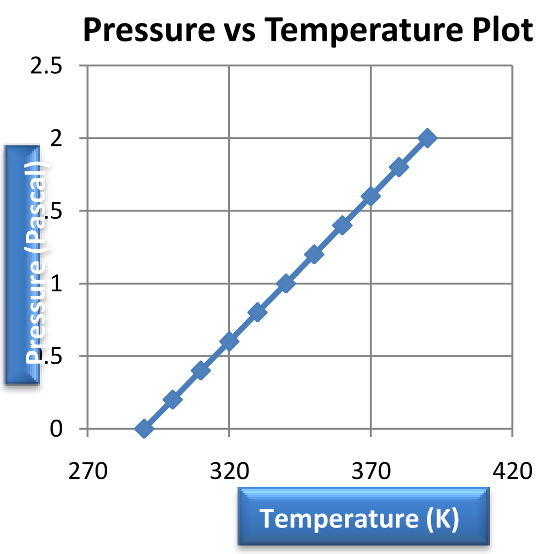
Figure(4) Static Pressure

Discussion

As from the above contour it is clearly seen that temperature is drop from 385 to 360 Kelvin so the total temperature drop is of 25 Kelvin. Above Analysis shows the temperature drop of water inlet and water outlet and from this analysis due to large temperature drop heat transfer rate will also increase. It is clearly visible that up to some point temperature drop is varying but after that there will not be any temperature drop and it remains constant.

Graphs

1.Temperature vs. Pressure graph



Above graph shows the relation between temperature and pressure at different points in the radiator.It shows that the as temperature is increasing the pressure also increasing

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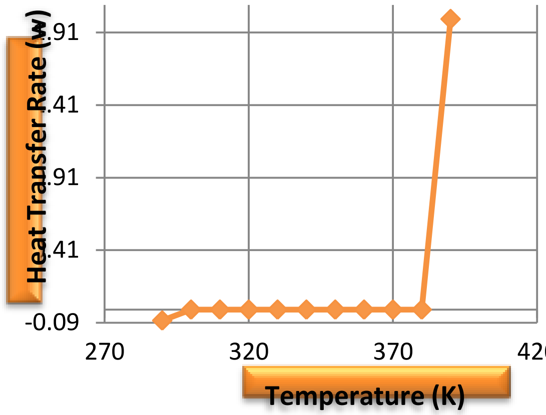
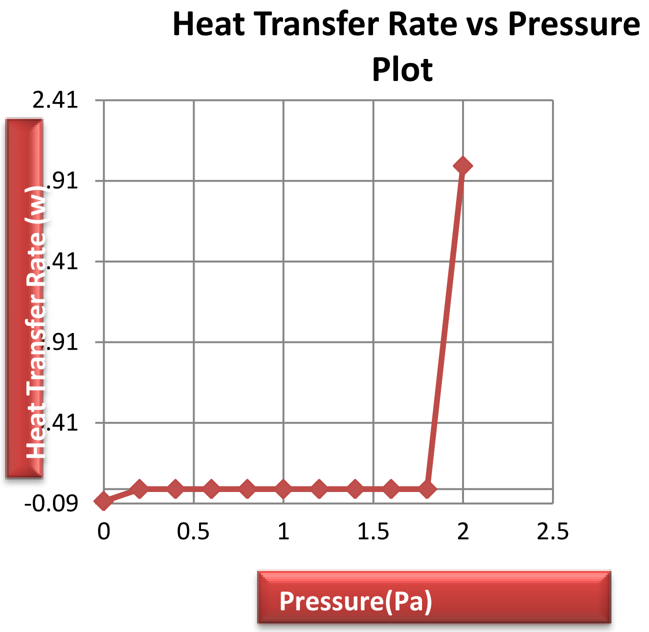
continuously, and it is clearly seen that pressure is zero at ambient temperature.

2.Temperature vs. Heat transfer rate



Above Graph shows the relation between temperature and the heat transfer rate of the given radiator. It is clearly seen that at initial stage heat transfer rate is lower and than after it remains constant but at one point there is sudden hike and it is highest at that point.

3.Pressure vs. Heat transfer rate



Above Graph shows the relation between pressure and the heat transfer rate of the given radiator. It is clearly seen that as the pressure increases the heat transfer rate of the radiator also increases.

Heat Transfer Rate (w)	Pressure (Pascal)
-0.075086221	0
0	0.2
0	0.4
0	0.6
0	0.8
0	1
0	1.2
0	1.4
0	1.6
0	1.8
2.0031919	2

Inlet	2.0031919
Outlet	-0.075086221
Wall-100	0
Wall-104	0
Wall-105	0
Wall-106	0
Wall-107	0
Wall-111	0
Wall-112	0
Wall-113	0
Wall-114	0
Wall-55	0
Wall-56	0
Wall-57	0
Wall-58	0
Wall-62	0
Wall-63	0
Wall-64	0
Wall-65	0
Wall-69	0
Wall-70	0
Wall-71	0
Wall-72	0
Wall-76	0
Wall-77	0
Wall-78	0
Wall-79	0
Wall-83	0
Wall-84	0
Wall-85	0
Wall-86	0
Wall-90	0
Wall-91	0
Wall-92	0
Wall-93	0
Wall-97	0
Wall-98	0
Wall-99	0
Wall-base	0
Wall-covection	-1.9109179
Wall-cubierta	0
Wall-tubo_recto	0
Total Heat Transfer Rate(w)	**0.017187849**

Heat Transfer Rate

3. CONCLUSIONS

Cooling capacity increases with increase in mass flow rate of air and coolant. Reduction in cooling capacity with the increase in inlet air temperature while cooling capacity increases with the increase in inlet coolant temperature. The pressure drop also increases with the increase in air and coolant mass flow rate through radiator. Heat transfer rate increases with increase in surface are of radiator. Effectiveness of radiator increases with increase in the heat transfer rate.

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