*International Journal of Engineering Applied Sciences and Technology, 2017*
**Vol. 2, Issue 4, ISSN No. 2455-2143, Pages 186-189**
Published Online February-March 2017 in IJEAST (http://www.ijeast.com)

# ENHANCING THE PERFORMANCE OF THE RADIATOR OF AUTOMOBILE ENGINE – A REVIEW

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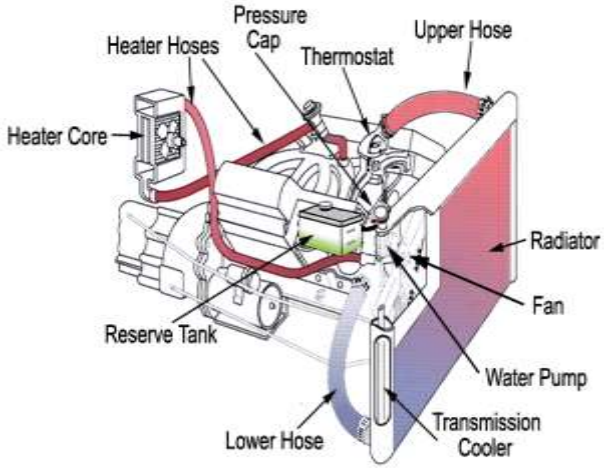
**Abstract:** ***In present days uses of automobile is increases, it is the need for the industries of automobile to produce powerful and efficient engine. Performance of engine mainly affected by cooling system, Lubricant system, etc. In an automobile engine cooling system is the main key for obtain better performance. In this review paper various experimental and Computational Fluid Dynamic (CFD) modeling or analysis has been discussed (for enhance the efficiency of the engine by providing better technology in radiators. It has been studied and experimented in various coolant systems. All the included factor increases efficiency of the engine with the help of radiator.***

## I. INTRODUCTION

As we are discussing on radiator or cooling system of automobile this works or based on convection of heat transfer. Convection is the process in which the heat is transferred from one place to another by the movement of fluid and air. Radiator works on the principle of forced convection in which the flow of liquid is caused by a pump, fan, or by atmospheric air which are used to cool the internal heat of the engine. Radiator is usually used in automobile engine to read out the waste heat generated during the working of automobile engine. Radiators are heat exchanger is so designed that transfer thermal energy from one medium to another for the cooling purpose of automobile engine. It consists of radiator, cooling fan, thermostat and water pump in most of automotive engine cooling system. It's designed or assembly consists of many parts such as core, outlet tank, tube, inlet tank, core cover, tank etc. Atmospheric air flows through between fins takes and takes out the heat. If radiator is not working properly then many troubles rises in the automobile engine like knocking, cylinder deformation, piston deformation, and overall efficiency reduce, etc.




## II. LITERATURE SURVEY

(1) Oilet et al (2007) has been investigated that the various method which influenced radiator performance such as air, fin density, coolant flow and air inlet temperature. Air and coolant mass flow rate affected the radiator performance which is caused by heat transfer. When the flow of air and cooling flow increases ultimately it increases the cooling capacity. But whenever the air inlet temperature increases the heat transfer and the cooling capacity turns to low level. For reducing heat transfer it has been sodesigned the fin angle that the fin density increased.

(2) Sulaiman et al (2009) studied that the air flow distribution we need computational fluid dynamic (CFD) to move air from

radiator fan to radiator. Further studied it is found that theerrors occurs in air outlet velocity. The reason for error is the design of blades and shape. So there some change in their shape of blade hub.

(3) Chacko et al (2005) has been studied that air flow in direction of radiator core which increases the efficiency of automobile cooling system. There is need of optimization of radiator cover shape in flow of air in the direction of radiator. It increase the thermal efficiency radiator. CFD are used for the improvement of flow air which leads to increase the thermal efficiency.

(4) Jain et al (2012) has been carried out their study in computational fluid dynamic (CFD) . The flow of air is radial axial in the fan which are used in acid pump truck tier to regain the power. It is used to measure the static pressure at inlet and outlet. The result of evaluated data of flow is that the flow of air vilated by the hub obstruction. They may flow in unwanted flow region whuch results the left blade rotate anticlock wise and the right blade rotate at clockwise direction. The CFD data represent or satisfy the data which are measured in physical changing.

(5) Singh et al (2011) has been investigated that the geometric parameter of the blade which are used in the fan for backward and forward curved of the blade in centrifugal fan. It is mainly used these centrifugal fan to improve the heat dissipation from internal combustion of engine surface. On this we investigated about the diameter ratio, number of blades and angle etc. he forward fan are used to increase cooling system where need of cooling is more required on those automobile engine. As the number of blade is more flow coefficient and power coefficient increases and losses are reduced.

(6) Kumawat et al (2014) has been studied that the axial flow fans that principle is not fit at the high pressure and perform on high volume of air at low pressure. These axial blades are so designed in aerofoil modification in such blade that requireslow cost and perform better efficiency and have minimum number of blade show large result in term of efficiency of the automobile engine.

(7) Brave et al (2014) has been studied that design of fan and structure use finite element method to its strength and the movement of fluid in the direction of computational fluid dynamic (CFD). For the designing of fan, there is need of all dimension according to the model which was designed and tested before apply. As we obtained the result of analytical method to met with accuracy of the various pre-determined parameters. To measure the flow rate static pressure, velocity factor etc in calculated accurately. So we may get the torque accurately.

(8) Jama et al (2014) has been influenced that the air flow distribution and non regular along the radiator of full size. This experiment shown result which is the best for shielding of the front end of automobile/vehicle. The air flow are equality with horizontal to the vertical method due to shielding process the air enter high speed which results quick cooling and cooling effect on the vehicle. It is regular or uniform process of air flow distribution to cooling effect on vehicle and increase cooling capacity.

(9) Leong et al (2010) has been studied that the use of nano fluid which are performed as coolant which reduces the unwanted heat from the engine and produce cooling and cooling system result. Nano fluid has been produced more thermal conductivity than coolant and increase heat transfer. Radiator core area decreased when the heat transfer as nano fluid perform as a coolant (Al2O3). Nano fluid increase the aera when pumping power of same radiator using ethylene glycol. It shows to solve out minimize area.

(10) Sai et al (2014) has been investigated that now a days the vehicle in which nano fluid are used as a coolant. The percentage of nano particles mixes with water and there data is taken and other hand the use of pure water in radiator and their data was taken. The tested result have show with the use of different volume foci of nano particles mixed with water. The result shows that the nano particles are used as best cooling performance in radiator that the water. Nano particles Al2O3 have maximum potential for fluid flow or hydraulic flow and heat transfer at the radiator would increase.

(11) Trivedi et al (2012) has been studied that the effect of pitch tube for configured for required presentation. For increasing heat transfer we would modify the tube by changing their shape and dimension so that the area of radiated core is increased. So it

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performs for better cooling effect on radiator of automotive vehicle. So far it it can suggested that the pitch of tube is 12mm for better efficiency.

(12) Yadav et al (2011) has been investigated the parametric study of automotive radiator. To study the various parameter of radiator such as coolant temperature, mass flow rate of coolant etc are varied. The following marks are recorded during reading. The direct relation between mass flow rate of coolant and coolant flow rate with each other. As inlet temperature is increases the inlet temperature of coolant increases the cooling capacity of the radiator which is ultimately provide better performance for the engine and reduces the unwanted heat produced in the engine.

(13) Nyuyen et al (2007) represented that the heat transfer is produced and to enhnce it we have used nano fluid, Al2O3water mixture for a water closed system which is result of cooling microprocessor and other electronic components. Various data tested for distilled water and nano fluid concentration mainly 0.95% and 4.5%. Individual concentrations of sample in which the 4.5% heat transfer betterment as 25% to that of distilled water which are reached.

(14) Satya kumar et al (2006) it has been seen that water evaporates very quickly when engine over heated so that we need other than water which is not heat as quick as water so we use nano fluid mix with water which increases the cooling effect of radiator. As cooling effect it helps in increase in overall efficiency of engine. As heat transfer improved by using nano fluids it can be made energy efficient and compact.

(15) Vajjha et al (2010) it has been studied numerically experimented 3D laminar flow and heat transfer with two different nano fluid such as Al2O3 and C4O with the ethylene glycol water mixture revolving around the flat tube of the radiator of automobile. To evaluate the control over base fluid convected heat transfer coefficient with nano fluid flow through the required satisfied over base fluid and performs better cooling effect.

## III. CONCLUSION

There are different types of engine cooling system has been performed or studied by the researchers through experimental numerically, data representation and pre-determined analysis.
There are mainly two types of cooling processes are Air cooling system and Liquid cooling system

(1) In Air cooling system: By designed and modification of fins, blades angle, shape of blade in aerodynamic way for axial and radial air flow and it improves the radiator cooling system. There is need of changes in their shapes.
(2) Liquid cooling system : By modifying the radiator tubes fins, radiator core, fan and coolant (nanofluid) so the radiator cooling capacity can be improved.

Out of these the liquid cooling system transfers the heat at maximum level while comprising the air cooling system.
From the literature section it is concluded that to improve the air flow distribution of radiator by changing the number of blade angle. By mixing nano fluid cooling which improves the cooling effect as compared to water. There is some modification for the betterment of cooling system. Leminar flow of liquid helps in better output or modification.

## IV. FUTURE SCOPE

The modification of radiator is needed for better efficiencies of engine. In near future the radiator is so designed to get more efficient. In new edition vehicle the use of radiator are so adjustable to give maximum output at minimum input, So the change of radiator tube, fan, coolant etc are change with time to time for better performance and less heat produce and good efficiencies are managed. There is a need of change and modification in sense of look and performance.

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