

Design and CFD Analysis of Altered Shape of Honda 125 CC Engine Fins

P.Ramesh¹, Katta Sai Sri Kanth²

¹Asst. Professor, Mechanical Engineering, R.M.K. Engineering College, Gummidipoondi, India

²U.G student, Mechanical Engineering, R.M.K. Engineering College, Gummidipoondi, India

Abstract- Most modern internal combustion engines are cooled by a closed circuit carrying liquid coolant through channels in the engine block and cylindrical head, where the coolant absorbs heat, to a heat exchanger or radiator where the coolant releases heat into the air. Whereas in the air-cooled engine the heat generated is dissipated directly into the air using the engine fins. This work is a detailed design and analysis for improving the efficiency of engine fins in a Honda 125cc engine by using the altered shape fins.

Keywords- CFD, I.C engines, Cooling system, Engine Fins.

I. PROBLEM IDENTIFICATION

With the rise in technology of two-wheelers, a high-speed operation of the vehicle is possible. The utmost drawback to this the excessive heating of the engine. The heat generated in the engine has to be dissipated. If the oil cooling is used in the engines it is overpriced and it also increases the weight of the engine, which leads to decrease in efficiency. Also, it has a negative effect on the aerodynamics of the two-wheeler.

II. REASONS FOR ALTERATION OF ENGINE FINS

The reasons for alteration of the engine fins is that the square fins have lesser surface area for heat transfer, heat transfer is dependent on the ambient temperature, the heat transfer co-efficient of the material is low.

III. POSSIBLE SOLUTION

We have proposed the use of a coating of Aluminium nitride on the surface. Aluminium nitride is used in cooling of electronic components as it has the higher heat transfer coefficient. We modelled a two-wheeler engine and we have analysed the heat transfer for the engine with square fins, circular fins, angular fins, curved fins.

IV. DESIGN OF THE ENGINE WITH FINS

Steps to be followed in the design phase are:

- 1) A conventional size of the engine used in two wheelers is chosen.
- 2) The specification and sizes of the engine are collected.
- 3) The Engine is modelled using solidworks modelling package.

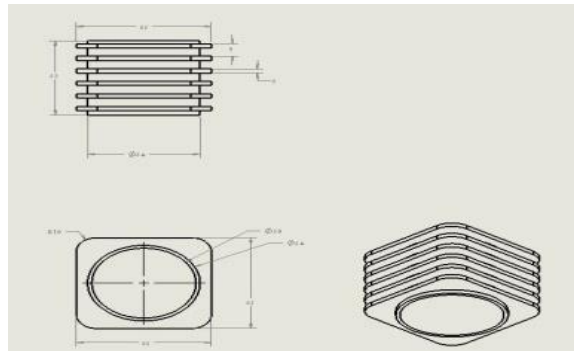
PRESENT MODEL DIMENSIONS

CC	STROKE (MM)	BORE (MM)	NO. OF FINS	DISTANCE BETWEEN FINS (MM)	THICKNESS (MM)
124.73	57.8	52.4	11-9-11	9	3

SPECIFICATION OF THE ENGINE AND FINS

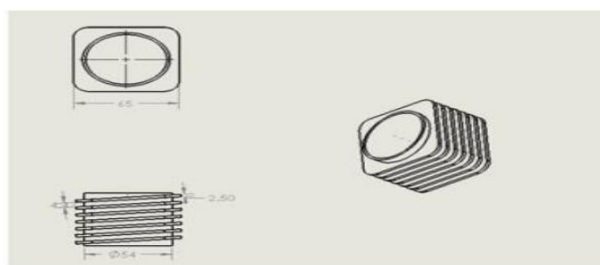
Types	Rectangle fin	Circular fin	Curved fin	Angular fin
Cross-section of fin (mm ²)	65 * 65	80 (dia)	50 (dia)	54 (dia)
Thickness of each fin (mm)	3	3	3	3
Number of fins	6	6	6	6
Fin pitch (mm)	9	9	9	9
Dia. of cylinder (inner dia) (mm)	50	50	50	50

2 D Layout of Square Fins

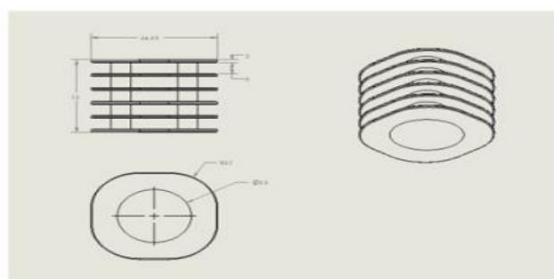


V. ANALYZED RESULTS OF VARIOUS STRUCTURES OF ENGINE FINS

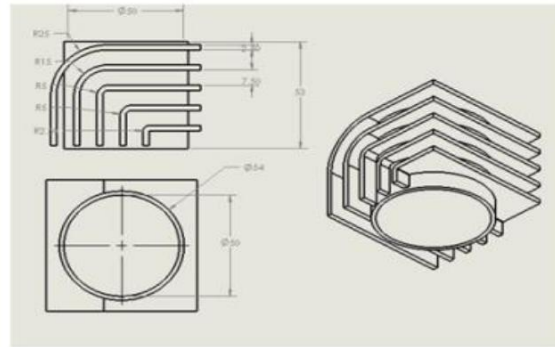
2d layout of angular fins



2d layout of cylindrical fins



2d layout of curved fins



Preparation for CFD

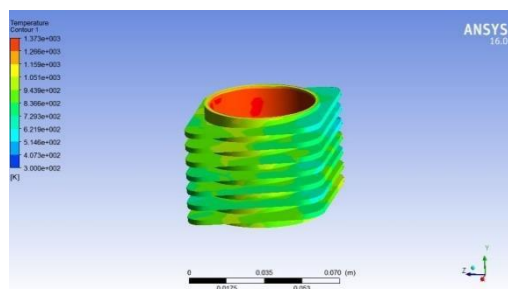
Boundary condition	Square Aluminum	Square aluminum nitride	Circular Aluminum	Circular Aluminum Nitride
Engine temperature (K)	1200	1200	1200	1200
Heat transfer coefficient (W/m ² K)	1000	1500	1000	1500
Ambient temperature (K)	300	300	300	300
Velocity (m/s)	20	20	20	20
Pressure (atm)	1	1	1	1

The CFD Analysis is carried out in ANSYS

WORKBENCH 2016

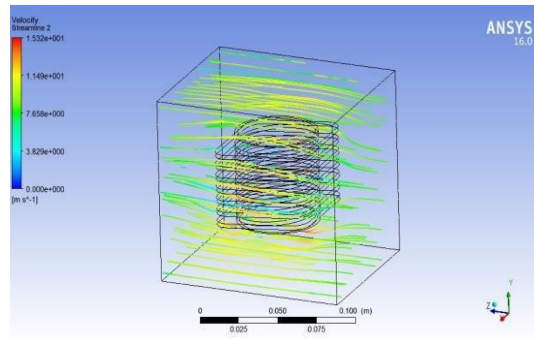
Thus, the different structures of designs which is created and its characteristics are differentiated for different model and its results are as follows,

TEMPERATURE FLOW AT THE ANGULAR ENGINE FINS

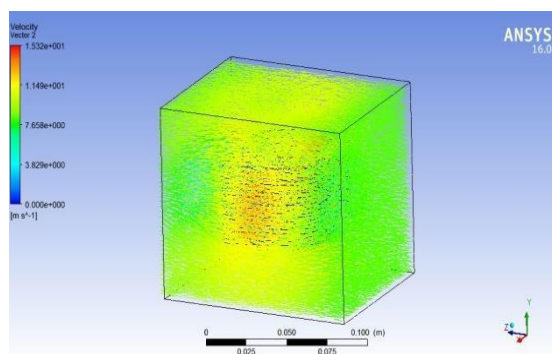




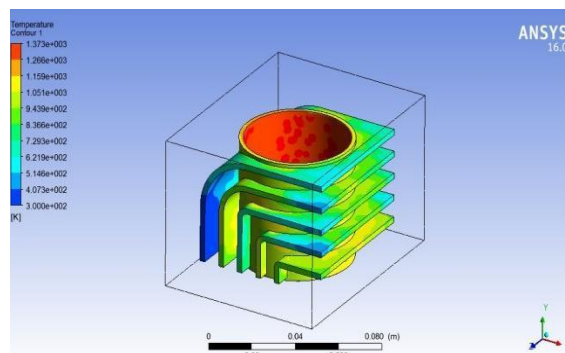
STREAM LINE FLOW OVER AN ANGULAR ENGINE FINS



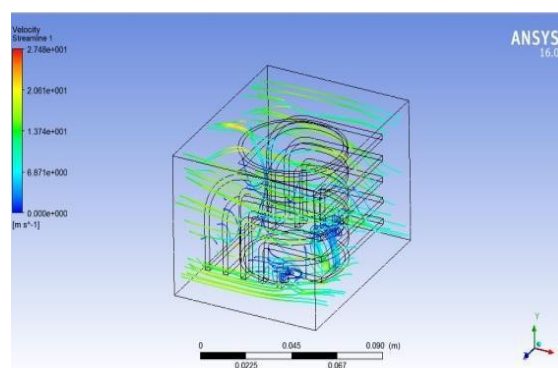
VELOCITY DISTRIBUTION OVER AN ANGULAR ENGINE FINS



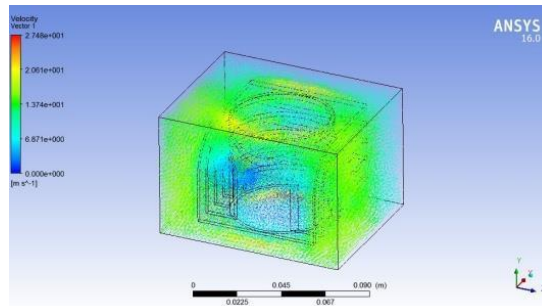
TEMPERATURE FLOW AT THE CURVED ENGINE FINS



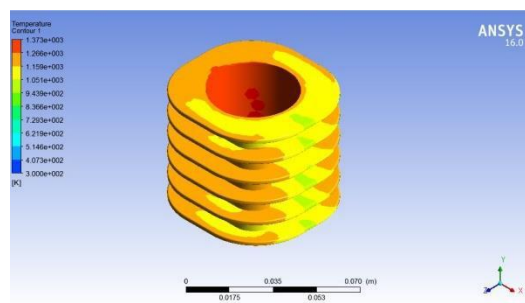
STREAM LINE FLOW OVER AN CURVED ENGINE FINS



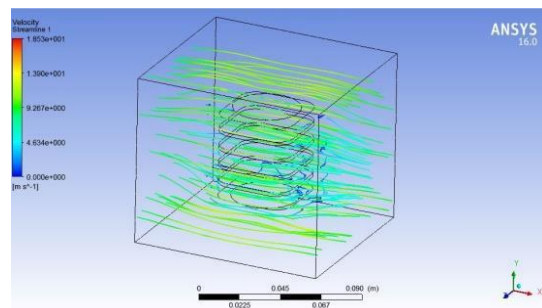
VELOCITY DISTRIBUTION OVER AN CURVED ENGINE FINS



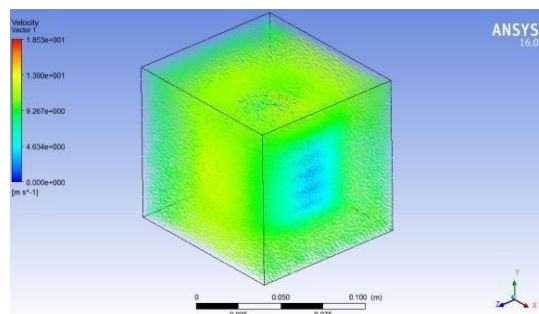
TEMPERATURE FLOW AT THE CYLINDRICAL ENGINE FINS



STREAM LINE FLOW OVER AN CYLINDRICAL ENGINE FINS



VELOCITY DISTRIBUTION OVER AN CYLINDRICAL ENGINE FINS



VI. CONCLUSIONS

Design of fin plays an important role in heat transfer. There is a scope of improvement in heat transfer of air cooled engine cylinder fin if mounted fin's shape varied from conventional one.

Contact time between air flow and fin (time between air inlet and outlet flow through fin) is also important factor in such heat transfer.

Wavy fin shaped cylinder block can be used for increasing the heat transfer from the fins by creating turbulence for upcoming air. Improvements in heat transfer can be comparing with all the four model of the engine fins geometry by CFD Analysis and its flow characteristics are studied for all the geometries it is found that the curved fins provide better result when compared with all the other geometries.

REFERENCES

- 1) Magarajan U.1, Thundil karuppa Raj R.2 and Elango T.3 , Numerical Study on Heat Transfer of Internal Combustion Engine Cooling by Extended Fins Using CFD, Research Journal of Recent Sciences ISSN 2277-2502 Vol. 1(6), 32-37, June (2012).
- 2) Masao Yoshida, M., Ishihara, S., Nakashima, K. and Yamamoto.M. Optimum Fin Layout of Air-Cooled Engine Cylinder in Air Stream Development of Air-Cooled Cylinder Utilizing Natural Convection, SAE Paper No. 2005-01-1385, (2005).
- 3) H. Azarkish, S.M.H. Sarvari, A. Behzadmehr "Optimum geometry design of a longitudinal fin with volumetric heat generation under the influences of natural convection and radiation", ELSEVIER, 98135-161 Zahedan, 2010.
- 4) G. Babu, M. Lavakumar, Heat Transfer Analysis and Optimization of Engine Cylinder Fins of Varying Geometry and Material, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 7, Issue 4 (Jul. - Aug. 2013), PP 24-29.
- 5) Thornhill D., Stewart A. and Cuningham G. "Experimental Investigation into the Temperature and Heat Transfer Distribution around Air-Cooled Cylinders" SAE paper 2006-32-0039/20066539 (2006).
- 6) Zakirhusen, Memon K. and Sundararajan T., Indian Institute of Technology Madras, V. Lakshminarasimhan, Y.R. Babu and Vinay Harne, TVS Motor Company Limited, "Simulation and Experimental Evaluation of Air Cooling for Motorcycle Engine", 2006-32- 0099 / 20066599 (2006).
- 7) Thornhill D., Graham A., Cunningham G., Troxier P.and Meyer R., "Experimental Investigation into the Free Air-Cooling of AirCooled Cylinders" , SAE Paper 2003-32-0034, (2003).
- 8) Olier C, Oliva A, Castro J. Parametric studies on automotive radiators. Appl Therm Eng 2007;27:2033e43
- 9) Zhang Qinguo, Qin Sicheng, Ma Runda. Simulation and experimental investigation of the wavy fin-and-tube intercooler. Case Stud Therm Eng 2016;8:32e40.
- 10) Kundu Balaram, Lee Kwan-Soo. Thermal design of an orthotropic flat fin in fin-and-tube heat exchangers operating in dry an wet environments. Heat Mass Transf 2010;30:1438e46.