A Review on Increasing the Heat Dissipation Rate of Engine Cylinder Block

Prof. Amol Kumar Tripathi[1], Dharmendra Kumar Dixit[2]
[1]*Rewa Institute of Technology, Professor, Department of Mechanical Engg. REWA, MP.*
[2]*Rewa Institute of Technology, M.Tech Scholar, Department of Mechanical Engg. REWA, MP.*

***Abstract*- Heat transfer is the science that seeks to predict the energy transfer that may take place between material bodies as a result of a temperature difference. The fact that a heat-transfer rate is the desired objective of an analysis points out the heat transfer. In this study the survey of various researches have been done and obtained that the heat transfer in the engine cylinder block is the largest issue. This issue has been tried to remove by providing extended surface in the engine cylinder block and improve the efficiency of the system. After the study of various researches it concluded that there is the improvement chance in the engine cylinder by providing some extra area in the cylinder fin without increasing the fin length. This can be obtained easily by providing holes in the fins.**
This is done by generating a model of engine cylinder block in the ANSYS 14.5 and the Discretization will be done Workbench APDL. The transient analysis has been done by using Transient thermal APDL.

Index Terms- Cylinder block, Fin, ANSYS, heat transfer, APDL, Transient Analysis.

1. INTRODUCTION

There are the three modes of heat transfer: conduction, convection, and radiation. When a temperature gradient exists in a body, experience has shown that there is an energy transfer from the high-temperature region to the low-temperature region. We say that the energy is transferred by conduction and that the heat-transfer rate per unit area is proportional to the normal temperature gradient. Heat lost by the hot body is always equal to the heat gained by the cold body. The heat flow takes place from higher to lower temperature. The substances expand on heating. In a order to change the state of a body from solid to liquid or liquid to gas without rise in temperature, certain amount of heat is required. When a body is heated or cooled its weight does not change.

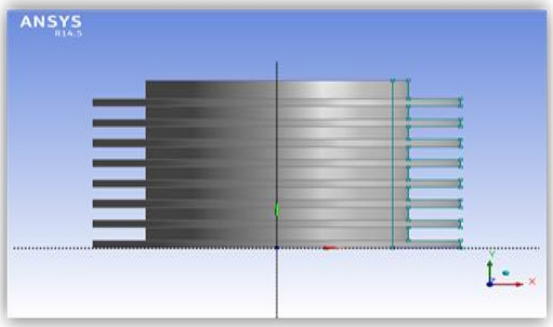

Figure 1 Model of engine cylinder block

2. LITERATURE REVIEW

Various researches carried out in past decade shows that heat transfer through fin depends on number of fins, fin pitch, fin design, wind velocity, material and climate conditions.

Arnold E. Biermann and Benjamin Pinkel [2015] obtained heat transfer coefficient over a range of air speeds from 30 to 150 miles per hour from tests in a wind tunnel of a series of electrically heated finned steel cylinder, which covered a range of fin pitches from 0.10 to 0.60 inch, average fin thickness from 0.04 to 0.27 inch, and fin width from 0.37 to 1.47 inch. They concluded that the value of surface heat transfer coefficient varies mainly with air velocity and the space between fins. The effect of the other fin dimensions is small.

J.C. Sanders et.al.[2015] carried out the cooling tests on two cylinders, one with original steel fins and one with 1-inch spiral copper fins brazed on the barrel. The copper fins improved the overall heat transfer coefficient from the barrel to the air 115 per cent. They also concluded that in the range of practical fins dimensions, copper fins having the same weight as the original steel fins will give at least 1.8 times the overall heat transfer of the original steel fins.

P. Sai Chaitanya, B. Suneela Rani [2014]
The main aim of the present paper was to analyze the thermal properties by varying geometry, material and thickness of cylinder fins using Ansys work bench. Transient thermal analysis determines temperatures and other thermal quantities that vary over time. The variation of temperature distribution over time is of interest in many applications such as in cooling.
G. Babu, M. Lavakumar [2013] The 3D modeling software used is Pro/Engineer. The analysis was done using ANSYS. Material used for manufacturing cylinder fin body was Aluminium Alloy 204 which has thermal conductivity of 110-150W/mk. They were analyzing the cylinder fins using this material and also using Aluminium alloy 6061 and Magnesium alloy which had higher thermal conductivities.
Fernando Illan [2013] simulated the heat transfer from cylinder to air of a two-stroke internal combustion finned engine. The cylinder body, cylinder head (both provided with fins), and piston have been numerically analyzed and optimized in order to minimize engine dimensions.
Bassam A and K Abu Hijleh [2013] The ratio between the permeable to solid Nusselt numbers increased with Reynolds number and fin height but tended to decrease with number of fins. Permeable fins resulted in much larger aerodynamic and thermals wakes which significantly reduced the effectiveness of the downstream fins, especially at $\theta < 90°$. A single long permeable fin tended to offer the best convection heat transfer from a cylinder.
Masao Yoshidaet.al.[2012] investigated effect of number of fin, fin pitch and wind velocity on air-cooling using experimental cylinders for an air-cooled engine of a motor-cycle in wind tunnel. Heat release from the cylinder did not improve when the cylinder had the more fins and too narrow a fin pitch at lower wind velocities, because it is difficult for the air to flow in to the narrower space between the fins.
Han-Taw Chen and Wei Lun Hsu [2012] used the finite difference method in conjunction with the least-squares scheme and experimental temperature data to predict the average heat transfer coefficient and fin efficiency on the fin of annular finned tube heat exchangers in natural convection for various fin spacing.
J. Ghorbanian • M. Ahmadi [2012] In order to look at this issue, authors zero in on wide-ranging experimental and analytical study to investigate temperature fields in cylinder head and block of a recently developed turbocharged bi-fuel engine. A bi-fuel turbocharged engine (CNG and gasoline) were equipped with more than 40 sets of thermocouples and a comprehensive thermal survey was carried out on the fired engine in the various conditions.

Objectives of proposed study
To generate 3-D model of cylinder block model and carry out Transient Thermal analysis and test heat transfer performance, Temperature distribution, Heat Flux and Directional heat flux. To design fins with holes at different segments and carry out Transient Thermal analysis for heat transfer and find out best result of fin design. To compare New fin Model with previous one. To validate results with previous research done.

3. PROBLEM DEFINITION

In this study we have analyse the heat transfer in engine cylinder block by introducing the holes in fins of cylinder block. The investigation has performed with the Transient Thermal Analysis by using ANSYS 14.5 and utilized the Heat flux, Directional Heat flux and Temperature distribution. The analysis has done by introducing the hole in the cylinder fin.

3.1 Computational Fluid Dynamics

CFD programs have become very prevalent, prominent, and widely used in many fields of academia, in industry, and in major research centres. CFD analysis, consisting of three main elements:

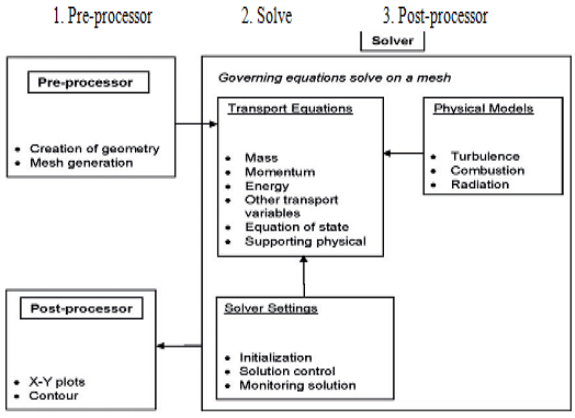

Fig 2 the interconnectivity functions of the three main elements within a CFD analysis framework.

4. MODEL DESCRIPTION

In this study the model of cylinder block has designed in design modular by using Ansys 14.5. Finite element method has used for transient thermal analysis of cylinder block the various geometry model have been shown below.

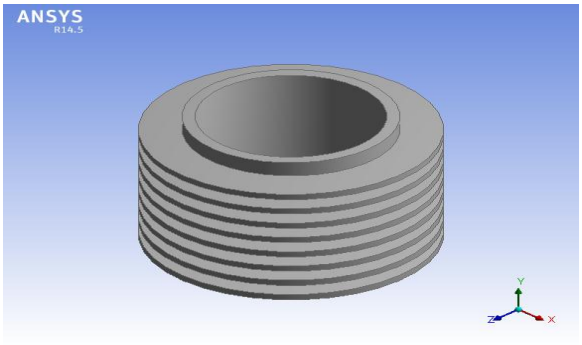

Figure: 3 Geometrical model of engine cylinder block

5. CONCLUSIONS

The geometrical model will be designed on ANSYS 14.5 and the model Discretization will be done on Workbench APDL. There after the transient analysis of engine cylinder block will be done and the temperature distribution, heat flux and direction heat flux can be analyzed by ANSYS 14.5 and make a comparison between them on various model.

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