Thermal Analysis of Compressor Cylinder Fins Heat Distribution by Varying Profile using Finite elements Method in MATLAB

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Abstract

Most of the air compressors are either reciprocating piston-type or rotary vane screws. Centrifugal Compressors are common in very large applications such as supplying high-pressure clean air to fill gas cylinders and supplying a large amount of moderate pressure air to power pneumatic tools. In the air, compressor heat can be generated in two ways, heat produced by friction as well as by compressing of air at high pressure. So, this heat will transfer to the atmosphere by fins. As engineers, we are primarily interested in knowing the extent to which particularly extended surfaces or fin arrangements could improve heat transfer from a surface to the surrounding fluid.

Introduction

Most modern internal combustion engines are cooled by a closed circuit carrying liquid coolant through channels in the engine block and cylinder head, where the coolant absorbs heat, to a heat exchanger or radiator where the coolant releases heat into the air. Thus, while they are not ultimately cooled by the liquid, because of the liquid-coolant circuit they are known as water-cooled. In contrast, heat generated by an air- cooled engine is released directly into the air. Typically this is facilitated with metal fins covering the outside of the Cylinder Head and cylinders which increase the surface area that air can act on. Air may be force fed with the use of a fan and shroud to achieve efficient cooling with high volumes of air or simply by natural air flow with well-designed and angled fins. In all combustion engines, a great percentage of the heat generated escapes through the exhaust, not through either a liquid cooling system nor through the metal fins of an air-cooled engine. About 8% of the heat energy finds its way into the oil, which although primarily meant for lubrication, also plays a role in heat dissipation through a cooler.

Objective

Experimental investigation to predict the performance of heated triangular fin array within a vertically oriented and air-filled rectangular enclosure to analyse the effects of many parameters.

Application of modified Bessel functions in the analysis of extended surface heat transfer and differential equations are formulated from the fundamentals of conduction and convection heat transfer.

Analyzed heat transfer through a wall containing triangular fins partially embedded in its volume, Coupled heat diffusion equations governing each constituent are solved numerically using an iterative finite volume method.

Calculated heat release of an IC engine cylinder cooling fins with six numbers of fins having pitch are determined numerically using the commercially available CFD tool Ansys Fluent.

The heat release from the cylinder which is calculated numerically is validated with the experimental results.

With the help of the available numerical results, the design of the I.C engine cooling fins can be modified for improving the heat release and efficiency.

Methodology

· Create a 3D model of the compressor fins using parametric software Catia v5.

· Convert the surface model into IGS and import the model into ANSYS to do analysis.

· Perform static and thermal analysis on the compressor fins.

· Finally, it will be analyzed which material is suitable for compressor fins.

References

Thermal Analysis of Compressor Cylinder Fins

By, Bade Yellaji, Dr. D Sriramulu, S. Krishna Madhavi