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Thermal Analysis of Air Cooled Engine Cylinder Under Varying Fins Thickness

Puppala Maruthi Narayana, PG Scholar,
Dept. of Mechanical Engineering, Prasiddha College of Engg & Technology, Anathavaram, pnarayana329@gmail.com

Abstract: In Entire Automobile structure, inside ignition motor is the essential part which is presented to high temperature assortments and warm burdens. Warmth will be conveyed to the air by methods for constrained convection in an air cooled motor .Heat blades are placed in outside surface of the air cooled engine chamber. Warmth move rate depends on the impacts of blade calculation, the encompassing temperature and the vehicle (speed).

Current paper is to analyze the effect of balance boundaries on heat blade execution in sensible working conditions which consolidates heat balance materials, variable thickness and variable pitch of warmth balance .Heat balances of an air cooled engine chamber is planned in UG-NX 11 (Unigraphics) and warm examination is done by the ANSYS 18.0 and NX-Nastran programming apparatuses . Current assessment relies upon Transient underlying examination and transient Thermal examination taken as an information is Heat move. Procured results are complete distortion, temperature dissemination and warmth transition of three variable materials like, Al6061 (aluminum blends), AMC-SCI (Mg composite), CGI (cast iron compound). Analyzed outcomes rely upon convective warmth move coefficient, pragmatic requirements, high temperature obstruction and low weight factor. Among three materials AMC-SCI (Mg compound) is the ideal material and it very well may be supplanted traditional Al 6061 (aluminum combination) for making of air cooled motor chamber in additional future.

Key words: Thermal investigation, balances, solidworks, ansys, Al6061, AMC-SCI, CGI

I. Introduction

The primary goal of the undertaking is to demonstrate the chamber with balances for TVS star 147cc motor, by fluctuating distance between the balances and thickness of the blades and to look at the warm properties of the balances. Investigation is additionally done by separating the materials of blades. Right way used material for chamber blade body is Cast Iron. Our goal is to veer the material for blade body by examining the balance body with different materials and furthermore by fluctuating the distance in the middle of the two nearby balances and changing thickness of the balances. For local Model impressive boundaries - Thickness of blades – 2.5mm and Distance between the balances – 10mm to leader the examination the Thickness of balances have taken in to thought – 1.5,2,3 and .5mm and Distance between the balances for burning side 10. Favored Materials for this undertaking – Al 6061, AMC-SCI (Magnesium compound) and CGI (Compacted graphite cast iron is solid metal amalgam).

Included foresteps in the venture

1. Displaying

2. Warm Analysis

Displaying of motor chamber with heat blades are perplexing shape which is planned by the high level proficient plan programming UGNX-11 (Unigraphics), which is a parametric 3D demonstrating programming. For this investigation we have utilized ANSYS, which is a FEA examination programming.

II. MATERIALS OF AIR COOLED ENGINE CYLINDER BLOCK

The air cooled motor chamber block (prominently known as the motor square) is the most grounded segment of a motor that gives a significant part of the lodging to the many parts found in a cutting edge motor. Since it is additionally a generally enormous part, it comprises 20-25% of the absolute load of a motor. Here lessening the motor chamber weight is required. motor chamber is fabricated from cast iron compounds principally because of its high strength and minimal effort aluminum amalgam use in motor squares expanded during the 1960's and 1970's as an approach to build eco-friendliness and execution another material interaction has made a magnesium composite

reasonable for use in motors. The amalgam, called AMC-SC1, weighs not exactly both cast iron and aluminum combinations and addresses additional opportunities in motor assembling. Another assembling interaction have made compacted graphite solid metal (CGI) a practical choice to dark cast iron for the production of diesel motor squares. Like magnesium combinations, this material offers a higher strength and lower weight than dim cast iron.

III.MODELLING OF FIN

Design parameters & Model calculations

Fin Thickness – 2 mm and Fin Distance – 10 mm

Length of fin (L)=48.35mm
Ti = Inside temperature = 300 ^{0}C
To = Outside temperature =35^{0}C
Film coefficient have taken into analysis with respect of time like at 60sec-
39.9 w/m^{2}c. LC=L+T=48.35+2=50.35
R1=29.15(radius of bore) R2C=R1+LC=79.5
R2C/R1=2.27 AM=T(R2C-R1)=100.7
(LC)3/2(h/KAM)1/2=0.4875 ή X=0.77
$Q_{MAX}=2\pi(R2C2-R12)h(T_0-T_\infty)$ =273.2 W
Q_{actual}=273.2 X 0.77=210 W (on both sides of fin)

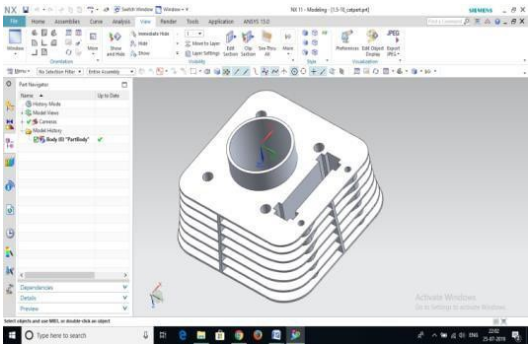

Fig.1.1 3D model created in UGNX-11

Fig.1.2 TVS fiero engine cylinder front view

Properties of materials are mentioned below.

Properties	AL6061	CGI	AMC-SCI
E (GPa)	68.9	170	44
Poisson ratio	0.33	0.294	0.281
K (w/m ^{0} c)	160	38	115
α(^{0}c)	2.32E-05	1.16E-05	2.20E-05
CP (J/Kg ^{0}C)	897	524	1030
ρ(kg/m^3)	2700	7100	1790

IV. THERMAL AND STRUCTURAL ANALYSIS OF FIN BODY

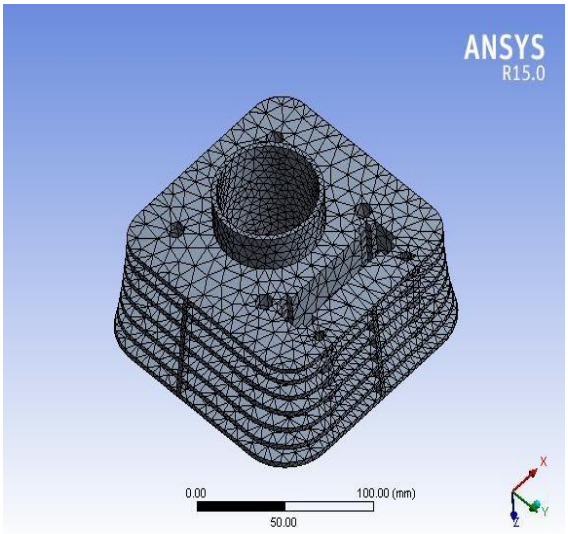

Fig.1.3 meshed model

Applied Loads:
Temperature -300 0c
Film Coefficient – 39.9 w/m2K ambient Temperature – 220c
time taken for transient analysis is 60sec
solution is transient thermal analysis

V.ANALYSIS

Analysis carried out to get the following results below.

Total Deformation of various materials

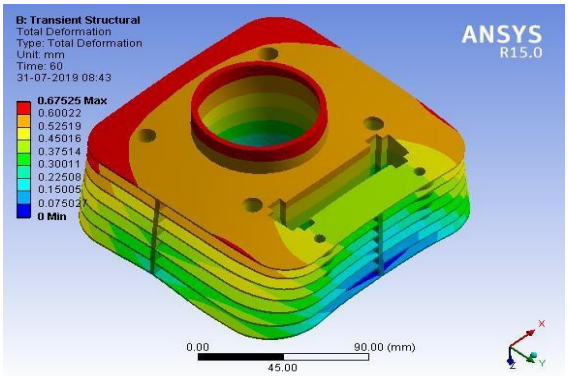

Fig. 1.4 Total deformation in cylinder at 60 sec for AL-1.5mm thickness

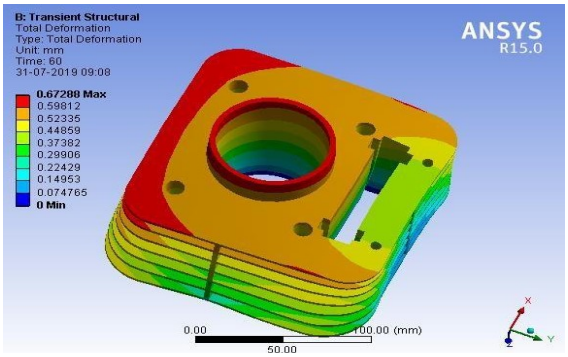

Fig. 1.5 Total deformation in cylinder at 60 sec for AL-2mm thickness

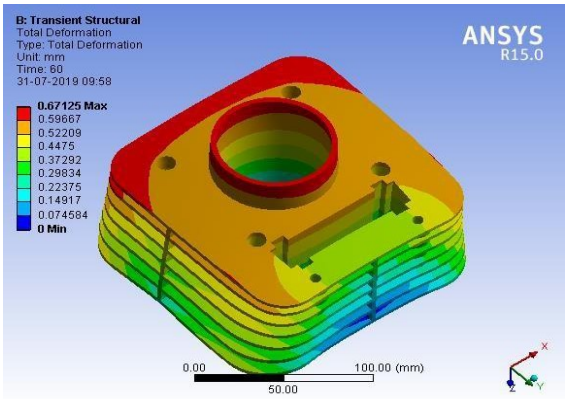

Fig. 1.6 Total deformation in cylinder at 60 sec for AL-2.5mm thickness

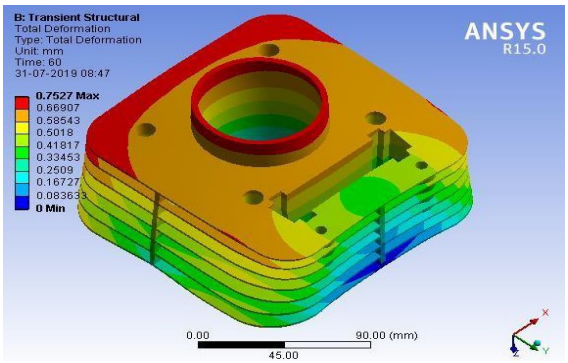

Fig. 1.7 Total deformation in cylinder at 60 sec for AMC-SCI 1.5mm thickness

TOTAL HEAT FLUX OF VARIOUS MATERIALS

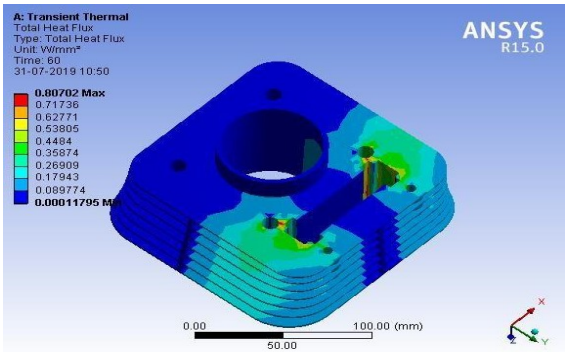

Fig. 1.8 Total heat flux in cylinder at 60 sec for Al 6061 1.5mm thickness

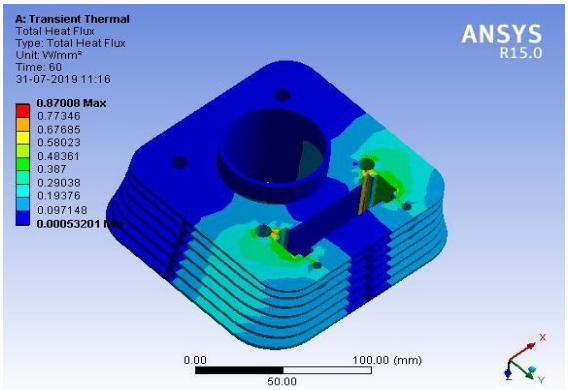

Fig.1.9 Total heat flux in cylinder at 60 sec for Al 6061 2.5mm thickness

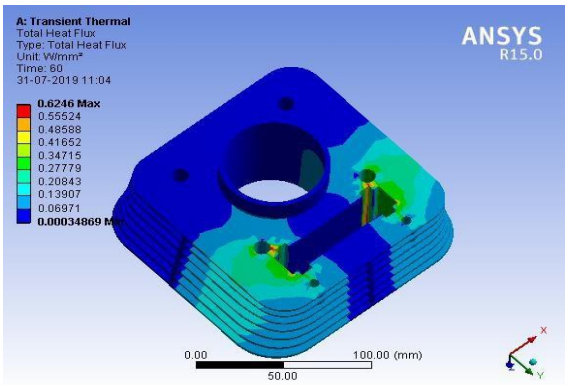

Fig.1.10 Total heat flux in cylinder at 60 sec for AMC-SCI 2mm thickness

TEMPERATURE DISTRIBUTION OF VARIOUS MATERIALS

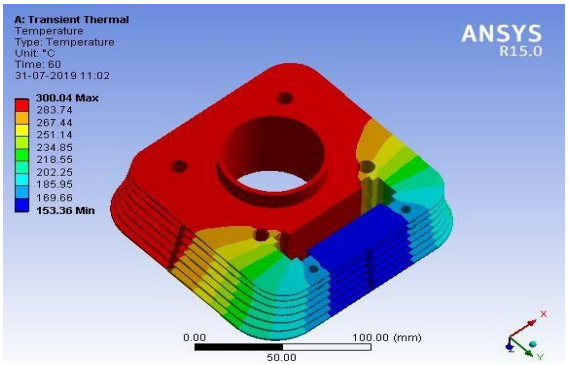

Fig.1.11 Temperature distribution in cylinder at 60 sec for Al6061 2mm thickness

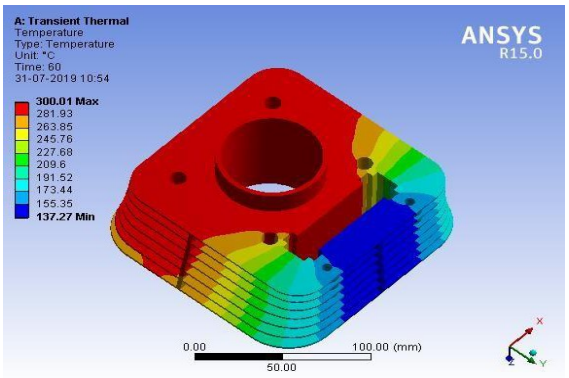

Fig.1.12 Temperature distribution in cylinder at 60 sec for AMC-SCI 1.5mm thickness

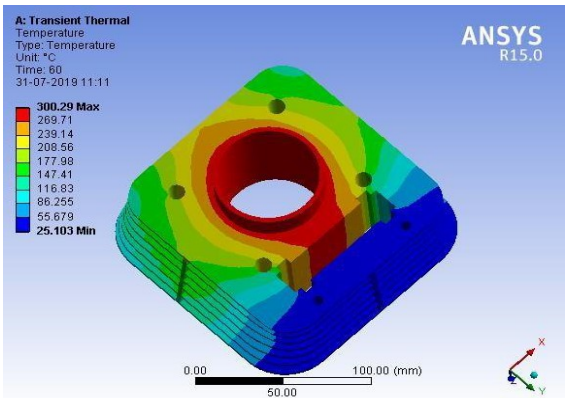

Fig.1.13 Temperature distribution in cylinder at 60 sec for CGI 2mm thickness

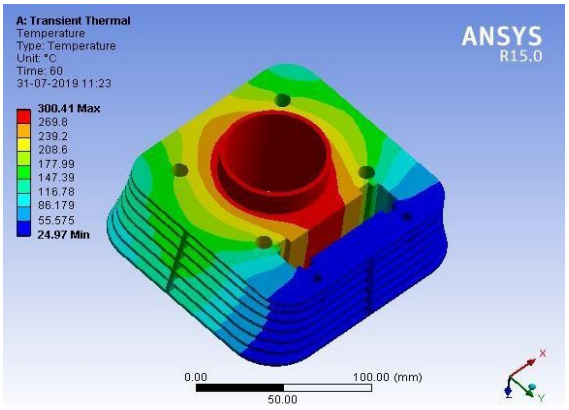

Fig.1.14 Temperature distribution in cylinder at 60 sec for CGI 2.5mm thickness

VI.RESULTS

Material	Deformation in mm	Heat flux	Temperature distribution range
Al 6061	0.67525	0.80702	154.37-300.1
AMC-SCI	0.7527	0.60869	137.27-300.01
CGI	0.28814	0.48836	25.244-300.2

Table 14.1 fin thickness 1.5 mm, spacing 10 mm

Material	Deformation in mm	Heat flux	Temperature distribution range
Al 6061	0.67288	0.82786	153.36-300.04
AMC-SCI	0.74984	0.6246	136.33-300.04
CGI	0.28708	0.49692	25.103-300.29

Table 14.2 fin thickness 2 mm, spacing 10 mm

Material	deformation mm	Heat flux	Temperature distribution range
Al 6061	0.67125	0.87008	152.54-300.06
AMC-SCI	0.74772	0.65845	135-300.06
CGI	0.32865	0.5255	24.97.26-300.41

Table 14.3 fin thickness 2.5 mm, spacing 10 mm

VII. CONCLUSION

By the end of the analysis, it conveys a message that to have an optimum material is AMC-SCI (Mg alloy) with 2.5mm thickness of fins. For making of Air cooled Engine cylinder one need to choose higher values for convective heat transfer coefficient, thermal conductivity, heat flux, high temperature resistance value and low weight factor.

VIII.REFERENCES

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