IJRI PUBLISHERS
1401-1402
International Journal of Research and Innovation (IJRI)
OPEN ACCESS
ATICS

DYNAMIC ANALYSIS OF ENGINE BLOCK FOR SELECTION OF SUITABLE MATERIAL FOR COST & WEIGHT REDUCTION.

Y.sathaiah [1], Gandhi Perumallapalli[2], D.sreeramprasad [3]

1 Research Scholar, Department Of Mechanical Engineering, Sri Venkateswara Engineering College, Amaravadi Nagar, Suryapet,India
2 Assistant professor , Department Of Mechanical Engineering, Sri Venkateswara Engineering College, Amaravadi Nagar, Suryapet,India
3 Associate Professor , Department Of Mechanical Engineering, Sri Venkateswara Engineering College, Amaravadi Nagar, Suryapet,India

Abstract

A cylinder block is an integrated structure comprising the cylinder(s) of a reciprocating engine and often some or all of their associated surrounding structures. The term engine block is often used synonymously with "cylinder block".

One of the main components in an IC engine is the combustion chamber. The design of a combustion chamber has an important influence upon the engine performance and its knock properties. Design of a combustion chamber involves the shape of the combustion chamber, location of the spark plug and the position of the inlet and exhaust valves.

The Aim of this project is to design a combustion chamber using Pro-E and perform analysis using ANSYS software. The analysis of the combustion chamber is done by using different materials. By conducting the above analysis on the combustion chamber combustion rate, pressure and temperature gradient conditions are found and the best material for the combustion chamber is suggested.

Thermal analysis is conducted to find heat dissipation rate in engine block with the variation of materials Structural and fatigue analysis(dynamic) is conduct on engine block at working load conditions to evaluate and compare stress, strain, deformation and fatigue life with the variation of materials.

Frequency analysis is conducted on engine block with the variation of materials to evaluate frequency,
Using these values material selection will be done, the value should be nearby previous one (cast iron) maximum accepted variation value 65HZ.

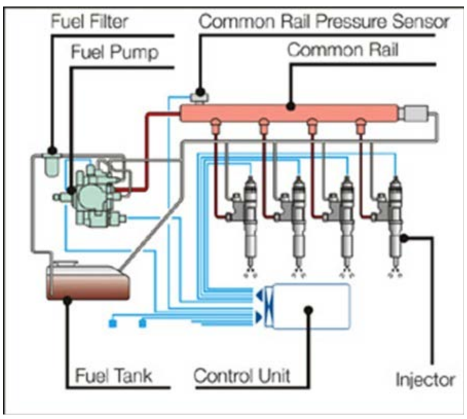
***Corresponding Author**:

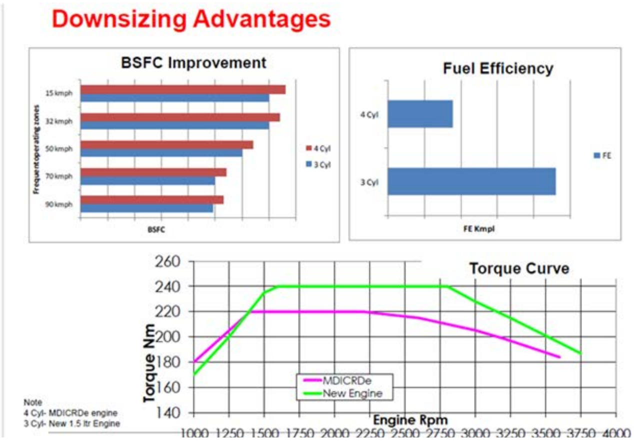
Y.sathaiah,
Research Scholar,
Department Of Mechanical Engineering,
Sri Venkateswara Engineering College,
Amaravadi Nagar,Suryapet,India
Published: June 30, 2015
Review Type: peer reviewed
Volume: II, Issue : III

Citation: Y.sathaiah, Research Scholar (2015) DYNAMIC ANALYSIS OF ENGINE BLOCK FOR SELECTION OF SUITABLE MATERIAL FOR COST & WEIGHT REDUCTION.

INTRODUCTION

CRDI diesel engine (Common rail direct fuel injection)





The Quanto resembles the Xylo, so looks would not be a concern for buyers, however the pricing is what we are looking forward to. Stay tuned for more updates on the Mini Xylo aka Mahindra Quanto.

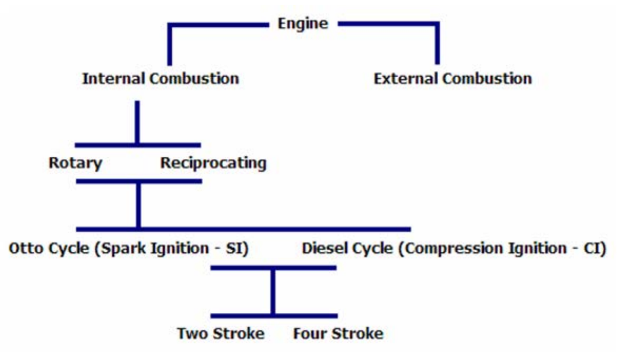
A cylinder block is an integrated structure comprising the cylinder(s) of a reciprocating engine and often some or all of their associated surrounding structures (coolant passages, intake and exhaust passages and ports, and crankcase). The term engine block is often used synonymously with "cylinder block" (although technically distinctions can be made between engine block cylinders as a discrete unit versus engine block designs with yet more integration that comprises the crankcase as well).
In the basic terms of machine elements, the various main parts of an engine (such as cylinder(s), cylinder head(s), coolant passages, intake and exhaust passages, and

crankcase) are conceptually distinct, and these concepts can all be instantiated as discrete pieces that are bolted together. Such construction was very widespread in the early decades of the commercialization of internal combustion engines (1880s to 1920s), and it is still sometimes used in certain applications where it remains advantageous (especially very large engines, but also some small engines). However, it is no longer the normal way of building most petrol engines and diesel engines, because for any given engine configuration, there are more efficient ways of designing for manufacture (and also for maintenance and repair). These generally involve integrating multiple machine elements into one discrete part, and doing the making (such as casting, stamping, and machining) for multiple elements in one setup with one machine coordinate system (of a machine tool or other piece of manufacturing machinery). This yields lower unit cost of production (and/or maintenance and repair).

Internal Combustion Engines:

The Internal Combustion Engine (also known as IC Engine) is an engine in which the combustion of fuel and an oxidizer (typically air) occurs inside a confined space called a combustion chamber. This exothermic reaction creates gases at high temperature and pressure, which are permitted to expand inside that confined chamber. Thrust produced by this expanding gas drives the engine creating useful work.

Engine classification:



Spark Ignition (SI) Engine: Inside the combustion chamber of this type of engine, the mixture of fuel and air is ignited by a spark plug to initiate the exothermic combustion reaction.

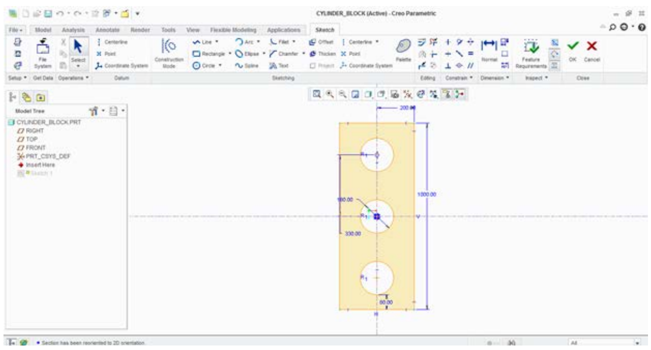
Compression Ignition (CI) Engine: This type of internal combustion engine does not have spark plug. Inside the combustion chamber of this engine, air is compressed to a high enough pressure and temperature that combustion occurs spontaneously when fuel is injected at the end of air compression.

Advantages and Applications
SI Engines
Lightweight
Low Cost
Suited for applications in smaller and medium sized automobiles requiring power up to about 225 kW (300 horsepower)
Also used as domestic electricity generators and outboard engines for smaller boats

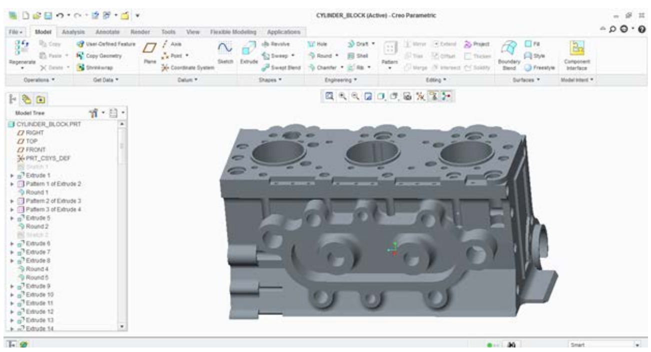
CI Engines
Suited for medium and large size mobile applications such as heavy trucks and buses, locomotives and ships, auxiliary power units (emergency diesel generators in industries) where fuel economy and relatively large amount of power both are required yet being noisy.

COMBUSTION CHAMBER:
A Combustion Chamber is a part in which combustion of fuel or propellant, in particular, is initiated in internal combustion engine The combustion technology increases the inner power of a gas, that translates into a rise in temp, pressure, or volume reliant on the specification in an enclosure, for instance the cylinder of a repayment engine, the volume is manipulated & the combustion creates a rise in pressure. In a constant flow arrangement, for example a jet-type engine combustor, the compression is initiated & the burning makes an rise in volume. This rise in compression or volume can be utilized to do work, for example, to push a piston on a crank or a engine disc-type in a gas turbine.

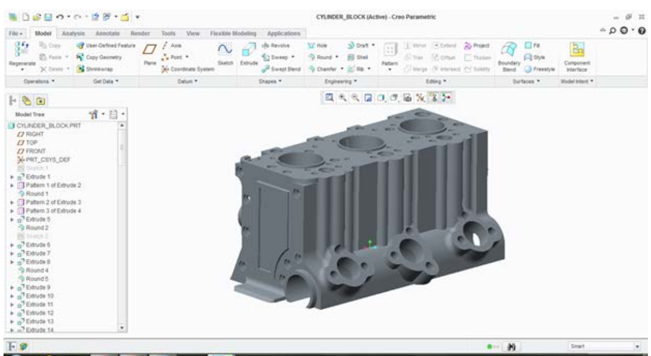
3D MODELS OF ENGINE BLOCK



The above image shows sketcher

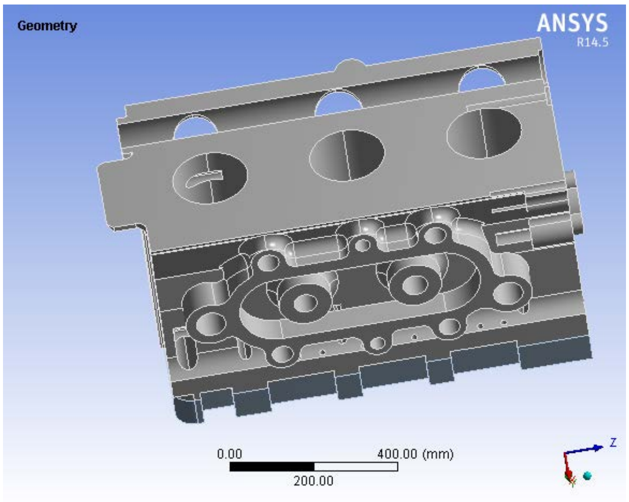


The above image shows engine block front view

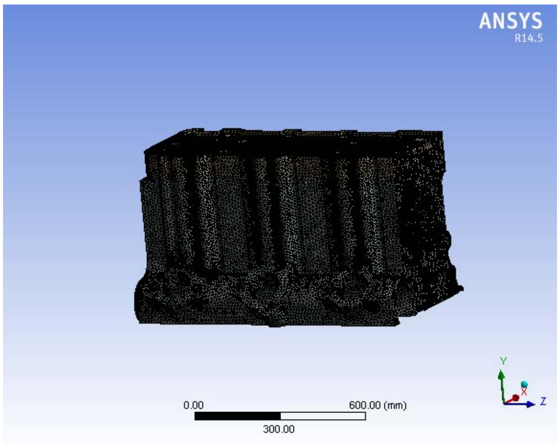


The above image shows engine block side view

COUPLE FIELD ANALYSIS OF ENGINE BLOCK USING CAST IRON

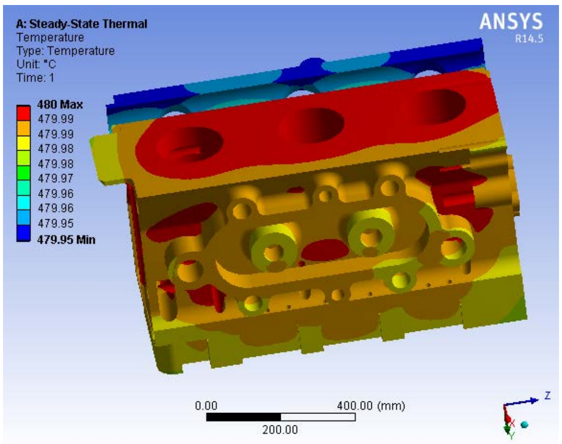


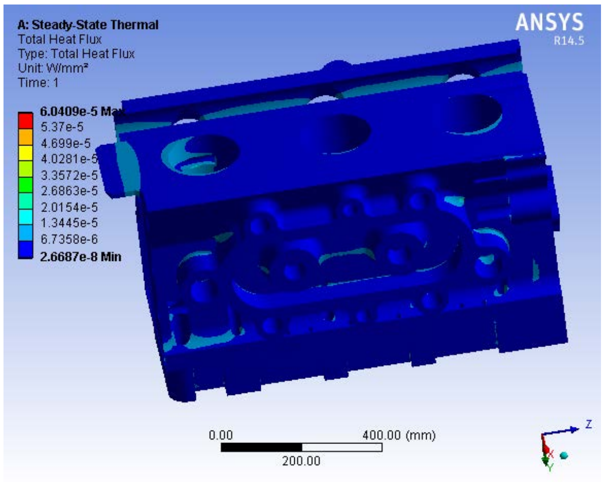
The above image shows engine block imported model

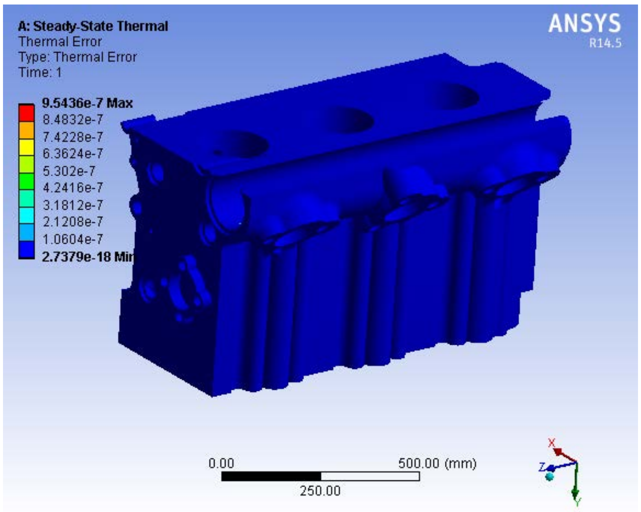


The above image shows engine block mesh model

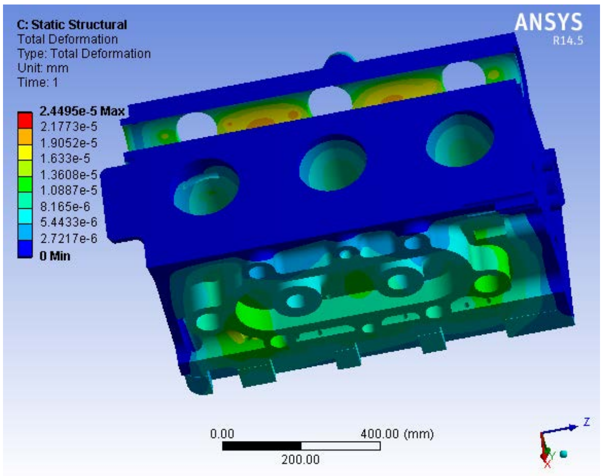
Thermal Analysis:





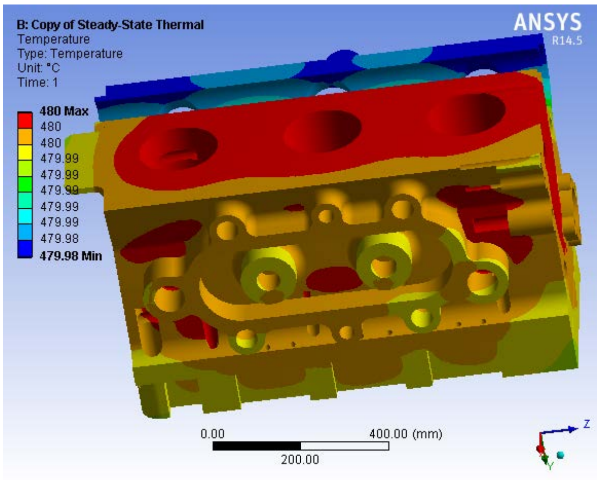


Structural analysis:

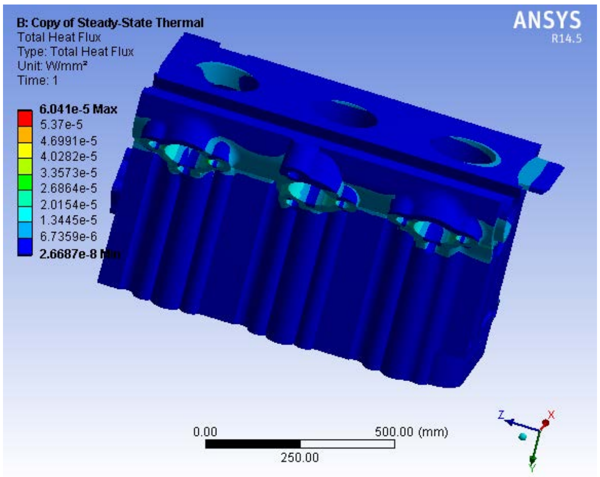


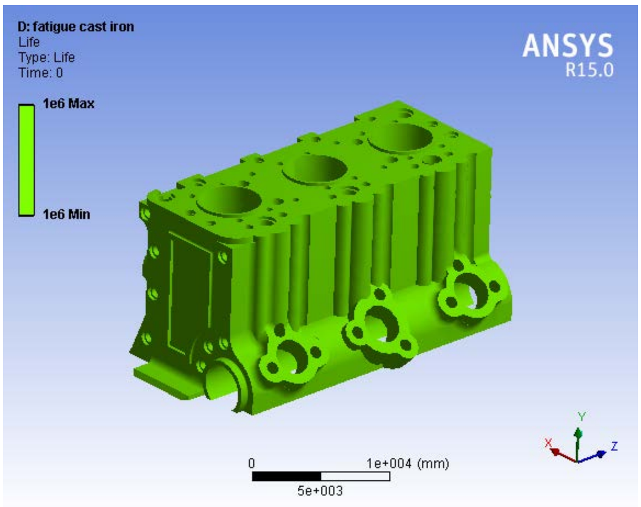
COUPLE FIELD ANALYSIS OF ENGINE BLOCK USING ALUMINUM ALLOY

Thermal analysis:

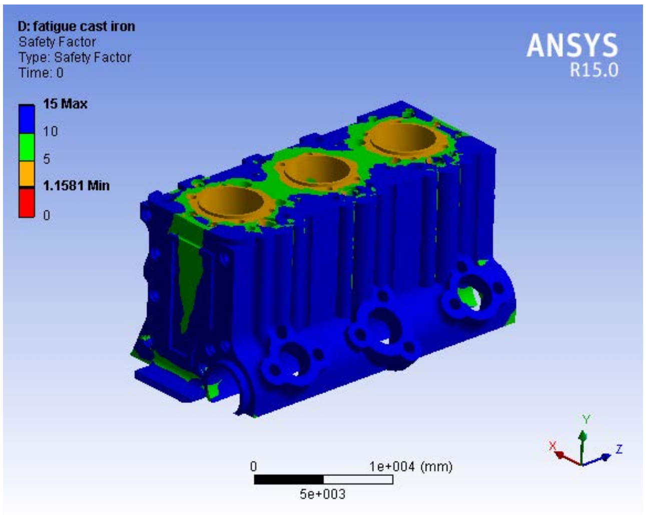


FATIGUE ANALYSIS OF ENGINE BLOCK USING CAST IRON

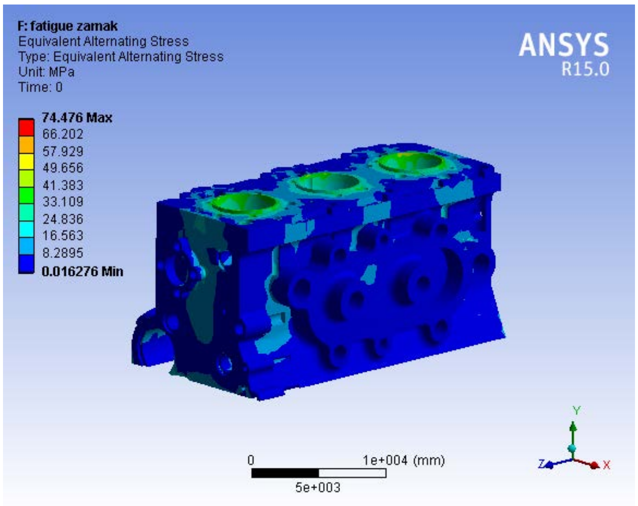




The above image shows life

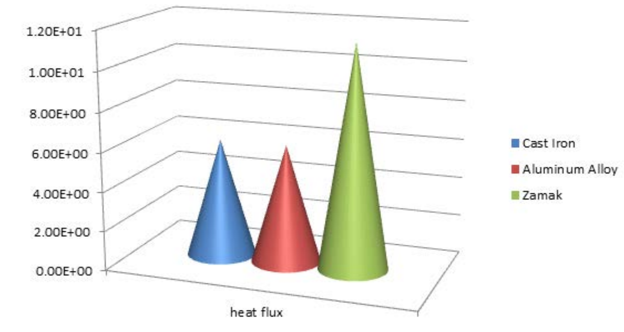


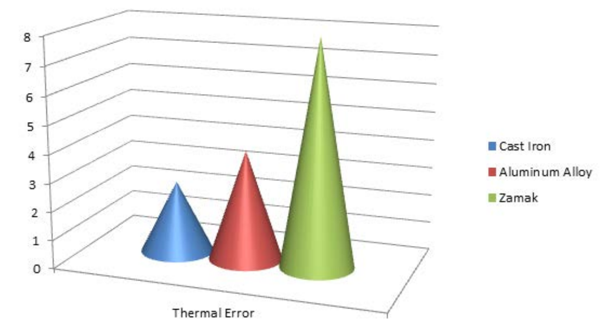
The above image shows safety factor



The above image shows alternating stress

GRAPHS AND RESULTS TABLES





		Cast Iron	Aluminum Alloy	Zamak
Thermal Analysis	Temperature	480	480	480
	Heat Flux	$6.0409e^{-5}$	$6.041\ e^{-5}$	$2.8938e^{-4}$
Structural Analysis	Deformation	$2.4495\ e^{-5}$	$1.804\ e^{-13}$	$4.6205\ e^{-9}$
	Strain	$1.4594\ e^{-6}$	$9.5932\ e^{-15}$	$2.8482\ e^{-10}$
	Stress	0.25687	$5.9794\ e^{-10}$	$4.9642\ e^{-5}$

dynamic analysis			
	Cast Iron	Aluminum Alloy	Zamak
Total deformation mode 1	26.444	33.861	25.816
Total deformation mode 2	33.518	42.432	32.65
Total deformation mode 3	35.455	44.829	34.529
Total deformation mode 4	52.762	66.932	51.417
Total deformation mode 5	62.498	79.912	61.004

CONCLUSION

This project works deals with "DYNAMIC ANALYSIS OF ENGINE BLOCK FOR SELECTION OF SUITABLE MATERIAL FOR COST & WEIGHT REDUCTION."
Initially literature survey and data collection was done to understand methodology.
ENGINE BLOCK 3d model is prepared using CREO Parametric (pro/e).
Static, thermal, fatigue and dynamic analysis is done on ENGINE BLOCK using Cast Iron. Same has been done using aluminum and ZAMAK materials and to find out the failure locations and to evaluate results.
As per the Static, thermal, fatigue and dynamic analysis results, existing model is up to the mark only. Implementation of ZAMAK material will increase life.
This project concludes that ENGINE BLOCK model with ZAMAK material increases the life and also weight will be reduced which interns increases the mechanical efficiency.
By reducing weight manufacturer can reduce cost of material and machining.

	Density	Weight of component	cost
Cast iron	7810	1227	1227*75=92025
aluminium	2680	422	422*106=44732
zamak	6600	1038	1038*80=83040

For engine block manufacture can reduce 9000/-for engine block weight up to 190 kgs by using above said model

REFERENCES

[1] ANALYSIS OF COMBUSTION CHAMBERS IN INTERNAL COMBUSTION ENGINE Global Science and Technology Journal Ariz Ahmad

[2] THERMAL AND STRESS DISTRIBUTION OF DIFFERENT I.C. ENGINE PISTON COMBUSTION CHAMBERS USING 3-D FINITE ELEMENT ANALYSIS METHOD International Journal of Innovative Research in Science, Engineering and Technology Dr .G.R.Kannan , Anoop Aravind

[3] STRUCTURAL STRESS ANALYSIS OF AN ENGINE CYLINDER HEAD Radek Tichanek , Miroslav Spaniel , Marcel Divis

[4] A STUDY ON STRUCTURAL STRESS ANALYSIS OF AN ENGINE CYLINDER HEAD Dr. M. Lakshman Rao

[5] LDA AND PIV ANALYSES AND COMPARISON OF IN-CYLINDER FLOW STRUCTURES UNDER STEADY FLOW CONDITIONS Graham Pitcher, Saud Binjuwair, Tom Picton-Turbervill, Andrew Wood, Graham Wigley and Dave Hollis

[6] SURFACE TEMPERATURE PREDICTION AND THERMAL ANALYSIS OF CYLINDER HEAD IN DIESEL ENGINE International Journal of Engineering Research and Applications (IJERA) Amit V. Paratwar, D.B Hulwan

[7] STATIC STRESS ANALYSIS OF IC ENGINE CYLINDER HEAD INTERNATIONAL REVIEW OF APPLIED ENGINEERING RESEARCH Sreeraj Nair K., Kiran Robert and Shamnadh M.

[8] THERMAL ANALYSIS ON CYLINDER HEAD OF SI ENGINE USING FEM International Journal of Scientific Engineering and Research (IJSER) Pradeep Mani Tripathi, Satya Prakash, Rahul Singh, Satish Kumar Dwivedi

Authour

Y.sathaiah
Research Scholar, Department of Mechanical Engineering,Sri Venkateswara Engineering College, Amaravadi Nagar, Suryapet - 508213.Nalgonada (Dt), India.

Gandhi Perumallapalli
Assistant Professor in Mechanical Engineering
Sri Venkateswara Engineering College,
Amaravadi Nagar, Suryapet - 508213.Nalgonada (Dt),India.

D[illegible]d
Associate Professor In Mechanical Engineering
Sri Venkateswara Engineering College,
8 Years Industrial, 18 Years Teaching+ Years