Design and Analysis of Six Stroke Cylinder Block

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Abstract - **A cylinder block is an incorporated structure containing the cylinder(s) of a reciprocating engine and regularly a few or the greater part of their related surrounding structures (coolant passage, intake and exhaust passages and ports, and crankcase). The term engine block is regularly utilized synonymously with "cylinder block".**

In the basic terms of machine elements, the different fundamental parts of a engine, (for example, cylinder(s), cylinder head(s), coolant sections, intake and exhaust passages, and crankcase) are theoretically particular, and these ideas can all be instantiated as discrete pieces that are bolted together. Such construction was extremely widespread in the early many years of the commercialization of internal combustion motors (1880s to 1920s), and it is still in some cases utilized as a part of specific applications where it stays profitable (particularly large engines, additionally some small engines). However, it is no more the ordinary method for building most petrol engines and diesel engines, in light of the fact that for any given engine setup, there are more effective methods for planning for production (furthermore for support and repair). These for the most part include incorporating different machine components into one discrete part, and doing the making, (for example, casting, stamping, and machining) for multiple components 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).

Today most engines for autos, trucks, buses, tractors, so on are built with fairly highly integrated design, so the words "mono block" and "en block" are from time to time utilized as a part of describing them; such constructions is frequently certain. Thus "engine block", "cylinder block", or basically "block" are the terms liable to be heard in the garage or in the city.

In this project we are going to do design of cylinder engine block and thermal analysis of engine block with different materials then we conclude the witch material is good to manufacturing the engine block.

Index Terms - **Reciprocating engine, Cylinder block, Internal combustion motors, Machine coordinate system, Mono block, En block etc.**

INTRODUCTION

The first successfully working internal combustion engine used in an automobile was built by Siegfried Marcus in approximately 1864. It was an upright single-cylinder, two-stroke petroleum-fuelled engine that also utilized a carburettor to deliver fuel to the engine. The engine was placed on a cart with four wheels and successfully ran under its own power. Not only has Marcus produced the first engine that is the direct predecessor to today's engines, he had also built the first automobile in history, some 20 years before Gottlieb Daimler's automobile.

Today's engines are an integral component of an automobile that are built in a number of configurations and are considerably more complex than early automotive engines.

Technological innovations such as electronic fuel injection, drive-by-wire (i.e., computer-controlled) throttles, and cylinder-deactivation have made engines more efficient and powerful.

The use of lighter and stronger engineering materials to manufacture various components of the engine has also had an impact; it has allowed engineers to increase the power-to-weight of the engine, and thus the automobile.

Common components found in an engine include pistons, camshafts, timing chains, rocker arms, and other various parts. When fully stripped of all components, the core of the engine can be seen: the cylinder block. The cylinder block (popularly known as the engine block) is the strongest component of an engine that provides much of the housing for the hundreds of parts found in a modern engine. Since it is also a relatively large component, it constitutes 20-

25% of the total weight of an engine. Thus there is much interest in reducing the block's weight.

1.1 Cylinders integrated into one or several cylinder blocks

A cylinder block is a unit comprising several cylinders (including their cylinder walls, coolant passages, cylinder sleeves if any, and so forth). In the earliest decades of internal combustion engine development, monobloc cylinder construction was rare; cylinders were usually cast individually. Combining their castings into pairs or triples was an early win of monobloc design.

Each cylinder bank of a V engine (that is, each side of the V) typically comprised one or several cylinder blocks until the 1930s, when mass production methods were developed that allowed the modern form factor of having both banks plus the crankcase entirely integrated.

A wet liner cylinder block features cylinder walls that are entirely removable, which fit into the block by means of special gaskets. They are referred to as "wet liners" because their outer sides come in direct contact with the engine's coolant. In other words, the liner is the entire wall, rather than being merely a sleeve

1.2 Cylinder head

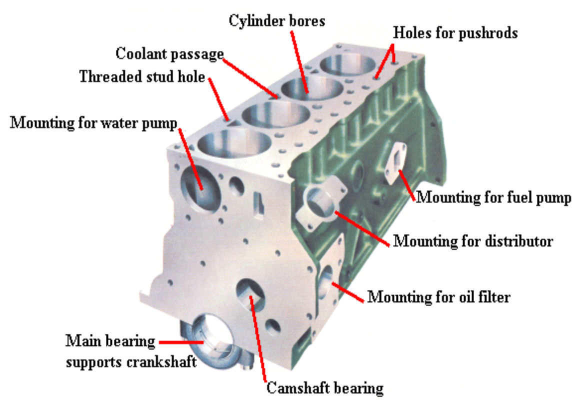
The head gasket is the most highly stressed static seal in an engine and was a source of considerable trouble in early years. The monobloc cylinder head forms both cylinder and head in one unit, thus avoiding the need for a seal.

Along with head gasket failure, one of the least reliable parts of the early petrol engine was the exhaust valve, which tended to fail by overheating and burning. A monobloc head could provide good water cooling, thus reduced valve wear, as it could extend the water jacket uninterrupted around both head and cylinder. Engines with gaskets required a metal-to-metal contact face here, disrupting water flow.

The drawback to the monobloc head is that access to the inside of the combustion chamber (the upper volume of the cylinder) becomes difficult. Access through the cylinder bore is restricted for machining the valve seats, or simply for inserting angled valves. An even more serious restriction is that for the maintenance task of de-coking and re-grinding the valve seats, a regular task on older engines. Rather than removing the cylinder head from above, the mechanic must now remove pistons, connecting rods and the entire crankshaft from beneath.

1.3 Technology used in engine block manufacturing

Casting technology at the dawn of the internal combustion engine could reliably cast either large castings, or castings with complex internal cores to allow for water jackets, but not both simultaneously. Most early engines, particularly those with more than four cylinders, had their cylinders cast as pairs or triplets of cylinders, then bolted to a single crankcase. As casting techniques improved, the entire cylinder block of four, six or even eight cylinders could be cast as one. This was a simpler construction, thus cheaper to make, and the communal water jacket permitted closer spacing between cylinders. This also improved the mechanical stiffness of the engine, against bending and the increasingly important torsional twist, as cylinder numbers and engine lengths increased. In the context of aircraft engines, the non-monobloc precursor to monobloc cylinders was a construction where the cylinders (or at least their liners) were cast as individuals, and the outer water jacket was applied later from copper or steel sheet. This complex construction was expensive, but lightweight, and so it was only widely used for aircraft.



1.4 Manufacturing of cylinder block

There are two methods used to cast engine blocks for all materials: green sand moulding or lost foam casting. The latter, pioneered by General Motors for their Saturn vehicles, have become more popular due to its capability to produce near net shape components, provide tight tolerances for critical components, and reduce machine maintenance and cost.

II. MATERIALS

Gray Cast Iron Alloys

Gray cast iron alloy have been the dominant metal that was used to manufacture.conventional gas-powered engine blocks. Though extensive use of aluminium alloys has diminished the popularity of this material, it still finds wide use in diesel-fuelled blocks, where the internal stresses are much higher. Gray cast iron alloys typically contains 2.5-4 wt.% carbon and 1-3 wt.% silicon, 0.2-1.0 wt.% manganese, 0.02-0.25 wt.% sulphur, and 0.02-1.0 wt.% phosphorus

BMW’s S54 inline-6 engine, which uses a gray cast iron engine block

Aluminum Alloys

One of the key weight saving features in the engine design is the use of a cast aluminium cylinder block with cast iron cylinder liners.The cast iron liners (with ground outside-diameter) are press-fit into the precision bored aluminium cylinder block. This provides optimal heat transfer into the cylinder block.

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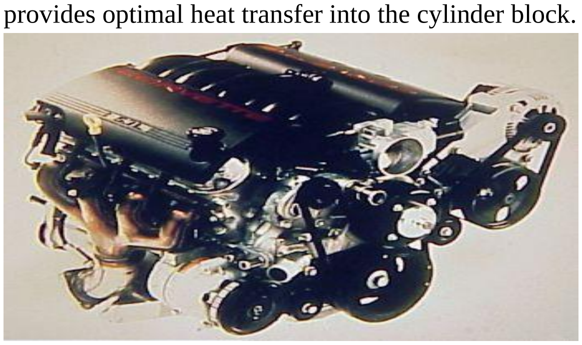


The Chevrolet Corvette LS1 V8 engine which utilizes an aluminium alloy 319-T5 cylinder block

Magnesium Alloys

Magnesium alloys have been used in engines before, but not for cylinder blocks. Rather, they were used as valve covers, cylinder head covers, intake manifolds, rocker arm covers, air intake adaptors, induction systems, and accessory drive brackets.

BMW’s 6-cylinder R6 power plant uses a magnesium alloy AMC-SC1-fabricated cylinder block

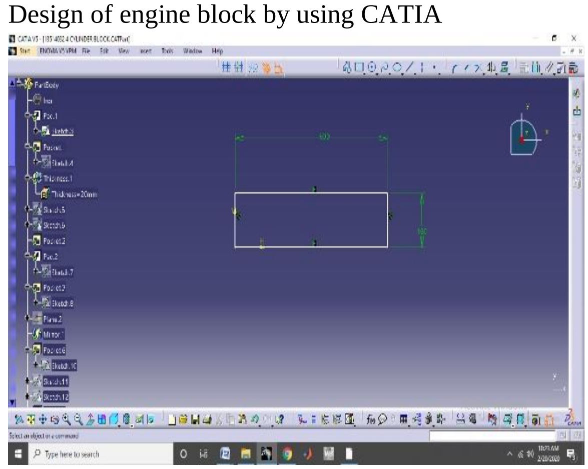
III. CATIA

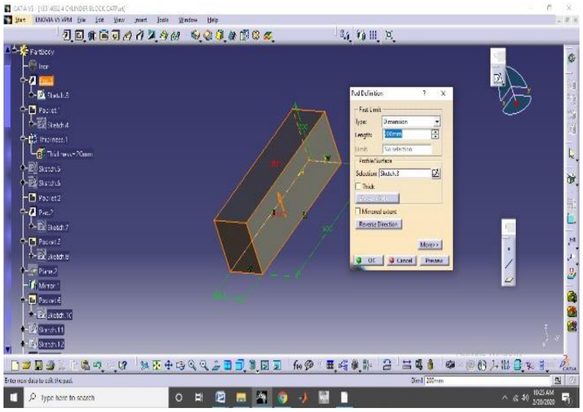
French organization Dassault Systems created multi-stage CAD/CAM/CAE business programming CATIA (Computer Aided Three-dimensional Interactive Application). This is composed in the C++ programming language, CATIA is the primary result of the Dassault Systems item lifecycle administration programming suite.

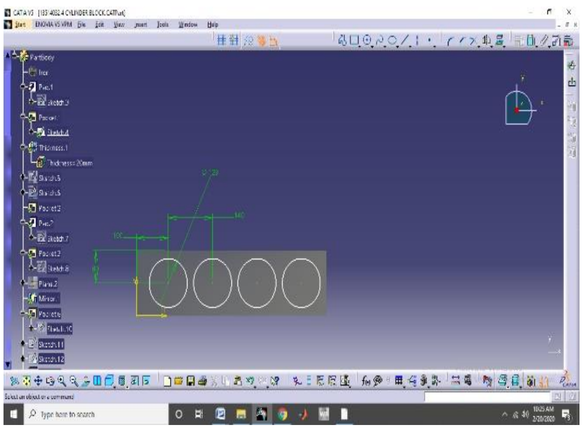
CATIA competes with Siemens NX, Pro/E, Autodesk Inventor, and Solid Edge as well as many others in the CAD/CAM/CAE market

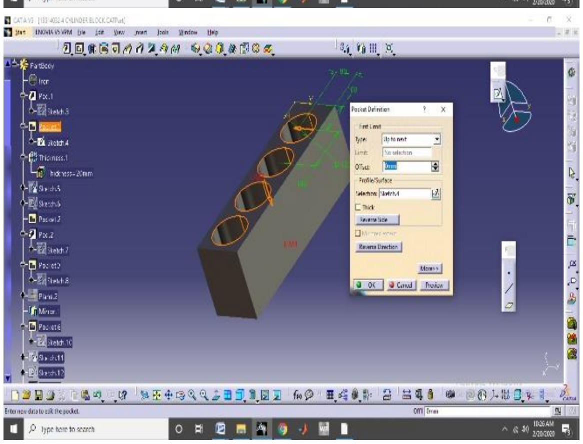
Developer(s)	Dassault Systems
Stable release	V6R2011x / November 23, 2010
Operating system	Unix / Windows
Type	CAD software
License	Proprietary
Website	WWW.3ds.com

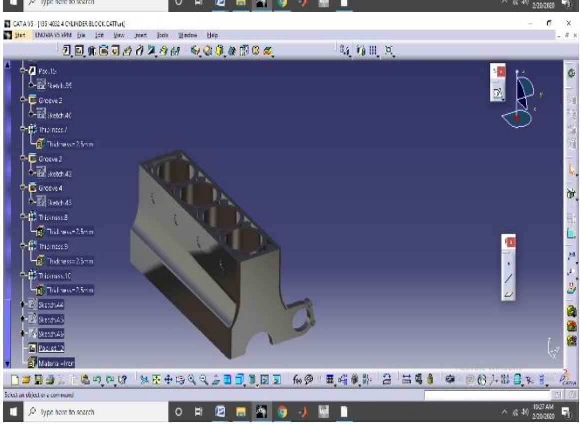
Design of engine block by using CATIA











IV.ANALYSIS

The ANSYS program is self-contained general purpose finite element program. This is developed and maintained by Swason analysis systems Inc.

ANSYS finite element analysis software enables following tasks:

- Apply design performance conditions or other operating loads.
- Build computer model or transfer models of structures, components, products, or system.
- Testing prototype in environments where it otherwise would be impossible or undesirable.
- Studying physical responses such as temperature distributions, stress levels or electromagnetic fields.
- Reducing the productions cost by optimizing design early in the development process.

The ANSYS project has a compressive graphical client interface (GUI) that gives clients simple, intelligent access to program capacities, orders, documentation and reference material. A natural menu framework offers clients some assistance with navigating through the ANSYS program. Clients can enter information utilizing a mouse, a console, or a blend of both.

A graphical client interface all through the project, to direct new clients through the learning process and furnish more experienced clients with different windows, draw down menus, dialog boxes, apparatus bar and online documentation.

ORGANIZATION OF THE ANSYS PROGRAM

The ANSYS program is organized into two basic levels:

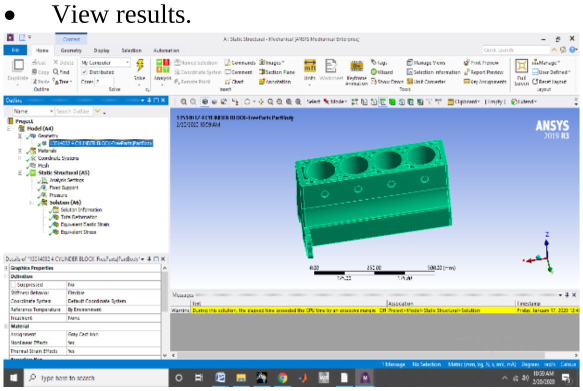
- begin level (Start level)
- Processor (or routine) level

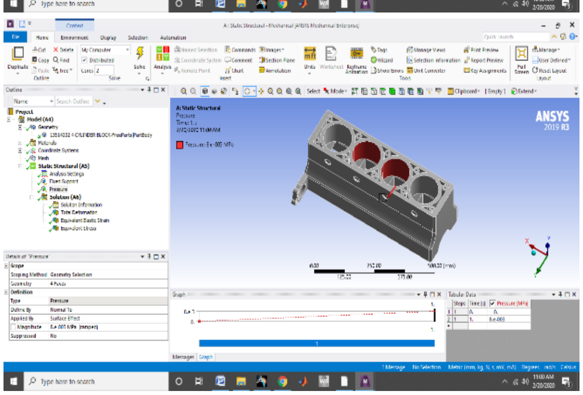
Begin level acts as a gateway into and out of the ANSYS program. Changing the name of job, database clearing, and binary files copying are program controls used. When we first enter the program, we at the begin level.

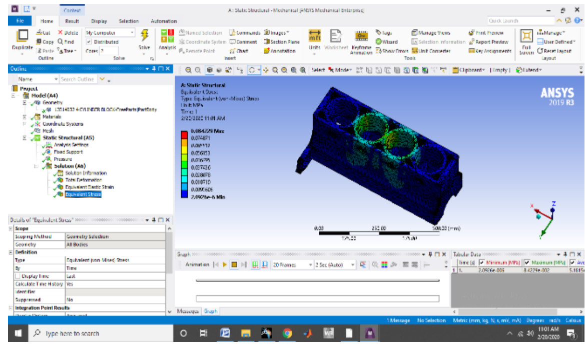
At the processor level, several processors are available; each processor is a set of functions that specific analysis task perform. For instance, the general preprocessor (PREP7) is the place we fabricate the model, the arrangement processor (SOLUTION) is the place we apply stacks and get the arrangement, and the general postprocessor(POST1) is the place we assess the outcomes and acquire the arrangement. An extra postprocessor (POST26) empowers we to assess arrangements results at particular focuses in the model as an element of time.

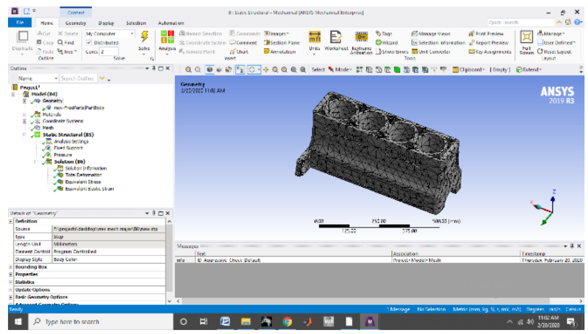
Analysis Steps:
The steps needed to perform an analysis depend on the study type. You complete a study by performing the following steps:

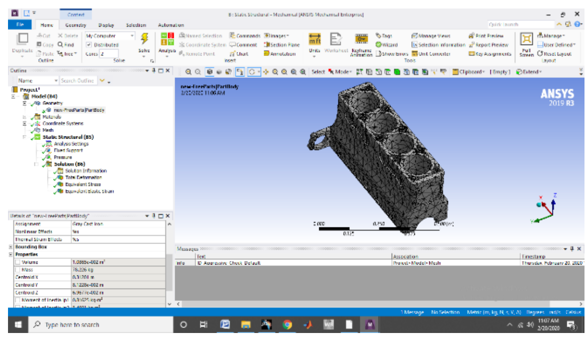
- Create a study defining its analysis type and options.
- If needed, define parameters of your study. A parameter can be a model dimension, material property, force value, or any other input.
- Define material properties.
- Specify restraints and loads.
- The program automatically creates a mixed mesh when different geometries (solid, shell, structural members etc.) exist in the model.
- Define component contact and contact sets.
- Mesh the model to divide the model into many small pieces called elements. Fatigue and optimization studies use the meshes in referenced studies.
- Run the study.
- View results.











V. RESULTS

S.NO	OLD GEOMETRY	NEW GEOMETRY
STRESS	84229 Pa	81989Pa
WEIGHT	83.585kgs	78.226kgs

VI. CONCLUSION

Extracting maximum amount of energy from the gases at high temperature to improve thermal efficiency is the main aim of the multi cylinder engine block technology.

In this project, thermal stresses on the turbine engine block are analyzed. The design of engineis generated by using CATIA V5 design software. structural analysis is performed on the engine block by applying engine optimum pressure .

and we compared the results of both design we got low stress value for the new design and weight also decreased.

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