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Design and Stress Analysis of AL-SIC MMC and Cast Iron Single Cylinder 4 Stroke Engine Crankshaft

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Abstract—the crankshaft is the important component in the automobiles. In this paper static analysis is conducted on the $ stroke engine crankshaft. The part modelling of the 2 crankshaft is made in the modelling tool UNIGRAPHICX NX8 of similar dimensions and discretization meshing of the model is done in the meshing tool HYPERMESH and analysis of the both the crankshaft are made in the analysis tool ANSYS. The boundary conditions for both the crankshafts are derived from the engine mounting specifications. After the analysis comparison of the stress of the both the cast iron and Al-Sic crankshaft is done and results are concluded.
Keywords: - Cast iron, Aluminium silicate, ANSYS, UNIGRAPHICX, HYPERMESH, and Static.

I. INTRODUCTION

The crankshaft is the heart of the automobiles of land, water and air (Internal combustion engine) which is located below the piston connected through the connecting rod and which converts the reciprocating motion of the piston to the rotary motion. Generally the crankshaft is made by forging and casting. Most of the crankshafts are made of cast iron and some other alloy. Some of the crankshafts are coated with nitrite etc. Crankshaft experience maximum force in its life time so the damage occurs in the crankshaft generally the breakdown of the crankshaft take place at the fillet radius and maximum deformation at the centre of the crank surface. Generally the strength of the crankshaft should be high and weight should be less with respect to cost too. In this current research crankshaft is made of aluminium silicate (Al-Sic) and compared with cast iron crankshaft and determine that aluminium silicate suitable or not. Jaimin Brahmbhatt have been investigated crankshaft model was made by Solid works 2009 programming. At that point, the model made by Solid works was transported in to ANSYS programming. After that FEA Results Conformal coordinates with the theoretical estimation so they can say that FEA is a decent tool to reduce time during hypothetical Work. The greatest distortion shows up at the centre point of crankpin neck surface. The greatest stretch shows up at the filets between the crankshaft journal and crank cheeks and close to the main Journal. The edge of primary journal is high stress area. The Value of Von-Misses Stresses that turns out from the investigation is far not as much as material yield stress so the design is safe and optimization should be done to reduce the material and cost. In the wake of Performing Static Analysis they performed Dynamic examination of the crankshaft which results are more practical while static investigation gives an overestimate comes about. Deformation and stress are the input to fatigue analysis and optimization of the crankshaft. After Analysis Results, they can Say that Dynamic FEA is a best tool to reduce Costly exploratory work.

II. DESIGN CALCULATION FOR CRANKSHAFT

The Specifications of the Engine for crankshaft are listed below

Table 1: Specifications of engine

Type	Single cylinder engine
No of cylinders	1
Capacity	996
Bore x Stroke	98 x 66 mm
Cooling System	Liquid cooled
Compression Ratio	11.5:1
Max Power	112 hp / 83.5 kW @ 8500 rpm
Max Torque	99 Nm / 73 ft. lbs @ 7000 rpm

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Transmission	6 Speed

III. DESIGN METHODOLOGY

A. Initially part modelling of the two crankshaft(cast iron and Al-Sic) is made in UNIGRAPHICX NX8 tool and save the file in .IGES for analysis of crankshaft in ANSYS by importing.

B. Material application for crankshaft details

Material type 1: - Aluminium silicate (Al-Sic)
Poisson ratio: - 0.29
Yield strength:-500Mpa

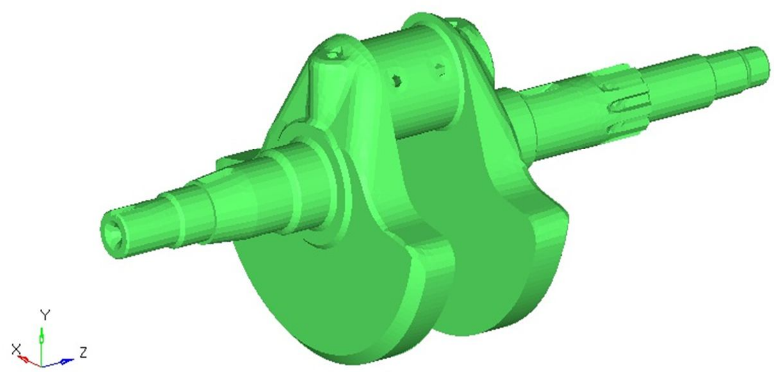

Fig 3.1 Al-Sic Crankshaft Model

Material type 2: - Cast iron
Poisson ratio: - 0.26
Yield strength:-620Mpa

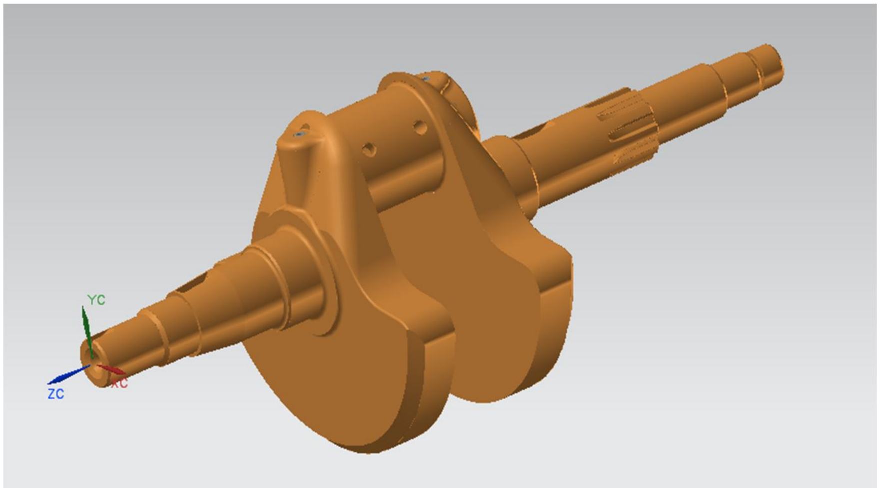

Fig 3.2 Cast iron Crankshaft Model

C. *Meshing of crankshaft*

Type of element: - Tetrahedron10.
Number of Nodes:-17338.
Number of Elements:-74045

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The visual of the both the crankshafts fig 3.3and 3.4 are similar but of different materials.

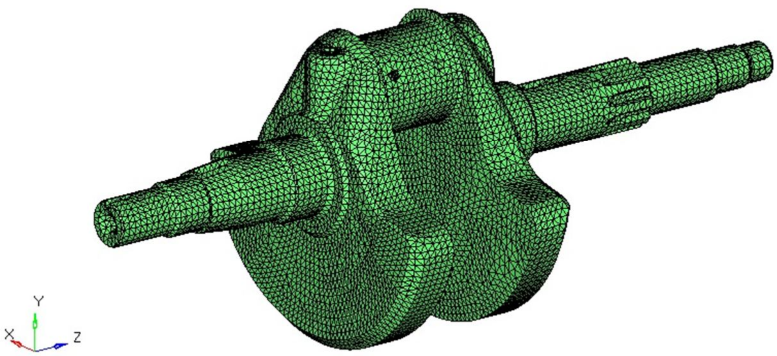

Fig 3.3 Meshed model of Al-Sic crankshaft

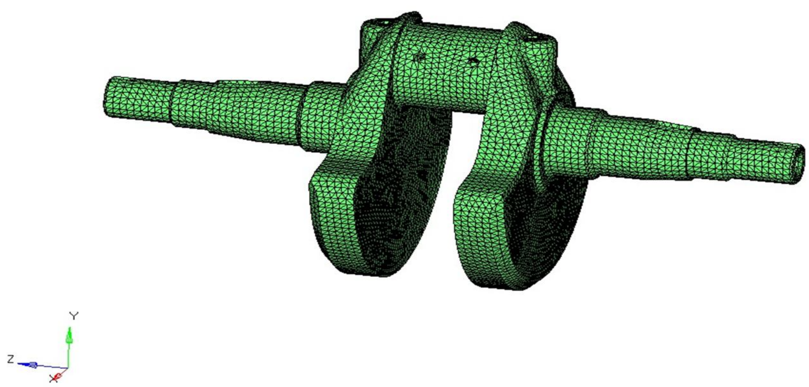

Fig 3.4 Meshed model of cast iron crankshaft

D. Boundary conditions for analysis

Boundary conditions play an important role in the part of analysis. Here we have taken the displacements for fixed bearing supports.

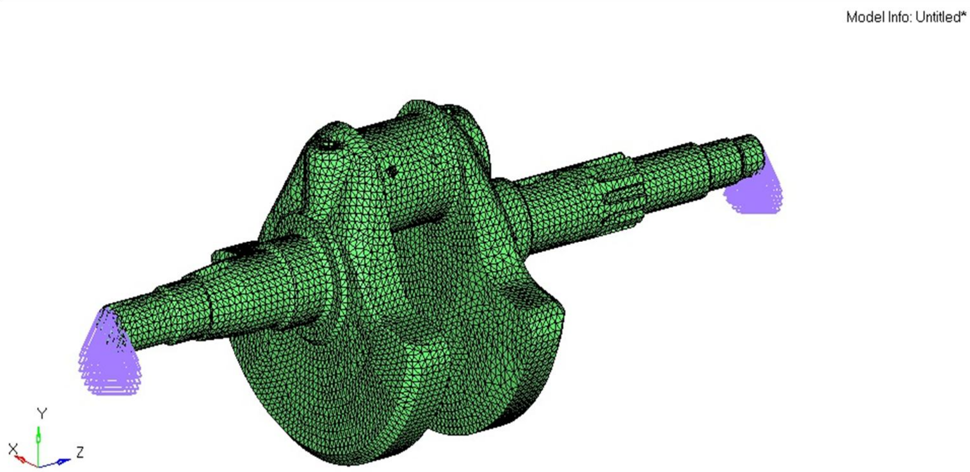

Fig 3.5 Fixed supports boundary conditions (Al-Sic)

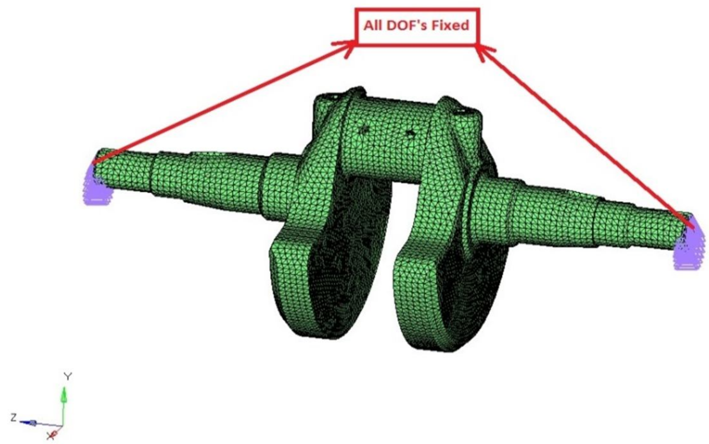

Fig 3.6 Fixed supports boundary conditions (Cast iron)

E. Type of analysis

Static structural analysis

Boundary conditions are calculated from the engine specifications.

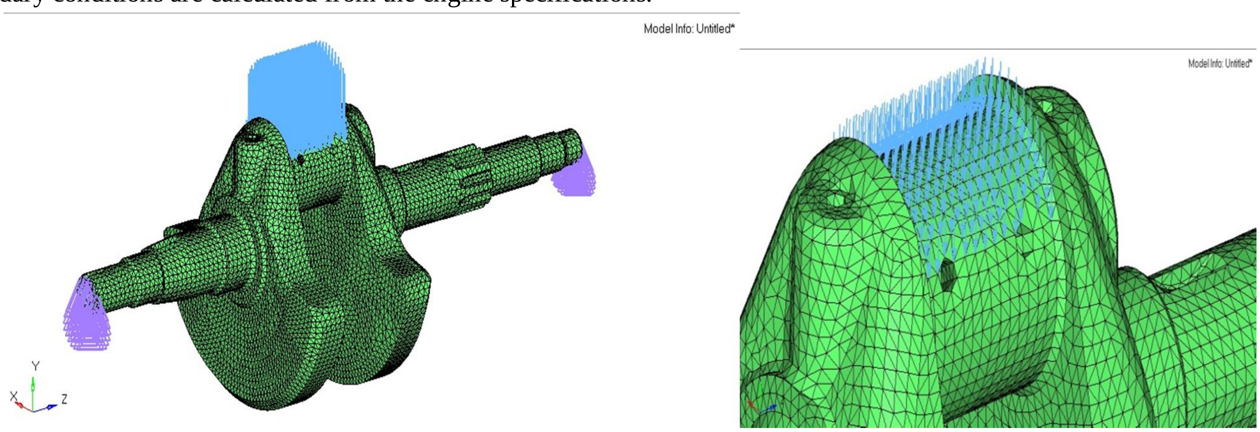

Fig 3.7 Applying of tangential force

F. Analysis run and results

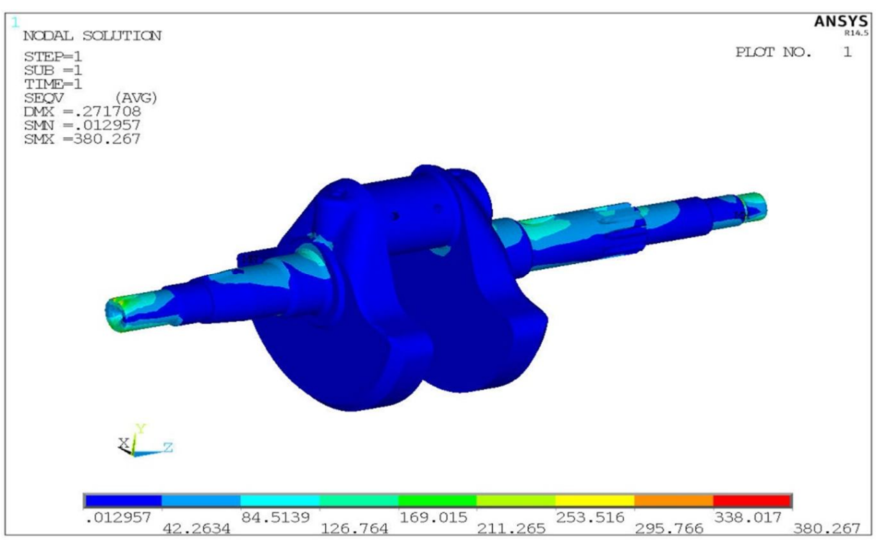

Fig 3.8 Von-Misses stress analysis for Al-Sic

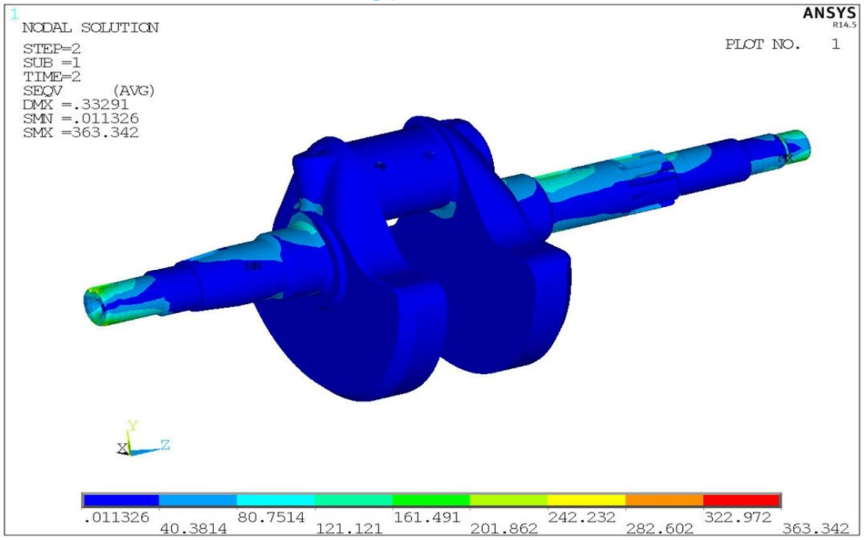

Fig 3.9 Von-Misses stress analysis for Cast iron

IV. RESULTS AND DISCUSSIONS

In this paper the model of crankshaft is created in UG NX8 and imported to ansys for analysis

Results table: 02

Type of stress	Al-Sic	Cast iron
Von-Misses stress, N/mm^2	380.267	363.342

A. Above Results Shows that FEA Results that the Von-Misses stress of aluminium silicate and cast iron are similar so aluminium silicate can be used for crankshaft. According to the analysis the maximum deformation appears at the centre of crankpin for both Al-Sic and cast iron crankshafts. So the damage occurs more at the fillet radius. The edge of main journal is high stress area.

B. The Value of material yield stress is more compared to von-misses stress obtained von-Misses Stresses so our design is safe and we should go for optimization to reduce the material and cost.

C. As the density of the Al-Sic is less compared to Cast iron. The component weight of the Al-Sic is 1.892Kg and cast iron is 4.481Kg so according to our goal the weight of the Al-Sic crankshaft is 55% less compared to cast iron crankshaft and stress of the both the components are similar with negligible difference in stresses.

D. The low density and high specific mechanical properties of aluminum metal matrix composites (MMC) make these alloys one of the most remarkable material replacements for the manufacture of lightweight parts for many types of vehicles. With wear resistance and strength equal to cast iron, 67% lower density and 3 times the thermal conductivity, aluminum MMC alloys are idyllic materials for the manufacture of lightweight automotive crankshafts.

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REFERENCES

[1] Hiren natvarbhai makwana, dr. pushpendra Kumar Sharma[1] analysis of mini tractor crankshaft subject to dynamic loading international journal of advance research in science and engineering http://www.ijarse.com ijarse, vol. no.3, issue no.8, august 2014 issn-2319-8354(e) 167 | p a g e www.ijarse.com

[2] Anand, s and *parthasarathy [2], c research article analysis of multicylinder crankshaft for i.c-engine international journal of recent scientific research vol. 5, issue, 3, pp.706-711, March, 2014.

[3] V. Mallikarjuna Reddy and T. Vijaya Devi [3] Design, Analysis and Optimization of a 6 cylinder Engine Crank shaft International Journal of Modern Engineering Research (IJMER).

Volume 4 Issue V, May 2016
ISSN: 2321-9653

[4] B D N S Murthy and N S Teja Kollati [4] Modelling, Analysis and Optimization Of Crankshaft International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 www.ijert.org IJERTV2IS90299 Vol. 2 Issue 9, September – 2013.

[5] Amit Solanki and Jaydeepsinh Dodiya [5] Design and Stress Analysis of Crankshaft for Single Cylinder 4-Stroke Diesel Engine Mechanical Engg.Deptt, C.U.Shah University, Wadhwan city, Gujarat, INDIA Vol. 2 Issue V, May 2014 www.ijraset.com.

[6] P.N.Rohini and S.Nagu [6]Design and Optimization of IC Engine Crankshaft Mechanical Engineering Department, PSNA College of Engineering and Technology, Dindigu, Tamilnadu, India international journal of engineering sciences & research technology ISSN: 2277-9655.