MODELING, DESIGN AND ANALYSIS OF CRANKSHAFT

BHUPENDER[1]

[1]M.tech Scholar, Industrial and Production Engineering, Indus Institute of Engineering and Technology, Kinana, Jind , Haryana, India

Abstract:

Crankshaft is enormous volume creation segment with a mind-boggling geometry in the Internal Combustion (I.C) Engine. This proselytes the responding relocation of the cylinder in to a rotational movement of the wrench. An endeavor is made in this paper to examine the Static investigation on a crankshaft from a solitary chamber 4-stroke I.C Engine. The displaying of the crankshaft is made utilizing CATIA-V5 Software. Limited component examination is performed to acquire the variety of stress at basic areas of the driving rod utilizing the ANSYS programming and applying the limit conditions. At that point the outcomes are drawn Von-misses stress prompted in the crankshaft is 15.83Mpa and shear stress is actuated in the crankshaft is 8.271Mpa. The Theoretical outcomes are acquired von-misses stress is 19.6Mpa, shear stress is 9.28Mpa. The approval of model is contrasted and the Theoretical and FEA aftereffects of Von-misses stress and shear stress are inside the cutoff points. Further it very well may be stretched out for the various materials and dynamic examination, advancement of driving rod.

Keywords: Static Analysis; crankshaft; engine

Introduction:

Crank shaft is an enormous part with a perplexing geometry in the I.C engine, which changes over the responding relocation of the cylinder to a revolving movement with a four-bar interface system. [1] Crankshaft comprising of shaft parts, two diary orientation and one crankpin bearing. [2] The Shaft parts which rotate in the primary orientation, the crank pins to which the large finish of the associating bar are associated, the crank arms or networks which interface the crank pins and shaft parts. [3] Likewise, the straight removal of an engine isn't smooth; as the uprooting is brought about by the ignition chamber in this way the dislodging has abrupt stuns. [4]The idea of utilizing crankshaft is to change these abrupt removals to as smooth turning yield, which is the contribution to numerous gadgets, for example, generators, siphons and blowers. It ought to likewise be expressed that the utilization of a flywheel helps in smoothing the stuns. [5]

Crankshaft encounters huge powers from gas ignition. This power is applied to the head of the cylinder and since the associating bar interfaces the cylinder to the crank shaft, the power will be transmitted to the crankshaft. [6] The size of the powers relies upon numerous variables which comprise of crank range, associating bar measurements, weight of the interfacing pole, cylinder, cylinder rings, and pin. Burning and inactivity powers following up on the crankshaft. 1. Torsional load 2. [7] Bowing burden. Crankshaft must be sufficiently able to take the descending power of the force stroke without inordinate twisting so the dependability and life of the inward ignition engine rely upon the quality of the crankshaft to a great extent. [8]

Crank shaft is a huge segment with a perplexing geometry in the I.C engine, which changes over the responding uprooting of the cylinder to a turning movement with a four bar connect component. [9] Crankshaft comprising of shaft parts, two diary course and one crankpin bearing. [10] The Shaft parts which spin in the fundamental direction, the crank pins to which the large finish of the interfacing pole are associated, the crank arms or networks which associate the crank pins and shaft parts. What's more, the direct relocation of an engine isn't smooth; as the dislodging is brought about by the burning chamber along these lines the removal has abrupt stuns. The idea of utilizing crankshaft is to change these unexpected removals to as smooth rotating yield, which is the contribution to numerous gadgets, for example, generators, siphons and blowers. It ought to likewise be expressed that the utilization of a flywheel helps in smoothing the stuns.

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The main objectives of the paper are:

- To do study modeling and analysis of crankshaft
- To model a crankshaft on software
- To perform static analysis of crankshaft

Modeling:

Simulation is a design investigation framework completely coordinated with Solid works. Strong works Simulation gives reenactment answers for direct and nonlinear static, recurrence, clasping, warm, weakness, pressure vessel, drop test, straight and nonlinear dynamic, and streamlining examinations.

Figure 1: simulation example

In the wake of building your model, you have to ensure that it performs productively in the field. Without investigation devices, this errand must be replied by performing costly and tedious item advancement cycles. An item improvement cycle normally incorporates the accompanying advances:

1. Building your model.
2. Building a model of the design.
3. Testing the model in the field.
4. Evaluating the aftereffects of the field tests.
5. Modifying the design dependent on the field test results.

This procedure proceeds until an agreeable arrangement is reached. Investigation can assist you with achieving the accompanying assignments:

- Reduce cost by reenacting the testing of your model on the computer rather than costly field tests.
- Reduce time to showcase by decreasing the quantity of item advancement cycles.
- Improve items by rapidly testing numerous ideas and situations before settling on an official conclusion, giving you more opportunity to consider new designs.

Analysis:

The analysis parameter is shown in table 1.

Table 1: Properties of material

Material	Density(g/cm^3)	Youngs modulus(Gpa)	Poissions ratio
Aluminum alloy	2.6898	68.3	0.34
Titanium alloy	4.62	96	0.36
Magnesium alloy	1.8	45	0.35

In figure 2 to 14 analysis of model screenshots are shown.

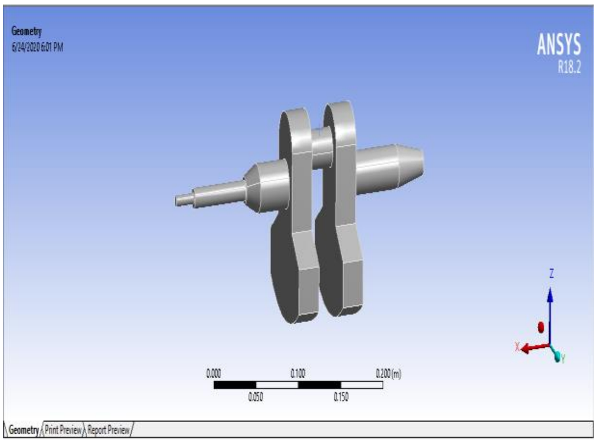

Figure 2: Model

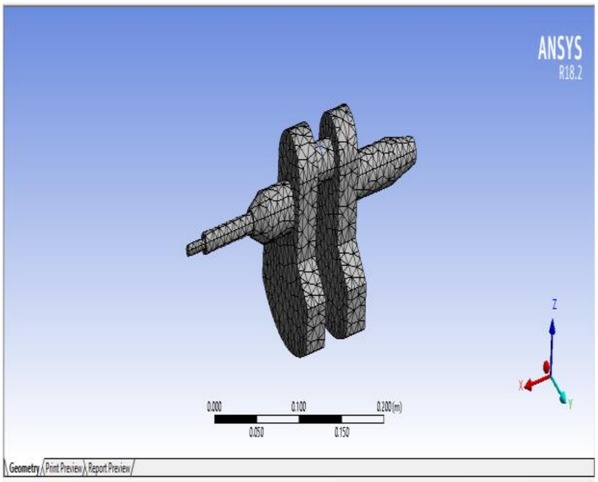

Figure 3: Mesh

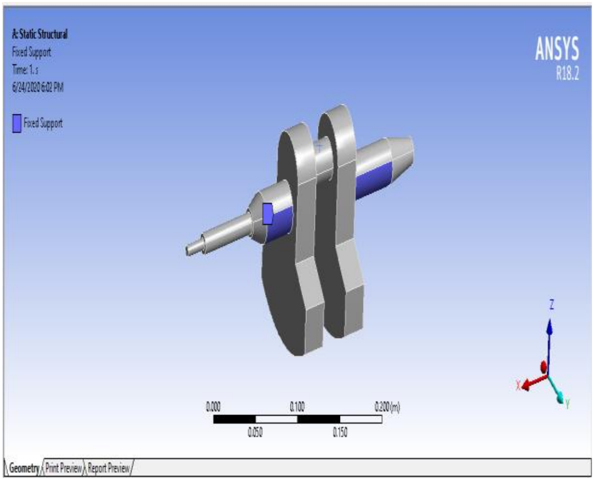

Figure 4: Fixed support

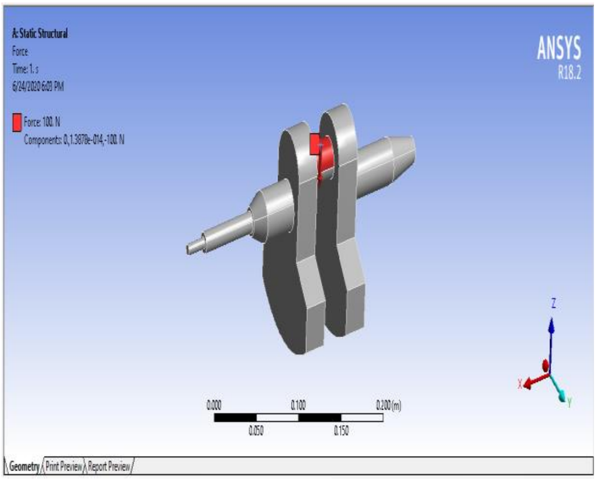

Figure 5: Load –force 100 N

For Aluminum alloy

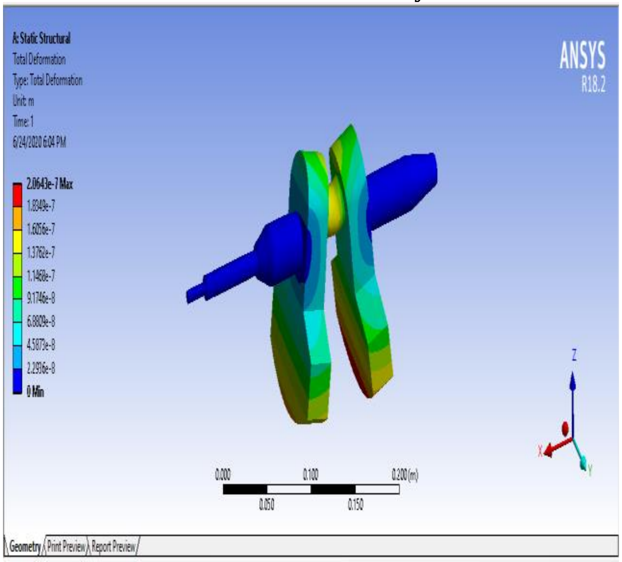

Figure 6: Total deformation

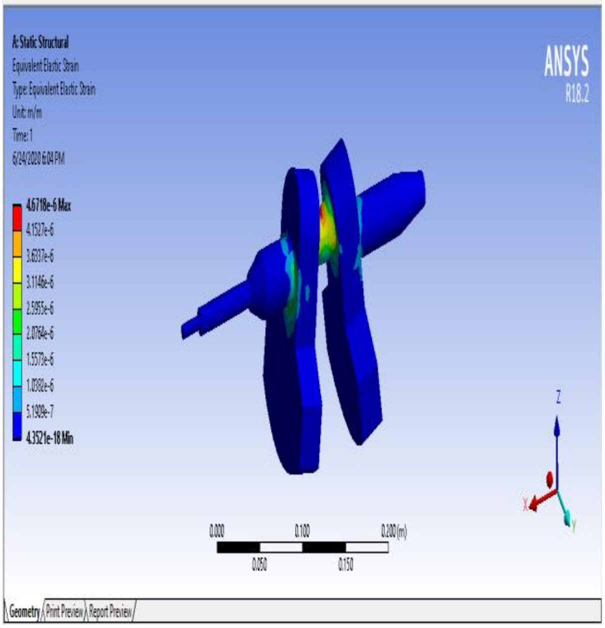

Figure 7: Strain

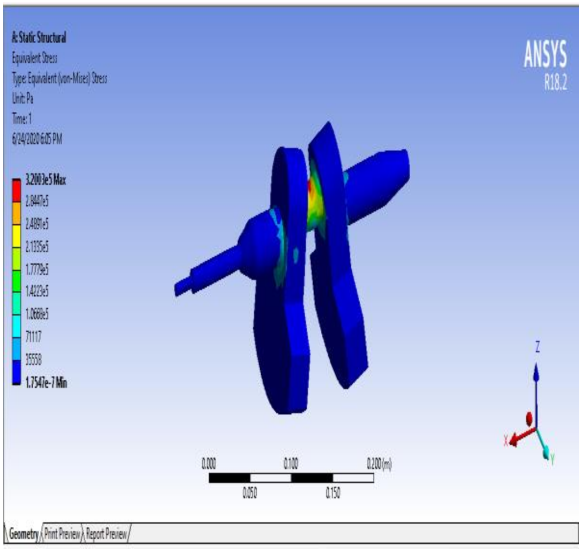

Figure 8: Stress for Titanium alloy

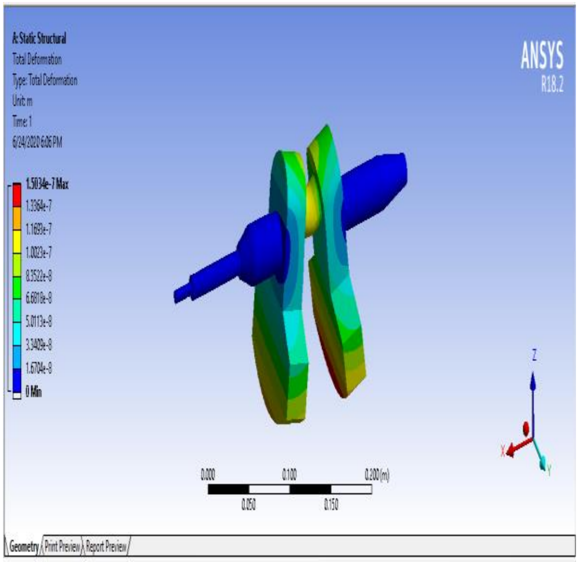

Figure 9: Total deformation

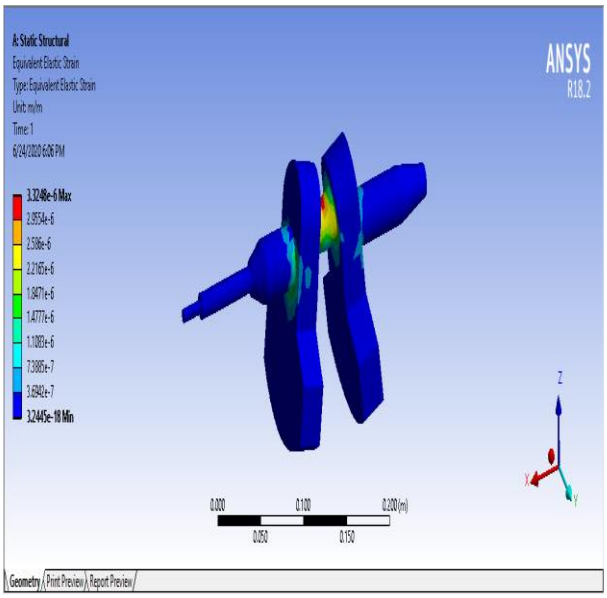

Figure 10: Strain

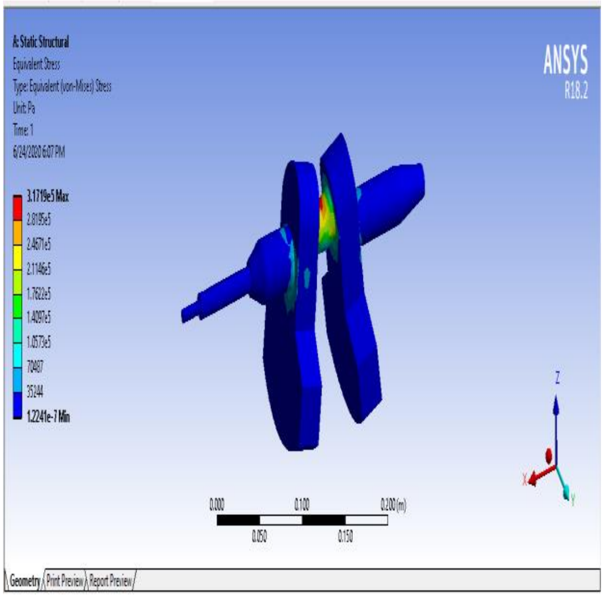

Figure 11: Stress
For Magnesium alloy

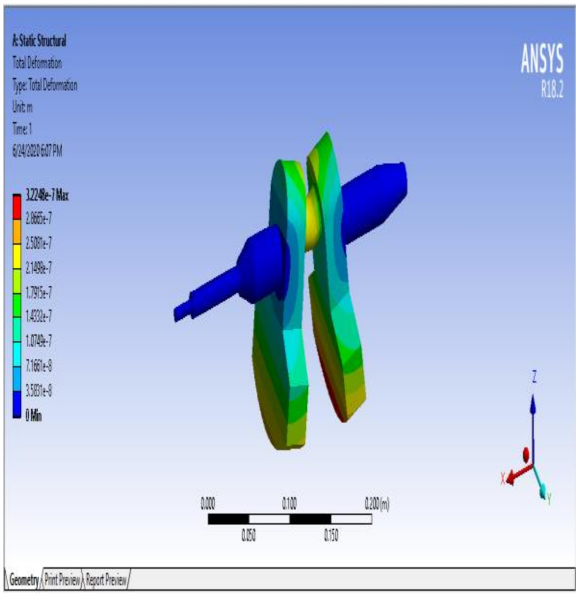

Figure 12: Total deformation

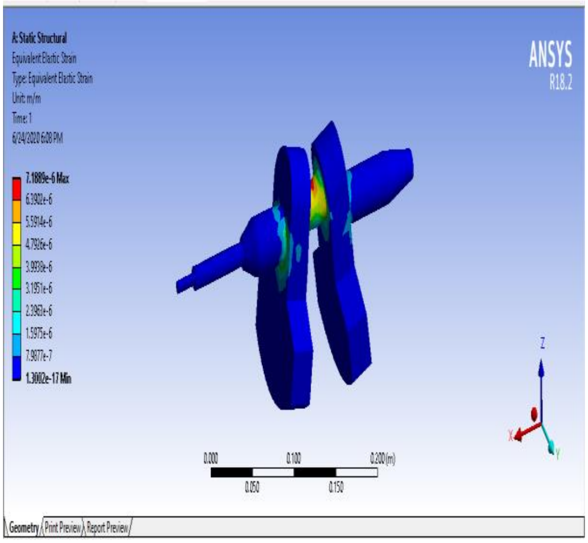

Figure 13: Strain

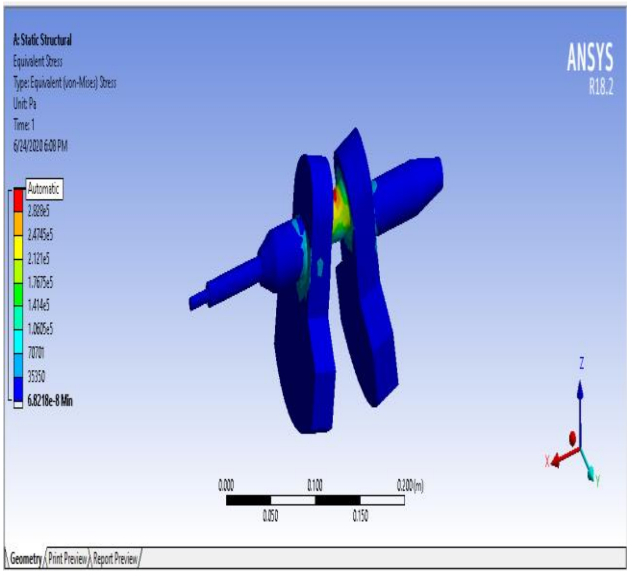

Figure 14: Stress

Result:

Table 2: results for all analysis

Material	Total deformation (M)	Strain	Stress (pascals)
Aluminum alloy	2.0643e-7	4.6718e-6	3.2003e5
Titanium alloy	1.5034e-7	3.3248e-6	3.1719e5
Magnesium alloy	3.2248e-7	7.1889e-6	3.1815e5

Conclusion:

Modeling and investigation of crank shaft is finished. Modeling of crank shaft is done in catia v5 design programming by utilizing different orders. The catia part record is changed over into IGS document and imported to ansys workbench. First Static auxiliary investigation is done on spike gear at 100 N with three unique materials, for example, aluminum compound , titanium amalgam and magnesium composite in ansys workbench. Maximum stress, twisting and most extreme strain are noted and arranged. From the tables it is presumed that the titanium amalgam is demonstrating proficient outcomes. Hence titanium composite is best among the three applied materials

References

[1.] Rincle Garg, Sunil Baghla, “Finite element analysis and optimization of crankshaft”, International Journal of Engineering and Management Reaserch, vol-2,Issue-6,ISSN: 2250- 0758, Pages:26-31, December 2012.
[2.] C.M Balamurugan, R. Krishnaraj, Dr.M.sakhivel, K.kanthavel, Deepan Marudachalam M.G, R.Palani, “Computer Aided modelling and optimization of Crankshaft”, International Journal of scientific and Engineering Reaserach, Vol-2, issue-8, ISSN:2229- 5518, August-2011.
[3.] Gu Yingkui, Zhou Zhibo, “Strength Analysis of Diesel Engine Crankshaft Based on PRO/E and ANSYS”, Third International Conference on Measuring Technology and Mechatronics Automation, 2011.
[4.] Abhishek choubey, Jamin Brahmbhatt, “Design and Analysis of Crankshaft for single cylinder 4- stroke engine”, International Journal of Advanced Engineering Reaserch and studies, vol-1, issue-4, ISSN:2249-8974, pages: 88-90, July-sept 2012.
[5.] R.J Deshbhratar, Y.R Suple, “ Analysis and optimization of Crankshaft using FEM”, International Journal of Modern Engineering Reasearch, vol-2, issue-5, ISSN:2249-6645, pages:3086-3088, Sept-Oct 2012.
[6.] Farzin H. Montazersadgh and Ali Fatemi “ Stress Analysis and Optimization of Crankshafts Subjected to Dynamic Loading”, AISI, August 2007.
[7]Xiaorong Zhou., Ganwei Cai., Zhuan Zhang. Zhongqing Cheng., 2009, “Analysis on Dynamic Characteristics of Internal Combustion Engine INTERNATIONAL JOURNAL OF PROFESSIONAL ENGINEERING STUDIES Volume VIII /Issue 5 / AUG 2017 IJPRES Crankshaft System,” International Conference on Measuring Technology and Mechatronics Automation.
[8]. Farzin H. Montazersadgh and Ali Fatemi., 2007,“Dynamic Load and Stress Analysis of a Crankshaft,” SAE Technical Paper No. 010258, Society of Automotive Engineers
[9]. Jonathan Williams, Farzin Montazersadgh, and Alifatemi.,2007, “FatiguePerformance Comparison And Life Prediction Of Forged Steel And Ductile Cast Iron Crankshafts,” Published in Proceeding of the 27th Forging Industry Technical Conference in Ft.Worth,Texas
[10]. Shenoy, P. S. and Fatemi, A., 2006, “Dynamic analysis of loads and stresses in connecting rods,”IMechE, Journal of Mechanical Engineering Science, Vol. 220, No. 5, pp. 615- 624