FINDINGS AND MODEILING FOR A CAMSHAFT IN SIX CYLINDER ENGINES

K CHINNA KASAIAH
Student M.Tech
Chinakasaiah305@gmail.com
Department of Mechanical Engineering
Indira Institute of Technology and Science

K RAJASEKHARA REDDY
M.Tech
Assoc. Professor
Rajsekhar12314@gmail.com
Department of Mechanical Engineering
Indira Institute of Technology and Science

ABSTRACT

The cam shaft and its associated factors control the hole and ultimate of the 2 valves. The associated components are push rods, rocker palms, valve springs and tappets. It includes a cylindrical rod jogging over the period of the cylinder financial group with a number of rectangular lobes sticking out from it, one for every valve. The cam lobes stress the valves open via pressing at the valve, or on some intermediate mechanism as they rotate. This shaft moreover offers the force to the ignition device.

The camshaft is driven by using the crankshaft via timing gears cams are made as vital additives of the camshaft and are designed in the kind of manner to open and close to the valves at the proper timing and to maintain them open for the vital length. A commonplace example is the camshaft of an automobile, which takes the rotary motion of the engine and interprets it in to the reciprocating movement essential to carry out the consumption and exhaust valves of the cylinders.

In this paintings, a camshaft is designed for multi cylinder engine and 3-D-model of the camshaft is created the use of modeling software program CREO. The modeled in creo is imported in to ANSYS. After completing the element residences, meshing and constraints the loads are achieved on camshaft for three certainly one of a kind substances specifically aluminum 7075, stain less steel and molybdenum to decide the displacement, equivalent strain of the cam shaft.

In this thesis, static, modal, fatigue and fracture analysis done in ANSYS.

1.0 INTRODUCTION TO CAMSHAFT

A cam is a rotating or sliding piece in a mechanical linkage used specially in reworking rotary movement into linear motion or vice versa. It is often a part of a rotating wheel (e.G. An eccentric wheel) or shaft (e.G. A cylinder with an irregular shape) that moves a lever at one or extra points on its round course. The cam can be a clean teeth, as is used to supply pulses of power to a steam hammer, for example, or an eccentric disc or other form that produces a smooth reciprocating (to and fro) movement within the follower, that's a lever making contact with the cam.

Overview

The cam may be seen as a device that translates from round to reciprocating (or once in a while oscillating) movement. A not unusual instance is the camshaft of an automobile, which takes the rotary motion of the engine and translates it into the reciprocating movement important to feature the consumption and exhaust valves of the cylinders.

The contrary operation, translation of reciprocating movement to spherical motion, is carried out via a crank. An example is the crankshaft of a automobile, which takes the reciprocating motion of the pistons and translates it into the rotary motion essential to carry out the wheels.

Cams also may be taken into consideration as facts-storing and -transmitting devices. Examples are the cam-drums that direct the notes of a music box or the movements of a screw tool's numerous tools and chucks. The information saved and transmitted through the cam is the solution to the query, "What movements need to appear, and even as?" (Even an vehicle camshaft basically solutions that query, despite the fact that the tune container cam is a still-better instance in illustrating this concept.)

2.0 DESIGN CALCULATIONS

PRESSURE CALCULATIONS

Bore ×stroke(mm)=fifty seven×fifty eight.6

Displacement =149.5CC

Maximum energy = 13.8bhp @8500rpm

Maximum torque = 13.4Nm @ 6000 rpm

Compression ratio =9.35/1

Density of petrol C_8 H_18=737.22 kg/m^three at 60F

= zero.00073722 kg/cm3

= 0.00000073722 kg/mm3

T = 60F =288.855K =15.550C

Mass = density ×quantity

m = zero.00000073722×149500

m = 0.11kg

Molecular cut for petrol 144.2285 g/mole

PV = mRT

P = mRT/V=(zero.11×eight.3143×288.555)/(0.11422×0.0001495)=263.9/0.00001 707

P = 15454538.533 j/m3 = n/m2

P =15.454 N/mm2

DESIGN OF CAMSHAFT

The cam is stain less as one piece with the camshaft

The diameter of camshaft D1 = 0.16 cylinder bore+12.7

D1 = 0.16 fifty seven+12.7=21.82mm

The base circle diameter is set 4mm greater than camshaft diameter

Base circle diameter = 21.82+3 = 24.82mm = 25mm

Width of camshaft w1 = zero.09 cylinder bore+6

W1 = zero.09 fifty seven+6 = eleven.13mm

OA = minimum radius of camshaft + (1/2 diameter of roller)

= 12.5+ (1/2 41) = 33mm

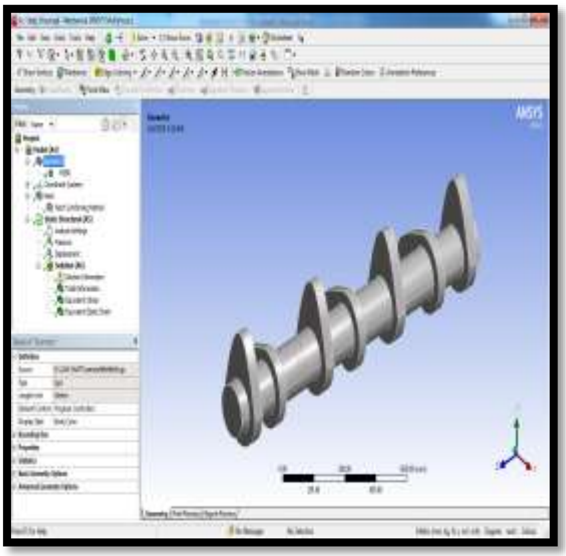
3.0 INTRODUCTION TO CAD

Computer-aided design (CAD) is using pc structures (or workstations) to resource within the advent, modification, evaluation, or optimization of a format. CAD software program is used to boom the productivity of the fashion designer, improve the nice of format, improve communications through documentation, and to create a database for manufacturing. CAD output is regularly within the shape of electronic documents for print, machining, or different manufacturing operations. The time period CADD (for Computer Aided Design and Drafting) is also used. Its use in designing virtual systems is called digital design automation, or EDA. In mechanical design it's miles called mechanical format automation (MDA) or pc-aided drafting (CAD), which includes the approach of creating a technical drawing with the use of computer software. CAD software program for mechanical design uses both vector-primarily based completely snap shots to depict the gadgets of traditional drafting, or can also moreover produce raster photos showing the general look of designed gadgets. However, it consists of greater than in reality shapes. As within the guide drafting of technical and engineering drawings, the output of CAD need to carry records, inclusive of substances, methods, dimensions, and tolerances, in keeping with software-particular conventions.CAD can be used to format curves and figures in -dimensional (2D) place; or curves, surfaces, and solids in 3-dimensional (3-d) area. CAD is an vital industrial art substantially utilized in lots of packages, which consist of vehicle, shipbuilding, and aerospace industries, commercial enterprise and architectural layout, prosthetics, and masses of more. CAD is likewise widely used to provide pc animation for computer graphics in films, advertising and technical manuals, regularly known as DCC digital content cloth introduction. The present day ubiquity and electricity of laptop structures manner that even fragrance bottles and shampoo dispensers are designed the usage of techniques unheard of by means of engineers of the Nineteen Sixties. Because of its huge economic significance, CAD has been a number one using pressure for research in computational geometry, pc pics (both hardware and software application), and discrete differential geometry.

INTRODUCTION TO CREO

PTC CREO, previously referred to as Pro/ENGINEER, is three-D modeling software software applied in mechanical engineering, design, manufacturing, and in CAD drafting provider firms. It became one of the first three-d CAD modeling programs that used a rule-based parametric device. Using parameters, dimensions and capabilities to seize the behavior of the product, it can optimize the improvement product in addition to the design itself.

31. The call changed into changed in 2010 from Pro/ENGINEER Wildfire to CREO. It changed into introduced by way of the use of the enterprise who advanced it, Parametric Technology Company (PTC), at some stage inside the release of its suite of layout products that includes programs which consist of assembly modeling, 2D orthographic views for technical drawing, finite detail evaluation and additional.PTC CREO says it may offer a greater efficient layout experience than different modeling software because of its unique competencies which includes the integration of parametric and direct



modeling in a single platform. The complete suite of applications spans the spectrum of product improvement, giving designers alternatives to use in every step of the system. The software program additionally has a greater customer excellent interface that provides a higher revel in for designers. It additionally has collaborative capacities that make it clean to share designs and make modifications.

There are countless benefits to the use of PTC CREO. We'll test them on this -element series.

4.0 STATIC ANALYSIS OF CAM SHAFT

Materials – stain less steel

Young's modulus

= 205000mpa

Poisson's ratio

= 0.3

Density

= 7850kg/mm3

Save creo Model as .Iges format

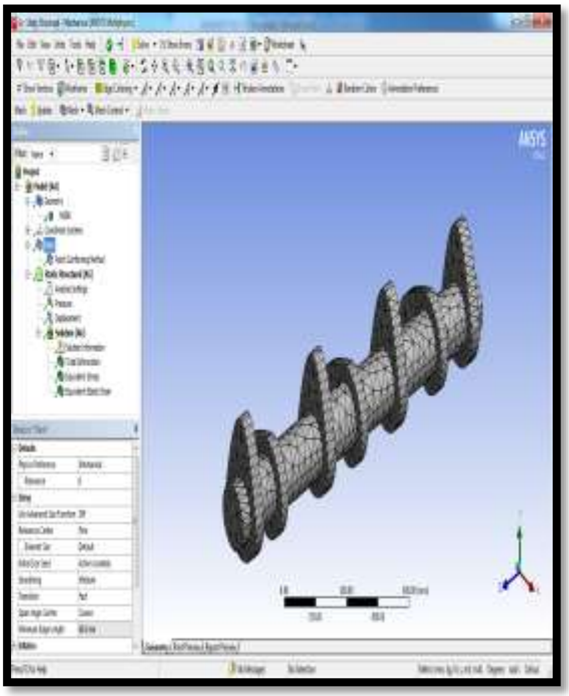
→→Ansys → Workbench→ Select evaluation device → static structural → double click on

→→Select geometry → proper click on → import geometry → pick out browse →open element → good enough

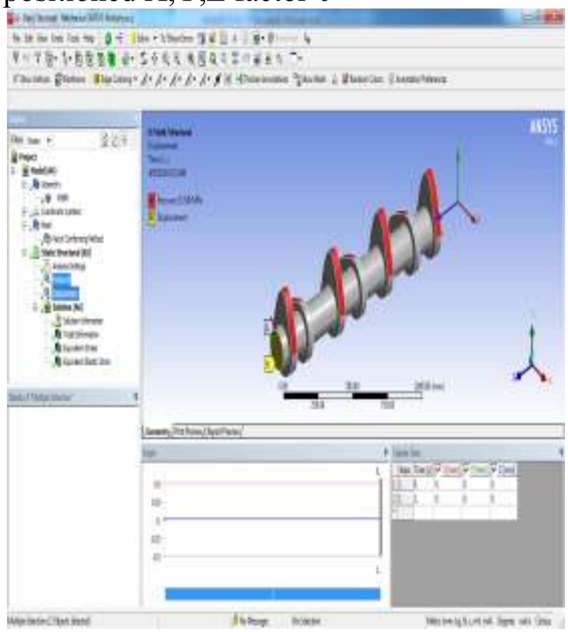
→→ Select mesh on work bench → proper click on →edit

Double click on geometry → choose MSBR → edit cloth →

Select mesh on left side part tree → right click → generate mesh →



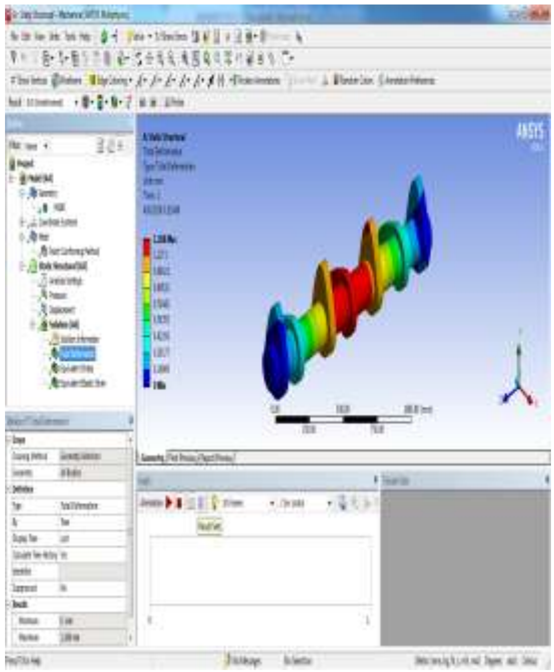
Select static structural right click on → insert → pick rotational velocity and stuck assist → Select displacement → select required area → click on practice → positioned X,Y,Z factor 0 →



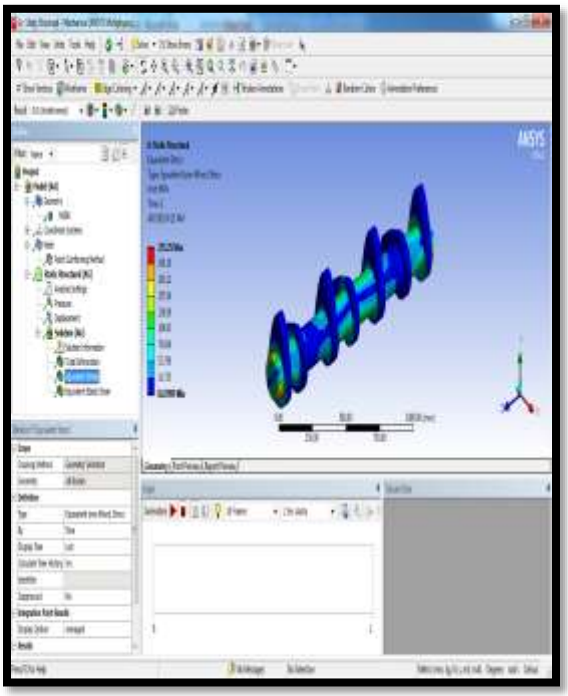
Select force → pick required place → click on follow → enter rotational speed
Select solution proper click on → remedy →
Solution right click on → insert → deformation → general → Solution proper click on → insert → strain → equivalent (von-mises) →

Solution proper click → insert → stress → equivalent (von-mises) →
Right click on on deformation → examine all result

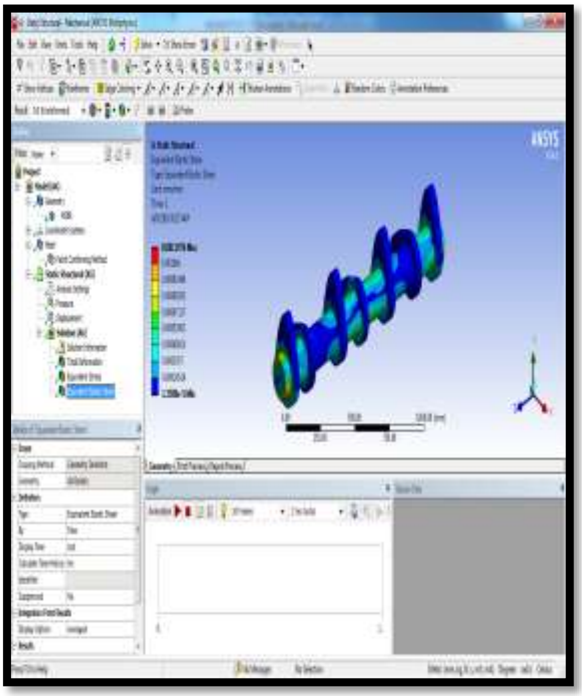
TOTAL DEFORMATION



VON-MISES STRESS

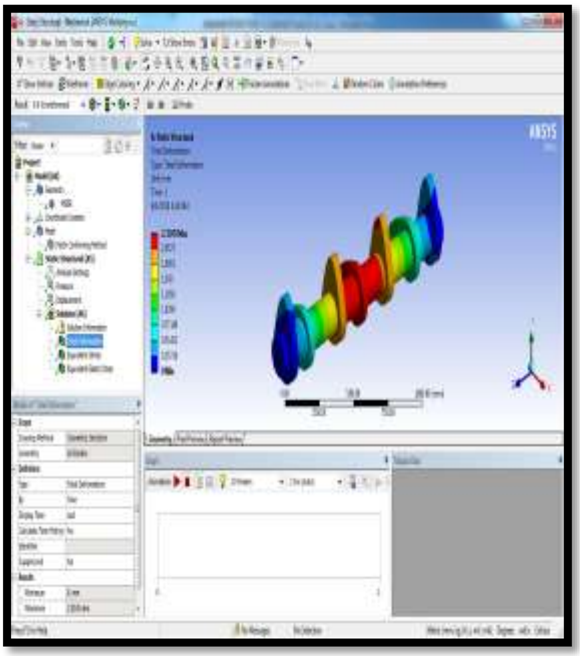


VON-MISES STRAIN



Materials – molybdenum

TOTAL DEFORMATION

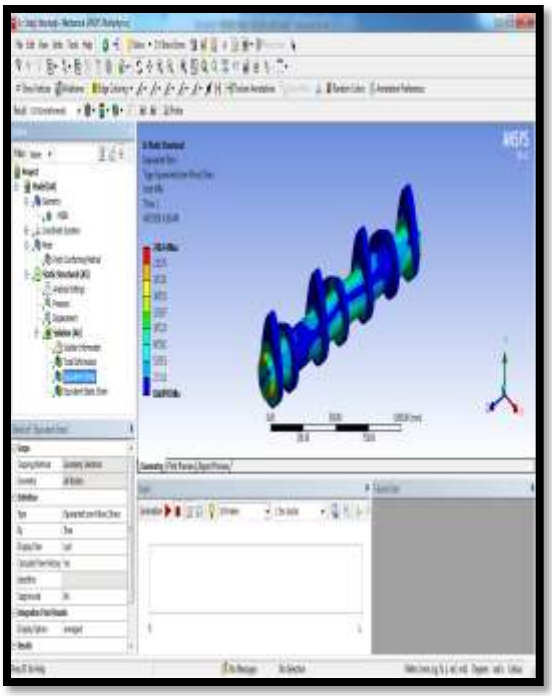


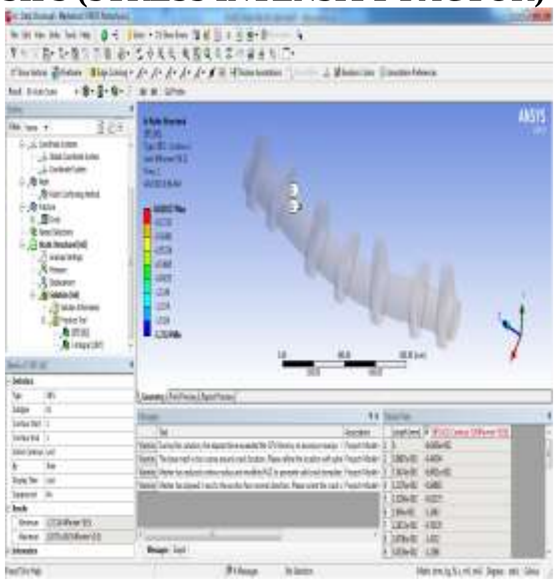
Stress

FRACTURE ANALYSIS OF CAM SHAFT

Materials – stain less steel

SIFS (STRESS INTENSITY FACTOR)

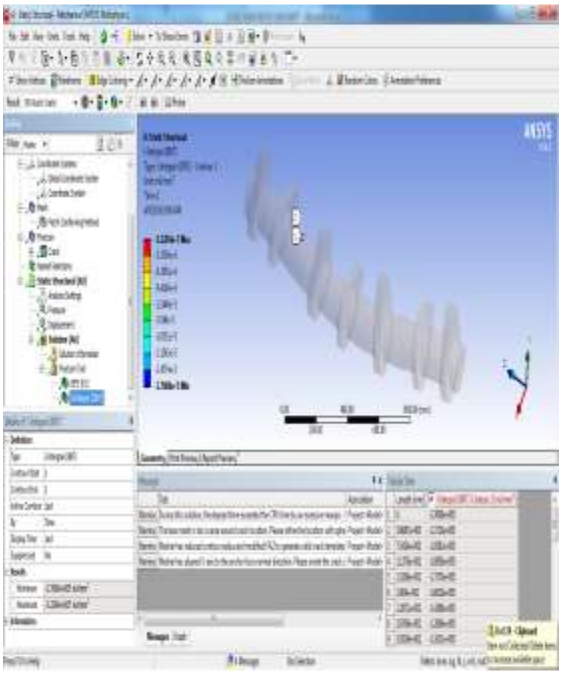




Tabular Data

	Length [mm]	SIFS (K1) Contour 1 [MPa·mm^(0.5)]
1	0.	-8.6436e-002
2	3.9687e-003	-0.44304
3	7.5424e-003	-6.9831e-002
4	1.1376e-002	-0.84865
5	1.5206e-002	-0.62175
6	1.904e-002	-1.2463
7	2.2872e-002	-0.70176
8	2.6706e-002	-1.4332
9	3.0539e-002	-1.2398
10	3.4374e-002	-1.5652
11	3.8208e-002	-1.3975
12	4.2042e-002	-1.6425
13	4.5876e-002	-1.4627
14	4.971e-002	-1.6843
15	5.3544e-002	-1.5024
16	5.7379e-002	-1.7124
17	6.1213e-002	-1.5116
18	6.5047e-002	-1.6854
19	6.8881e-002	-1.4742
20	7.2715e-002	-1.6423

J-INTEGREAL

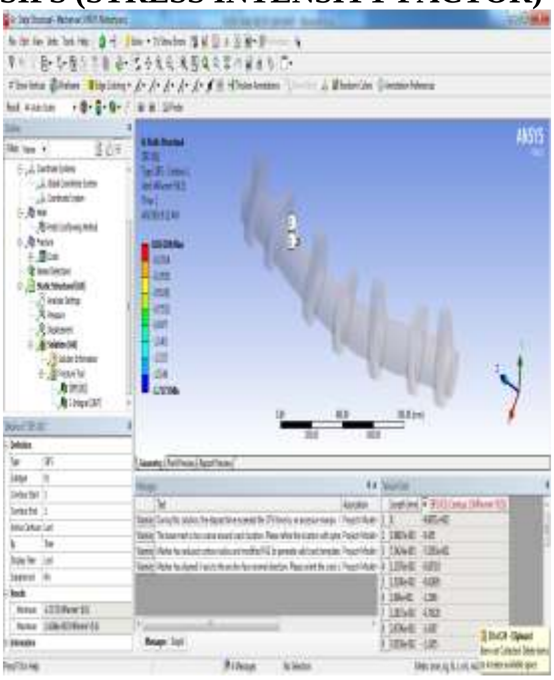


Tabular Data

	Length [mm]	J-Integral (JINT) Contour 1 [mJ/mm²]
1	0.	-2.7606e-005
2	3.9687e-003	-2.1726e-005
3	7.5424e-003	-1.9382e-005
4	1.1376e-002	-1.8958e-005
5	1.5206e-002	-1.7376e-005
6	1.904e-002	-1.6028e-005
7	2.2872e-002	-1.4288e-005
8	2.6706e-002	-1.2696e-005
9	3.0539e-002	-1.1031e-005
10	3.4374e-002	-9.5416e-006
11	3.8208e-002	-7.9678e-006
12	4.2042e-002	-6.3875e-006
13	4.5876e-002	-4.7252e-006
14	4.971e-002	-3.0766e-006
15	5.3544e-002	-1.3355e-006
16	5.7379e-002	-3.2204e-007
17	6.1213e-002	-1.6973e-006
18	6.5047e-002	-3.092e-006
19	6.8881e-002	-4.7666e-006
20	7.2715e-002	-6.5425e-006

Materials – MOLYBDENUM

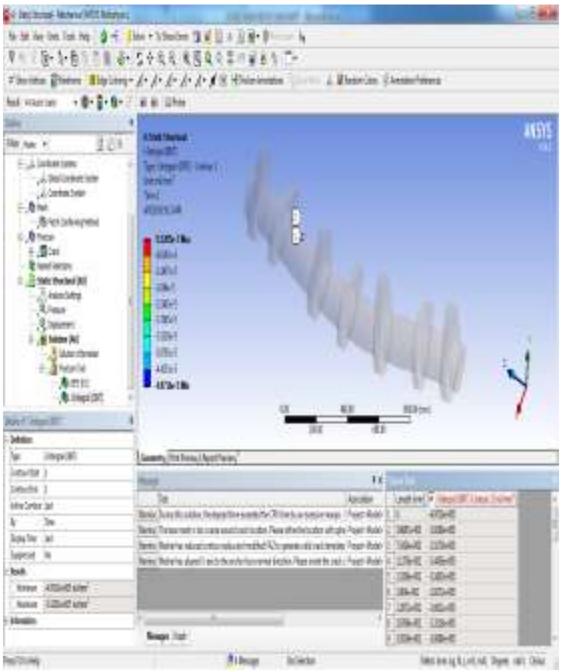
SIFS (STRESS INTENSITY FACTOR)



Tabular Data

	Length [mm]	SIFS (K1) Contour 1 [MPa·mm^(0.5)]
1	0.	-9.8071e-002
2	3.9687e-003	-0.455
3	7.5424e-003	-7.5303e-002
4	1.1376e-002	-0.85719
5	1.5206e-002	-0.62695
6	1.904e-002	-1.2546
7	2.2872e-002	-0.70528
8	2.6706e-002	-1.4397
9	3.0539e-002	-1.2455
10	3.4374e-002	-1.5713
11	3.8208e-002	-1.4021
12	4.2042e-002	-1.6478
13	4.5876e-002	-1.4667
14	4.971e-002	-1.6894
15	5.3544e-002	-1.506
16	5.7379e-002	-1.7173
17	6.1213e-002	-1.5153
18	6.5047e-002	-1.6903
19	6.8881e-002	-1.478
20	7.2715e-002	-1.6476

J-INTEGREAL

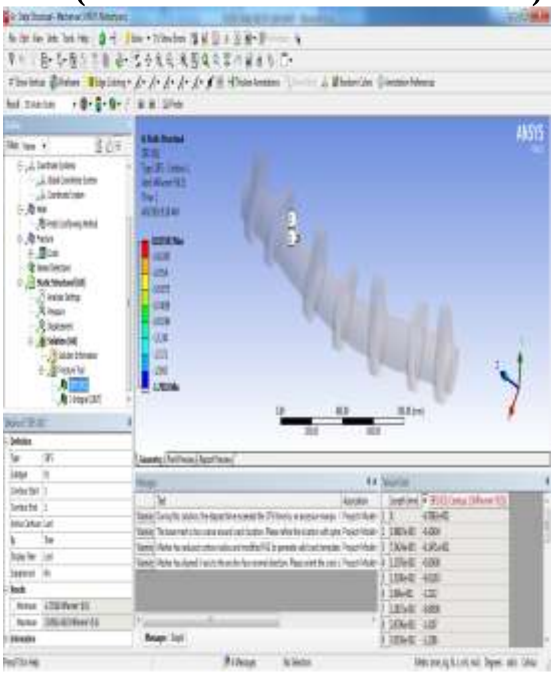


Tabular Data

	Length [mm]	J-Integral (JINT) Contour 1 [mJ/mm^2]
1	0.	-4.9716e-005
2	3.9687e-003	-3.9289e-005
3	7.5424e-003	-3.5179e-005
4	1.1376e-002	-3.4456e-005
5	1.5206e-002	-3.1603e-005
6	1.904e-002	-2.9172e-005
7	2.2872e-002	-2.6011e-005
8	2.6706e-002	-2.3118e-005
9	3.0539e-002	-2.0088e-005
10	3.4374e-002	-1.7375e-005
11	3.8208e-002	-1.4513e-005
12	4.2042e-002	-1.1644e-005
13	4.5876e-002	-8.6261e-006
14	4.971e-002	-5.6328e-006
15	5.3544e-002	-2.4674e-006
16	5.7379e-002	-5.5205e-007
17	6.1213e-002	-3.0687e-006
18	6.5047e-002	-5.6161e-006
19	6.8881e-002	-8.6608e-006
20	7.2715e-002	-1.1892e-005

Materials – ALUMINUM 7075

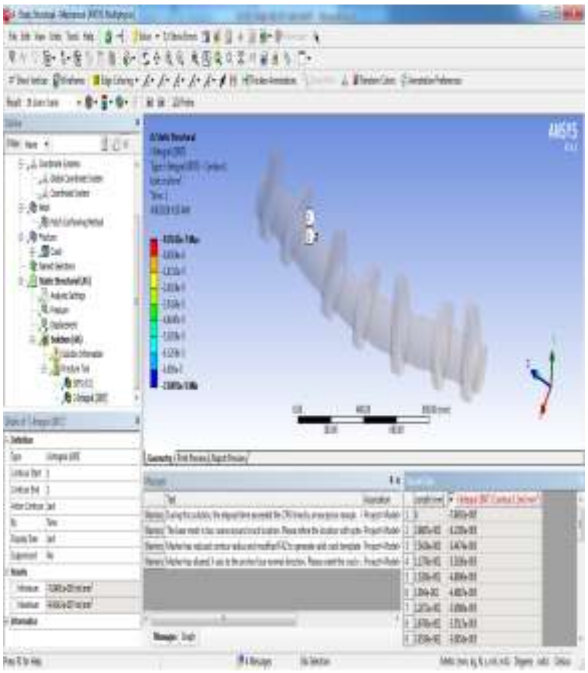
SIFS (STRESS INTENSITY FACTOR)



Tabular Data

	Length [mm]	SIFS (K1) Contour 1 [MPa·mm^(0.5)]
1	0.	-6.7692e-002
2	3.9687e-003	-0.42404
3	7.5424e-003	-6.1471e-002
4	1.1376e-002	-0.83408
5	1.5206e-002	-0.61283
6	1.904e-002	-1.2312
7	2.2872e-002	-0.69508
8	2.6706e-002	-1.4207
9	3.0539e-002	-1.2286
10	3.4374e-002	-1.553
11	3.8208e-002	-1.3879
12	4.2042e-002	-1.6315
13	4.5876e-002	-1.4539
14	4.971e-002	-1.6736
15	5.3544e-002	-1.4942
16	5.7379e-002	-1.7018
17	6.1213e-002	-1.5034
18	6.5047e-002	-1.6749
19	6.8881e-002	-1.4657
20	7.2715e-002	-1.6314

J-INTEGREAL



Tabular Data

	Length [mm]	J-Integral (JINT) Contour 1 [mJ/mm^2]
1	0.	-7.8491e-005
2	3.9687e-003	-6.1395e-005
3	7.5424e-003	-5.4474e-005
4	1.1376e-002	-5.3186e-005
5	1.5206e-002	-4.8696e-005
6	1.904e-002	-4.4867e-005
7	2.2872e-002	-3.9988e-005
8	2.6706e-002	-3.5515e-005
9	3.0539e-002	-3.0854e-005
10	3.4374e-002	-2.6698e-005
11	3.8208e-002	-2.2286e-005
12	4.2042e-002	-1.7841e-005
13	4.5876e-002	-1.3161e-005
14	4.971e-002	-8.5227e-006
15	5.3544e-002	-3.6399e-006
16	5.7379e-002	-9.9142e-007
17	6.1213e-002	-4.8079e-006
18	6.5047e-002	-8.6913e-006
19	6.8881e-002	-1.3386e-005
20	7.2715e-002	-1.8357e-005

5.0 RESULTS TABLE

static analysis results

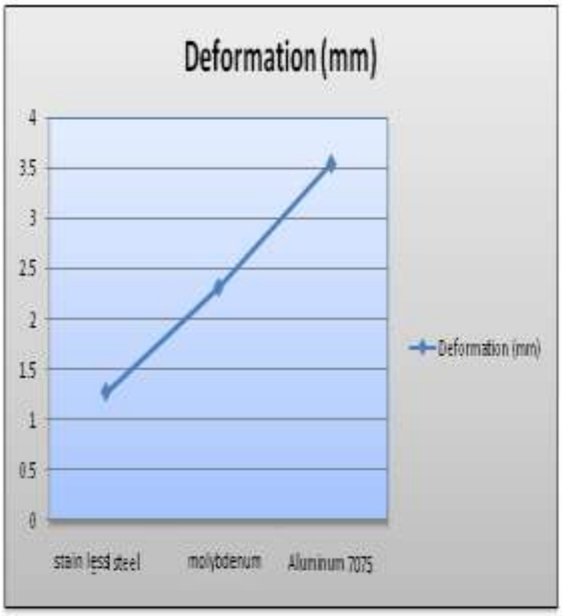
Material	Deformation (mm)	Stress (N/mm^2)	Strain
Stainless steel	1.268	235.25	0.0011976
Molybdenum	2.3145	240.44	0.002219
Aluminum 7075	3.5479	227.69	0.00327

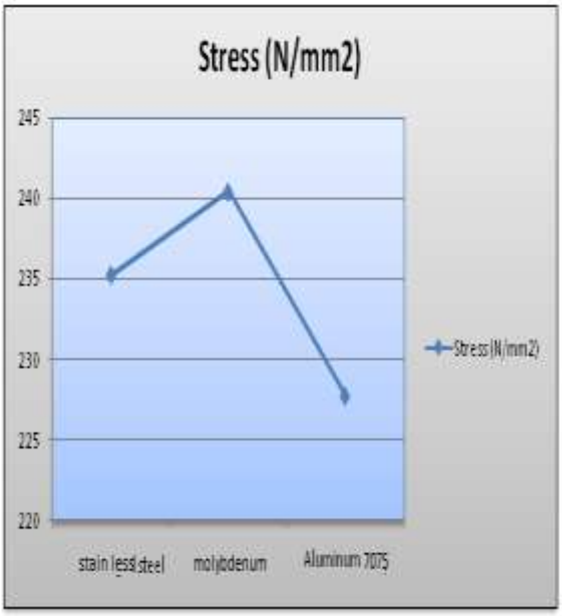
Modal analysis results

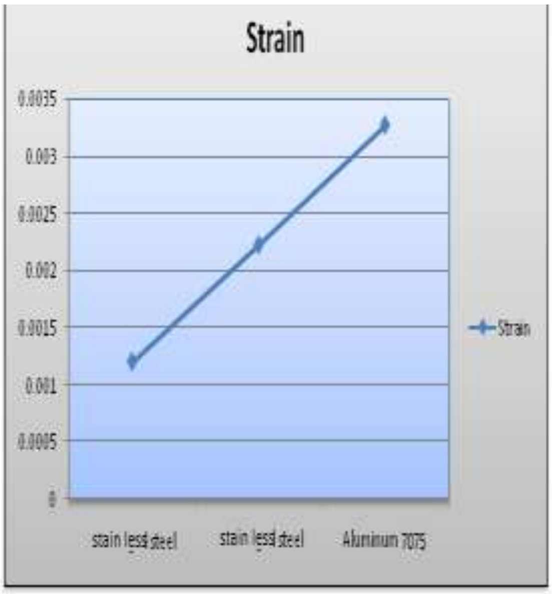
Material	Deformation1 (mm)	Frequency (Hz)	Deformation 2 (mm)	Frequency (Hz)	Deformation 3 (mm)	Frequency (Hz)
Stainless steel	3.0247	255.78	2.9848	256.27	6.8222	648.98
Molybdenum	3.1567	197.66	3.1099	198.02	7.123	506.41

Aluminum 7075	5.0966	257.35	5.037	257.91	11.486	643.67

GRAPHS







6.0 CONCLUSION

The camshaft is driven by using the use of the crankshaft through timing gears cams are made as vital components of the camshaft and are designed in one of these way to open and close to the valves on the nice timing and to hold them open for the essential duration. A not unusual example is the camshaft of an automobile, which takes the rotary motion of the engine and interprets it in to the reciprocating motion essential to characteristic the consumption and exhaust valves of the cylinders.

By looking at the static evaluation the strain values are much less for aluminum 7075 evaluate with cast steel and molybdenum.

By looking on the modal evaluation the deformation and frequency values are greater for aluminum 7075.

So it may be finish the aluminum 7075 is better cloth for cam shaft

REFERENCES

[1] A.S.Dhavale, V.R.Muttagi "Study of Modeling and Fracture Analysis of Camshaft" International Journal of Engineering Research and Applications, Vol. 2, Issue 6, November-December 2012, pp.835-842.

[2] Mahesh R. Mali, Prabhakar D. Maskar, Shravan H. Gawande, Jay S. Bagi , " Design Optimization of Cam & Follower Mechanism of an Internal Combustion Engine for Improving the Engine Efficiency", Modern Mechanical Engineering, 2012, 2, pp.114-119

[3] Bayrakceken H, Ucun I. & Tasgetiren S. "Fracture analysis of a camshaft made from nodular molybdenum". [1240-1245] 3 NOV 2005.

[4] Paradon V. "An Impact Model for Industrial CamFollower System: Simulation And Experiment". [01-11] 11th OCT, 2007

[5] G.K. Matthew., D. Tesar.(1976), Cam system design: The dynamic synthesis and analysis of the one degree of freedom model, Mechanism and Machine Theory, Volume 11, Issue 4, Pages 247-257.

[6] M.O.M Osman., B.M Bahgat., Mohsen Osman., (1987), Dynamic analysis of a cam mechanism with bearing clearances, Mechanism and Machine Theory, Volume 22, Issue 4, Pages 303-314.

[7] Robert L Norton.(1988), Effect of manufacturing method on dynamic performance of cams— An experimental study. part I—eccentric cams, Mechanism and Machine Theory, Volume 23, Issue 3, Pages 191-199