Modelling, Analysis and Fabrication of Bush Bearing on Plummer Block by Using Carbon Epoxy Material

A Sarath Kumar, B. Hari Prasad

Abstract--- Presently, the project deals with Plummer bush. The main function of Plummer bush is to give an additional strength for the load bearing capacity of Plummer block which are existing through rotational shaft. Basically they are manufactured from high strength cast iron as standard and also bronze alloys, but the materials such as cast steel are available. Generally, in Plummer blocks the bush plays a major role to increase the bearing life, and to bear the heavy loads. Design by using the CATIAV5 software and structural analysis using ANSYS for both existing and new taken materials after getting the result comparing the each other to finalizing which better suitable for plumber bush to fabricate. And also to improve some properties by comparing analytical results through applying loads on bush material which is made by using carbon epoxy comparing with bronze alloys.

Key words: Plummer block, Carbon Epoxy, ANSYS, experimental model.

INTRODUCTION:

Plummer piece or housed bearing unit is platform usually made of metals and used to offer help for a pivoting shaft with the aid of good direction and different adornments. Lodging material for a cushion square as mentioned earlier is normally made of solid metal or cast steel.

Plummer pieces. A get together comprising of circular roller course or self-adjusting metal ball and a heading lodging with a fixing gadget. The bearing lodging is by and large made of cast press, however can likewise be spheroid graphite cast press (Ductile cast iron) or cast steel contingent upon the application.

A Plummer square typically alludes to billet with an included intimidating to grinding bearing. A square Plummer alludes to any of the mounted bearing wherein the corresponding mounted shaft is in a parallel plane to the respective mounting surface, and opposite to the middle line of axis of the mounting gaps, as stood out from different kinds of rib pieces or small spine units. A Plummer square may also contain a holding on for one of a few kinds of moving machinery components, including balls, barrel shaped rollers, circular rollers, decreased rollers, or metallic or engineered bushing.

The principal use of the two sorts of the component is the same, which is to mount a course steadily vesting its external ring to be stationary while permitting revolutionary motion of the inward ring. The lodging is darted to a machine component establishment through the gaps in the base of the Plummer. Bearing lodgings might either be a part of a composed structure or a strong write which are sturdy. Split write lodgings are typically two-piece lodgings where the top and base might be separated when required, while others might be single-piece lodgings fixed steadily. Variety of fixing game plans might be given along with the block to keep it clean and prevent different contaminants from entering the lodging. Consequently the lodging also gives a spotless clean situation to the ecologically delicate and sturdy bearing to pivot free from contaminants while simultaneously holding lubricant oil, either oil or oil, subsequently expanding its execution and obligation cycle deliberately.

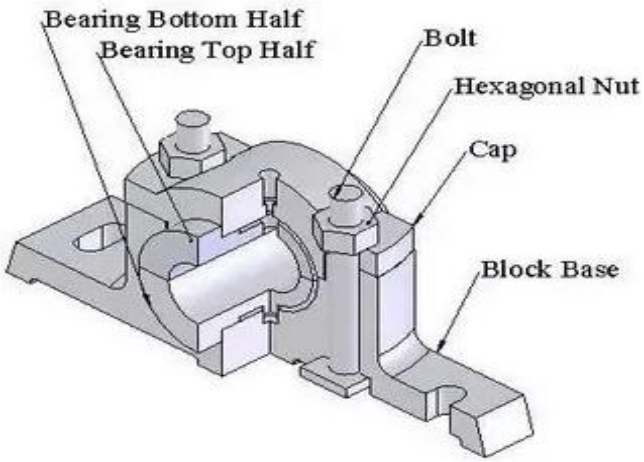

Figure 1: Breakout section view of bush

PLUMMER BLOCKS WORKING:

Plummer square bearing comes as an independent gathering, accessible in extensive variety of sizes.

We should simply guarantee accessibility of a level and firm stage where two openings can be bored (which would be utilized to jolt the Plummer obstruct down).

After establishment, all it needs is occasional lubing. Bearing inside Plummer piece works fine in any sort of air as it is securely tucked away inside a packaging.

After disappointment, we essentially need to purchase another OEM gathering which is superbly exchangeable without worrying about resistances (as they are as of now dealt with). Moreover, introducing a Plummer square get together is moderately less demanding and blunder confirmation.

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Accordingly, in long haul, Plummer piece course give gigantic coat benefits where downtime straightforwardly means creation misfortune. Furthermore, they make lives of individuals working in perilous surroundings somewhat less demanding.

OBJECTIVE OF THE WORK:

- Introducing the new material to improving the strength and bearing the loads.
- Experimental model design and analysis for taken material suitable or not.
- Using machineries to fabrication of proto type model of Plummer block.

LITERATURE REVIEW:

Review on mechanical properties of carbon epoxy of the best material selection by *Vishal Narula, Vipul Jain, Mohd Fazil Khan, Shailja Bahuguna (ISSN NO-2456-0472).-volume-2 .(feb-2017):-*

According to this journal the author improved the mechanical properties by taking rocket shell as an object and carbon epoxy as an material, it gives an better results by comparing with the aluminum alloy.

Y.X. Zhoul, P.X.Wu, Z-YCheng, J. Ingram, S.Jeelani. Improvement in Electrical, Thermal and Mechanical Properties Of Epoxy By Filling Carbon Nanotube. Express Polymer Letters *Vol.2, No.1 (2008) 40–48*:-

Related to this journal the author improved the several properties of epoxy by using ULG (ultra-sonic generator)process by adding carbon nano-tubes by applying frequency of amplitudes.

N. Senthil kumar, K. Kalaichelvan and K. Elangovan. Mechanical Behavior Of Aluminum Particulate Epoxy Composite –Experimental Study And Numerical Simulation International Journal Of Mechanical And Materials Engineering *(IJMME), Vol. 7 (2012), No. 3, 214-221:-*

According to this journal, author used the carbon epoxy as a material rod in the middle of the concrete beam and finally it gives an additional strength of that concrete beam while comparing with the existing material (Steel).

Norazman Mohammad Noor, Mohd Hanif Ahmad Boestamam, Mohammed Alias Yusuf. Carbon Fiber Reinforced Polymer (CFRP) As Reinforcement For Concrete Beam International Journal Of Emerging Technology And Advanced Engineering, *Volume 3, Issue 2, February 2013)*:-

By this journal the application of concrete beam, using of carbon epoxy gives an improved bending moment while author comparing with the existing material.

Sheikh Naunehal Ahamed, Jadhav Vijay Kumar, Mohammed Mushraffuddin, Parimi Shrawini. Modeling and Analysis of Rocket Outer Shell. International Journal Of Scientific & Technology Research *Volume 3, Issue 4, April 2014 ISSN 2277-8616 Ijstr©2014*:-

Related to this journal the author analyze the bending moment of rocket outer shell and improved the with stand capacity by using carbon epoxy composite material.

Parkhe Ravindra, Mhaske Raman, Belkar Sanjay. Modeling And Analysis Of Carbon Fiber Epoxy Based Leaf Spring Under The Static Load Condition By Using FEA, International Journal Of Emerging Science And Engineering *(Ijese) ISSN: 2319–6378, Volume-2, Issue-4, February 2014*:-

Leaf spring is plays an important role in heavy duty vehicles to with stand heavy load and the author used this carbon epoxy material, to give excellent bearing capacity for the huge application loads and the author compared the results with the existing material and it gives an better results.

MODELING:

CATIA is a modeling and design software that offers a variety of indifferent solution to shape the design, styling of surfaces, surfacing workflow and visualization to create, modify, and validate complex innovative shapes from industrial design to Class-A surfacing techniques with the ICEM surfacing technologies. CATIA supports multiple stages of product design from a small component to a huge machine part whether started from scratch or from 2D sketches. CATIA can also read and produce STEP format files for reverse engineering and surface reuse options.

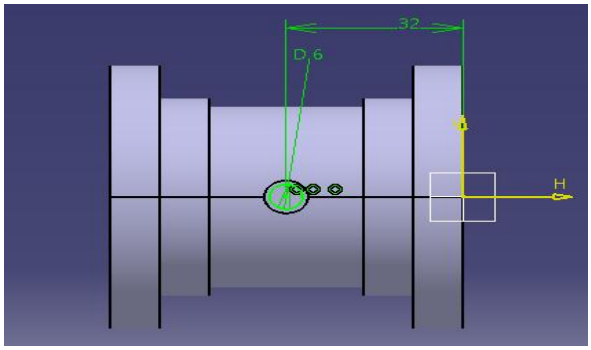

Figure 2: Orthogonal view of model

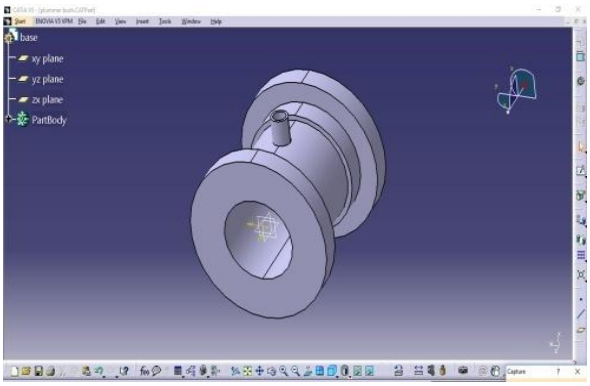

Figure 3: Isometric view of model

ANSYS:

ANSYS is general-purpose finite element analysis software, which is being used globally and enables engineers located worldwide to perform the following tasks ingeniously:

Build virtual software models or transfer CAD models of structures, products, components or systems.

Apply operating loads or other design performance parameters under variety of industrial and physical conditions.

Study the physical responses to which the machine component or building structures exposed are such as stress levels at different points, temperatures distributions at different locations and time period or the impact of electromagnetic fields.

4. Optimize a design early during the initial development process to reduce production costs and time.

5. A typical ANSYS analysis software has three distinct steps which are followed by default.

6. Pre Processor (Build the Model).

BRONZE ALLOY CA104

Density	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
7.58e-009 kg mm^-3	1.15e+005	0.3	95833	44231

Table 1: Material Data Input

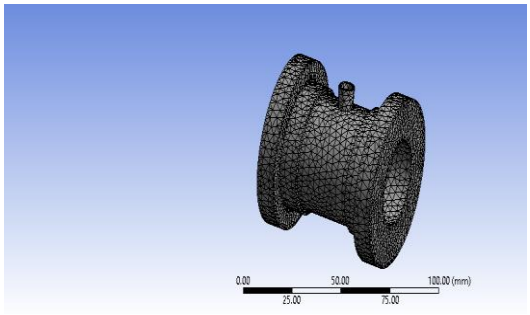

Figure 4: Meshing of model

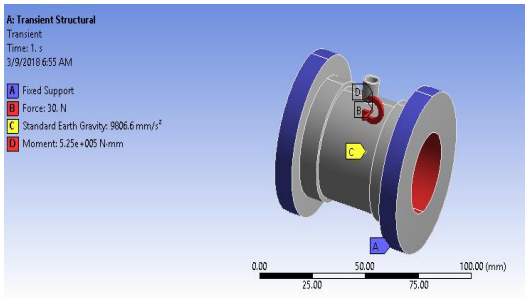

Figure 5: Applying Force and Moment

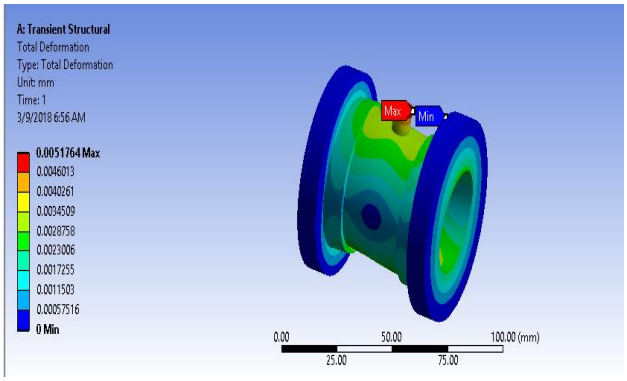

Figure 6: Total Deformation

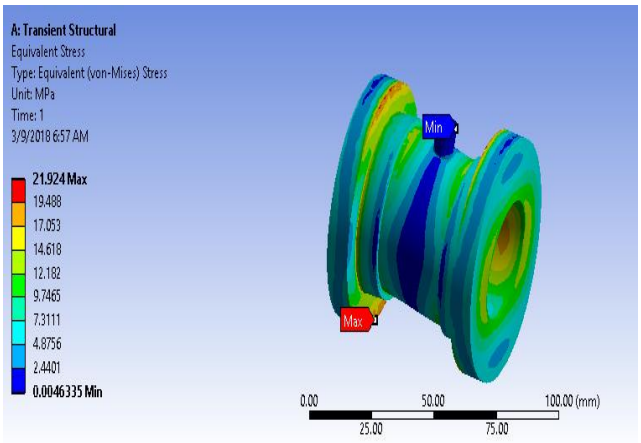

Figure 7: Equivalent stress

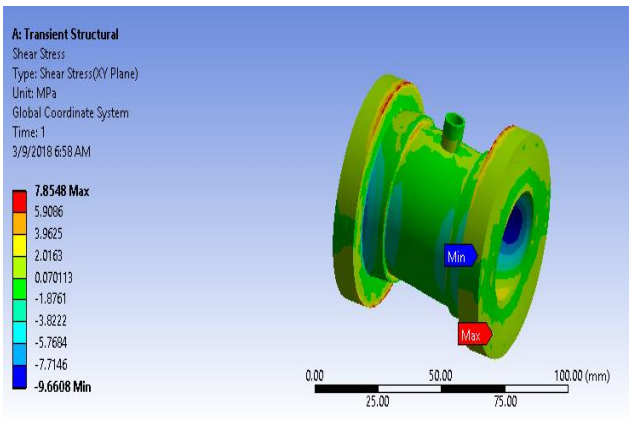

Figure 8: Shear stress

Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Equivalent Stress	Shear Stress
Minimum	0. mm	-3.0102e-003mm	7.3402e-008 mm/mm	4.6335e-003 MPa	-9.6608MPa
Maximum	5.1764e-mm	5.073e-003 mm	1.9064e-004 mm/mm	21.924 MPa	7.8548MPa

Table 2: Results Of bronze Alloy

CARBON FIBER

Material data input:

Density	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
1.6e-018 kg mm^-3	7.e+005	0.1	2.9167e+005	3.1818e+005

Table 3: Material Data Input

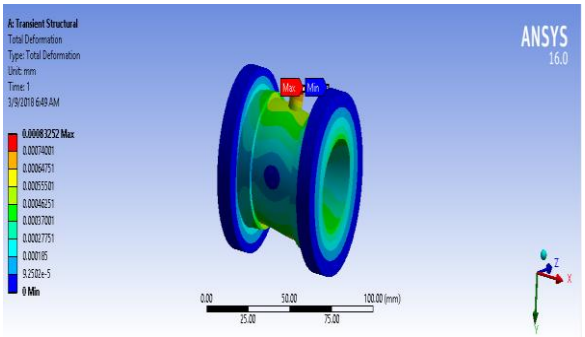

Figure 9: Total deformation

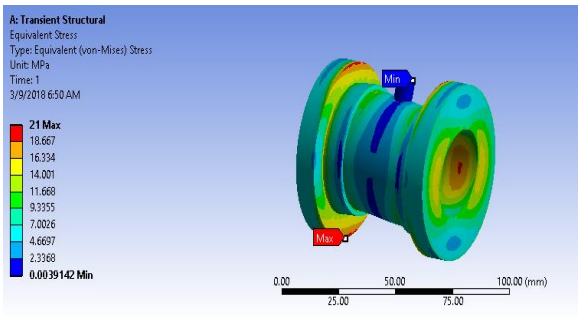

Figure 10: Equivalent Stress

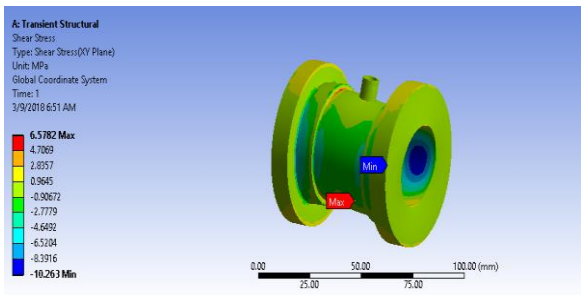

Figure 11: Shear Stress

FABRICATION PROCESS:

- **Casting Process**
- **Machining Process**
- **Facing**
- **Turning**
- **Drilling**
- **Boring**
- **Brazing**

CASTING PROCESS:-

Casting is a process in which production of replicate shapes with the help of mould cavities related to required dimensions by pouring of molten metal into the casting cavity. In some times cores and core prints will be use while the required part included internal shapes and also for the difficult external boundary shapes of the component.

Before the process of casting we need to apply heat treatment process (or) melting of required material at certain temperature. Amount of degrees is mainly depending upon the selected material and its properties.

And according to my project, heat treatment was occurs during the temperature of 1150 to 1200 degree centigrade, make an cylindrical rod with the external diameter of 70, I don't used an core prints in casting process due to un present of critical internal contours. And I maintained a constant pouring pressure to the cavity from the funnel through pure basin.

Figure 12: Pouring of molten metal to the cavity

Figure 13: finished casting component

MACHINING PROCESS:-

According to my component it includes the following operations to get a required shape. They are:-

FACING:-

Facing operation does the surface has smooth (or) flat of un even and rough surface of a component by holding the work piece in the 3 jaw chuck of lathe head and the amount of removal material to produce surface smooth depends upon the adjustment of cutting tool which are placed on tool bed of lathe machine manually(or)adjustment will be done automatically on CNC machines through program setup.

Related to my project I used single point cutting tool to get a smooth surface through lathe machine. Finally I got required length of a component after this facing operation.

Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Equivalent Stress	Shear Stress
Minimum	0. mm	-4.7793e-004 mm	8.4374e-009 mm/mm	3.9142e-003 MPa	-10.263 MPa
Maximum	8.3252e-004 mm	8.1549e-004 mm	3.e-005 mm/mm	21. MPa	6.5782 MPa

Table 3: Results of Carbon Epoxy

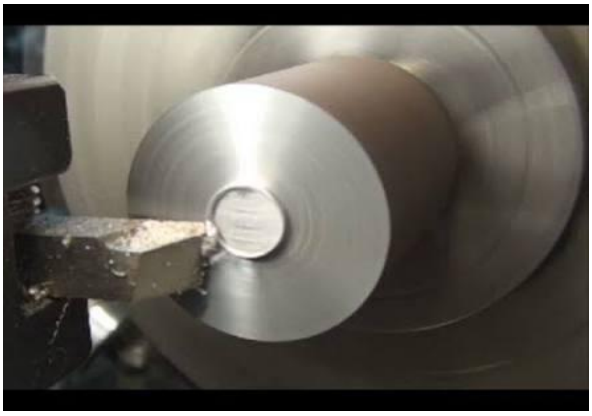

Figure 14: Facing operation

TURNING:-

Turning is one of the basic machining processes which involve production of parts which are round in shape by a single point machine tool on machines called lathes. The tool is called cutting tool and is fed either linearly in the direction parallel or perpendicular to the axis of rotation of the work piece/job, or along a specified path to produce cylindrical shapes of specified dimensions or complex rotational shapes respectively. The primary motion of cutting in a turning process is the rotation of the work piece/job, and the secondary motion of cutting is the feed motion given to the tool .

Turning of cylindrical surfaces:-

The lathe is a machine used to reduce the diameter of any given cylindrical part to a desired dimension. The resulting machined surface is also cylindrical with the specified dimension.

Figure 15: Turning operation

DRILLING:-

The process in which creation of hole feature in any component. Before that mark a center hole and aligning that center mark to the drill bit cutting tool to create a complete hole feature. This process is applied only small holes but if you want to enlarge that particular hole use the process of boring and broaching. According to my project hole was created with the diameter of 12. And finally to smooth the internal cylindrical surface of the hole used the process of broaching.

Figure 16: Drilling operation

BORING:-

It is the process of enlarging the hole feature of previous made hole with the drilling operation. And I was produced 32 diameter of hole by this process.

Figure 17:- Boring operation

BRAZING:-

Brazing is a metal-joining process where in two or more metal items are joined together by using a filler metal which is melted and spread across the joint. The filler metal has a lower melting point than the adjoining metal and hence solidifies between them immediately thereby joining them together.

Figure 18: Finished Component

CONCLUSION:

By observing above results carbon fiber gives low weight and low deformation value 8.3252e-004 mm When comparing to the Bronze Alloy CA104 that indicates carbon fiber have more strength due to less deformation. And also bronze Alloy CA 104 gives more Equivalent Stress 21.924 MPa both materials are within material yield strength so no failures are in both materials.

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