M.E.S. College of Engineering Pune 411001

Name:-Aniket Patil	Class: TE Mech 2
Semester/Year:- 6th SEM/3th YEAR	Roll no:-29
Date of Performance:-	Date of Submission:-
Examined By :- Prof B.R Pujari	Experinment No:- 5

Aim of Experiment:- **Design and Analysis of a Machine Component Using 3D Element**

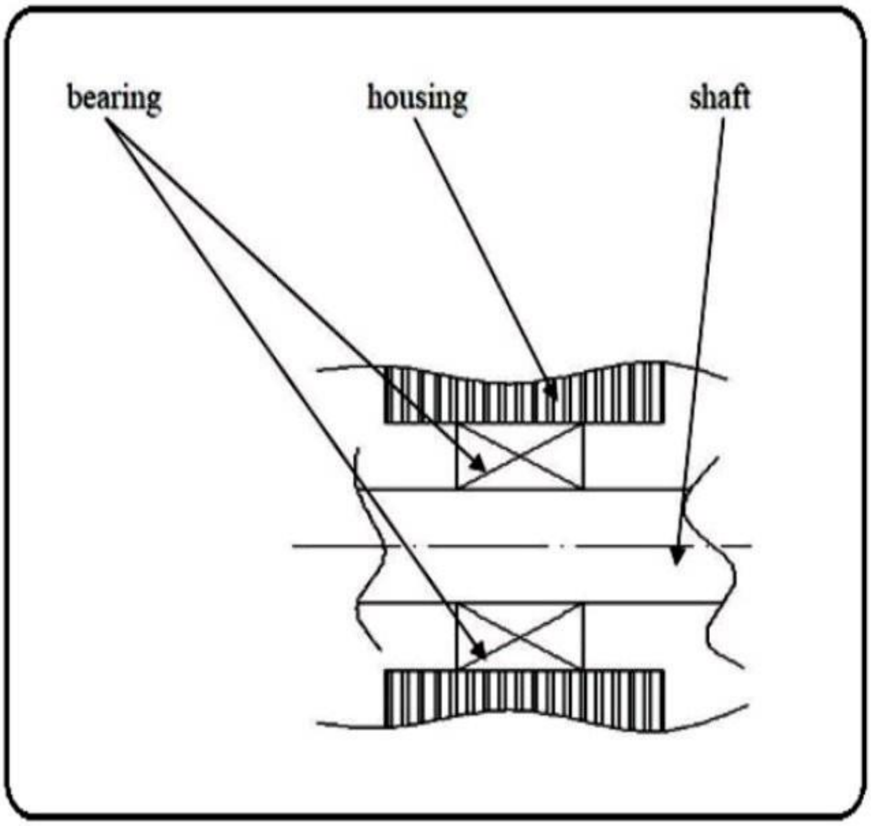
Problem Statement:- Design and Structural Analysis of Ball Bearing In ANSYS

Abstract: A bearing is popular for higher specific load carrying capacity, preventing misalignment defects and eliminating the risk of undesirable distortion of the bearings, rather than conventional one. Integral shaft bearing is used to reduce rotational friction and support radial and axial loads friction in bearings which cause an increase of Stresseinside the bearing. To analyze the stresses in a bearing system, a typical integral shaft bearing and its environment has been modeled and analyzed using the famous finite element toolANSYS. In this study we investigate structural performance of integral shaft bearing to analyze its effect on bearing clearances and vice-versa,

I. INTRODUCTION: The term "rolling bearing" includes all forms of roller and ball bearing which permit rotary motion of a shaft. Normallya whole unit of bearing is sold in the market, which includesinner ring, outer ring, rolling element (balls or rollers) andthe cage which separates the rolling element from each other.Rolling bearings are high precision, low cost but commonly used in all kinds of rotary machine. It takes long time for the human being to develop the bearing from the initial idea to the modern rolling bearing.

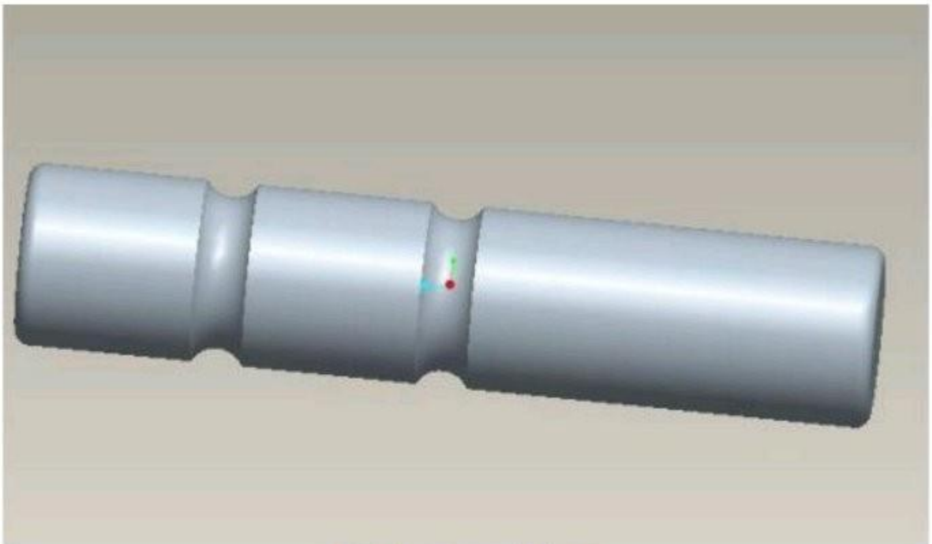
II. NEED OF INTEGRAL SHAFT BEARING

Integral Shaft Bearing has two widely spaced rows of Rolling element, do not have inner ring but raceways machined directly on the surface of the shaft. As a result there is more space available for the rolling elements, giving higher load carrying capacity with reduced price than conventional single bearings. The use of common outer ring for two rows of rolling elements prevents misalignment defects eliminating the risk of undesirable distortion of bearings. Integral Shaft bearing provides two internal designs viz. two rows of widely spaced balls and each row of ball and roller which gives broad range of load carrying capacities. The end of shaft normally extends beyond the outer ring on both sides. The length and diameter of these sections are matched to the specific application. This results in a simple, ready-to-fit bearing unit that is primarily used in water pumps for automobiles. Since they are not restricted to use in water pumps, also called as Integral Shaft Bearings. Specialty bearing shafts may have flats, knurl, keyways, holes, internal/external threads, splines

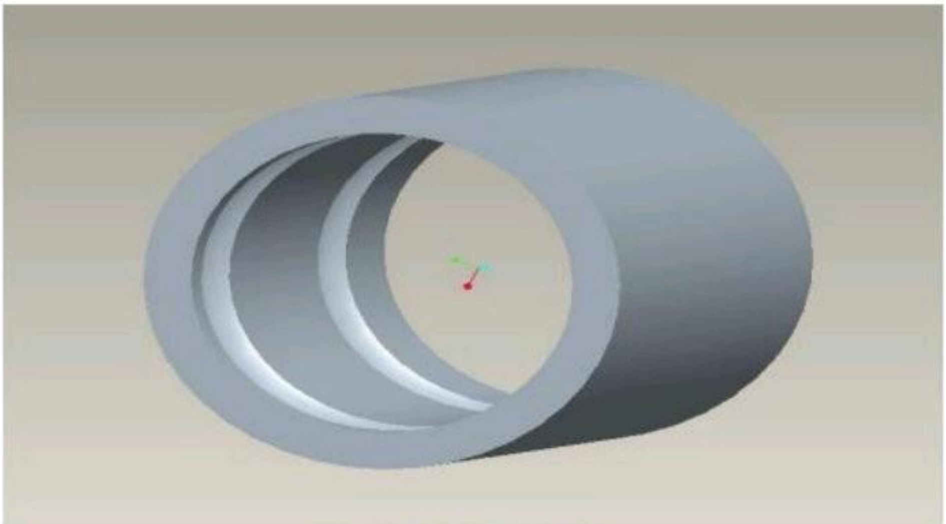


A. Modeling of Integral-Shaft Bearing

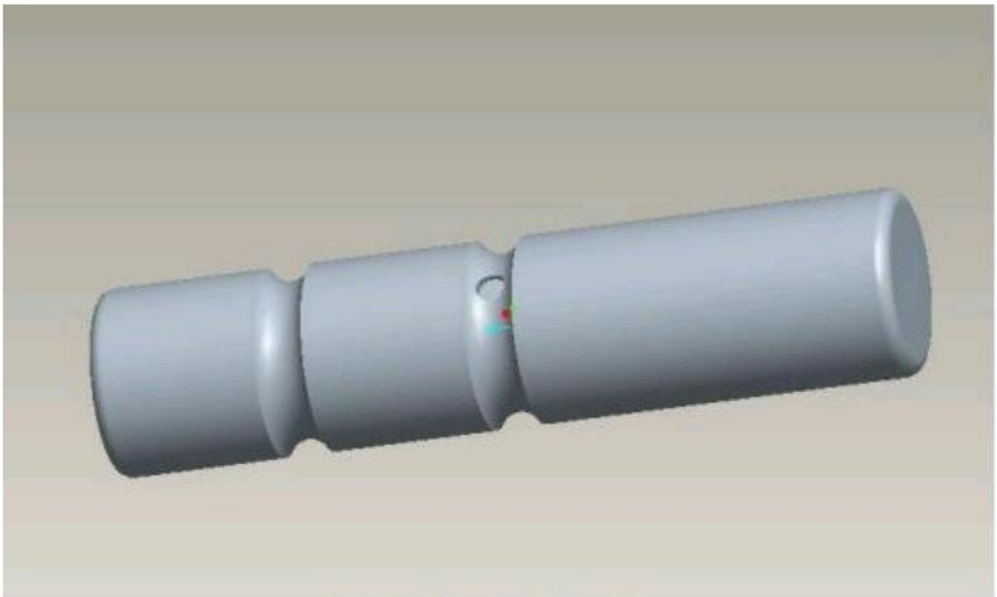
Models of Integral Shaft Bearing parts are modeled in PRO-E design software. The parts are Shaft, Hub, balls, assembly and the parts with circular defects



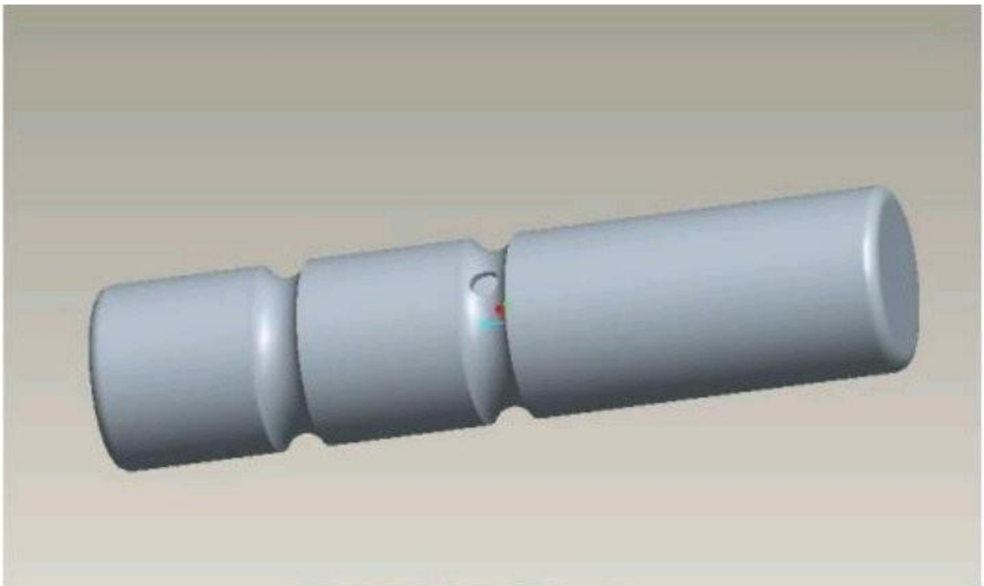
(a) Healthy Shaft



(b) Healthy Hub



(d) Defective Shaft



(d) Defective Shaft

III. ANALYSIS

ANSYS is a finite element analysis software package

- Capable of analyzing a range of engineering applications: - Structural - Thermal - Electromagnetic - Fluid Dynamics
- Unitless analysis, but must be consistent throughout Processors.

Preprocessing:

- Define element type, real constants, and material properties.
- Define geometry Processors.

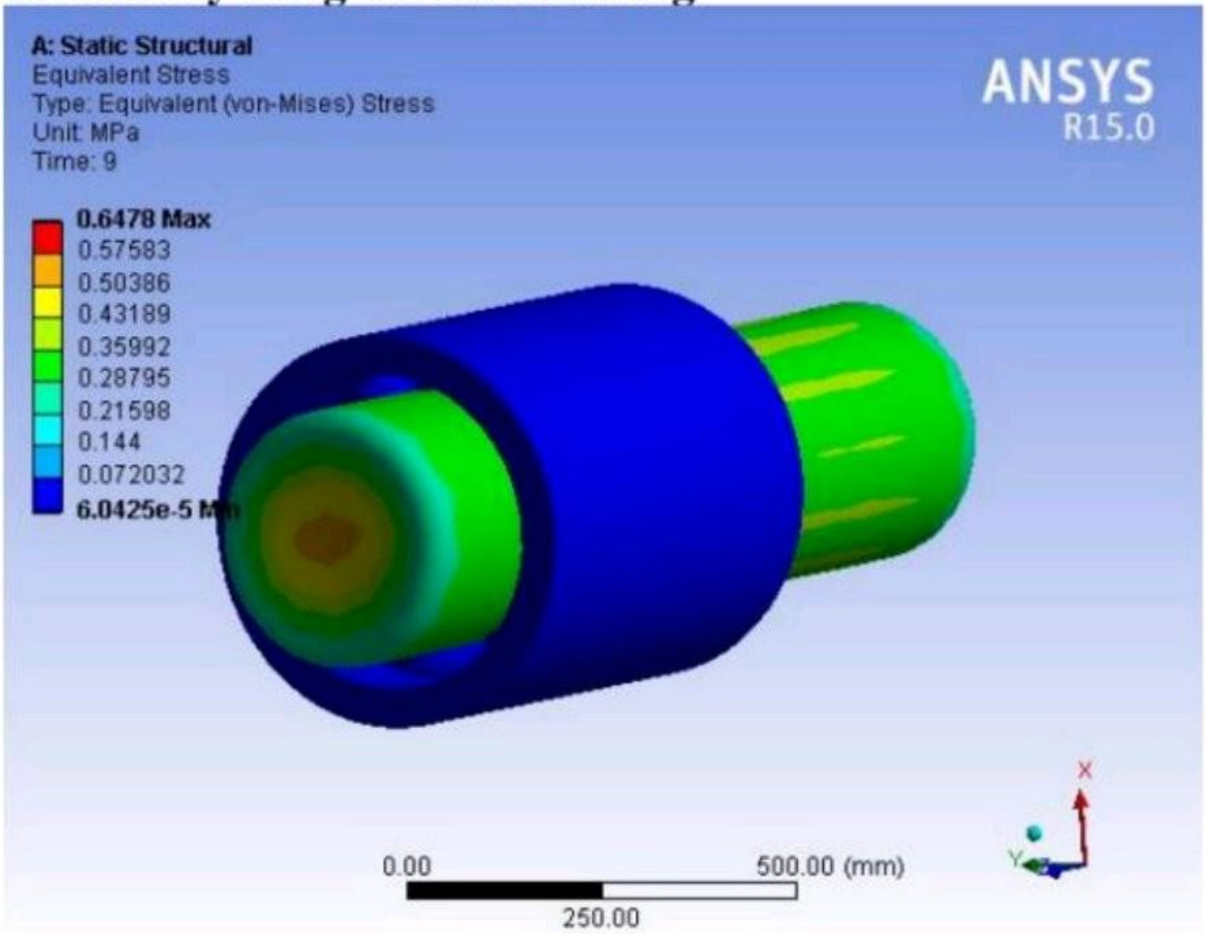
Solution:

- Define type of analysis.
- Set boundary conditions.
- Apply loads.
- Initiate finite element solution.

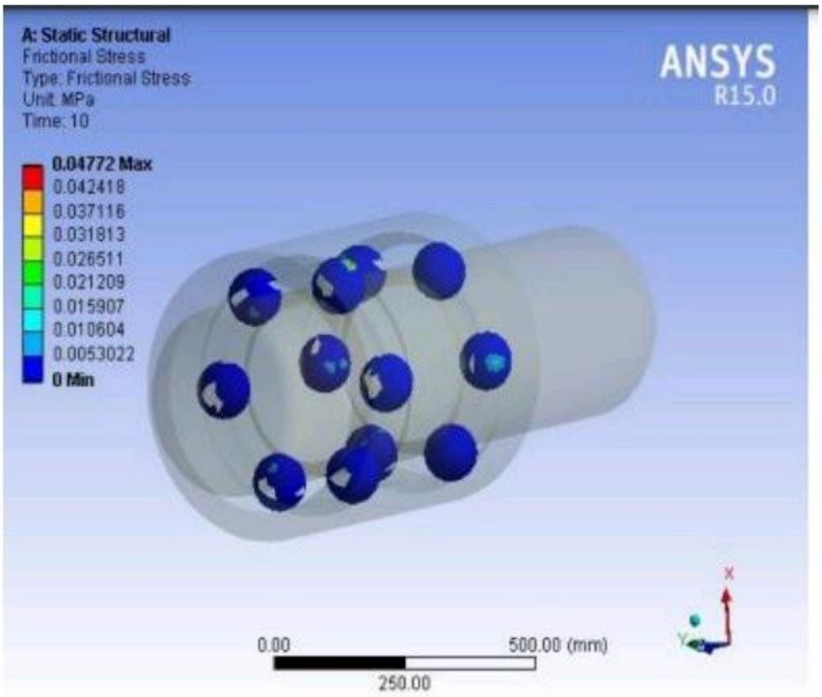
Post Processing:

- Review results using graphical displays and tabular listings. Verify against analytical solutions.

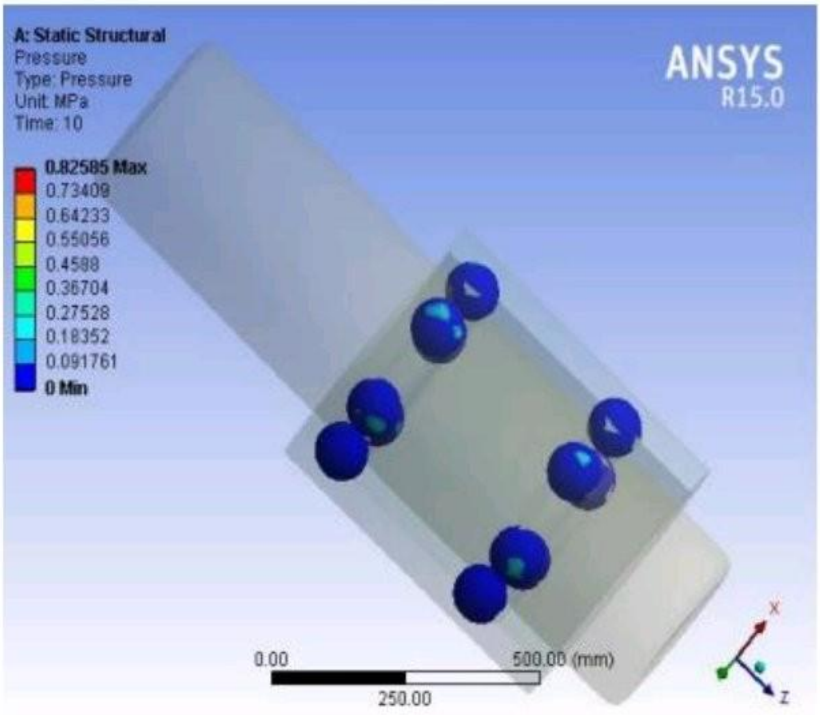
A. Healthy integral shaft bearing



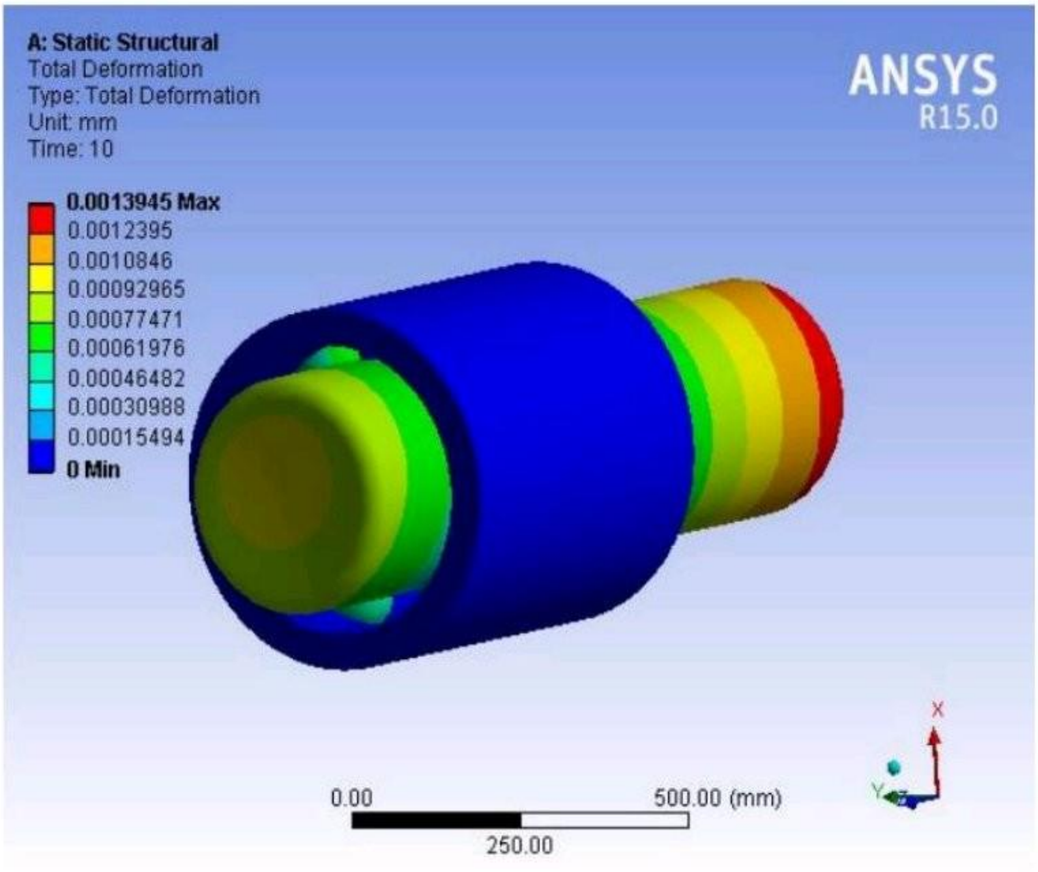
(a)


A: Static Structural
Frictional Stress
Type: Frictional Stress
Unit: MPa
Time: 10
0.04772 Max
0.042418
0.037116
0.031813
0.026511
0.021209
0.015907
0.010604
0.0053022
0 Min
ANSYS
R15.0
0.00
500.00 (mm)
250.00

(b)


A: Static Structural
Pressure
Type: Pressure
Unit: MPa
Time: 10
0.82585 Max
0.73409
0.64233
0.55056
0.4588
0.36704
0.27528
0.18352
0.091761
0 Min
ANSYS
R15.0
0.00
500.00 (mm)
250.00

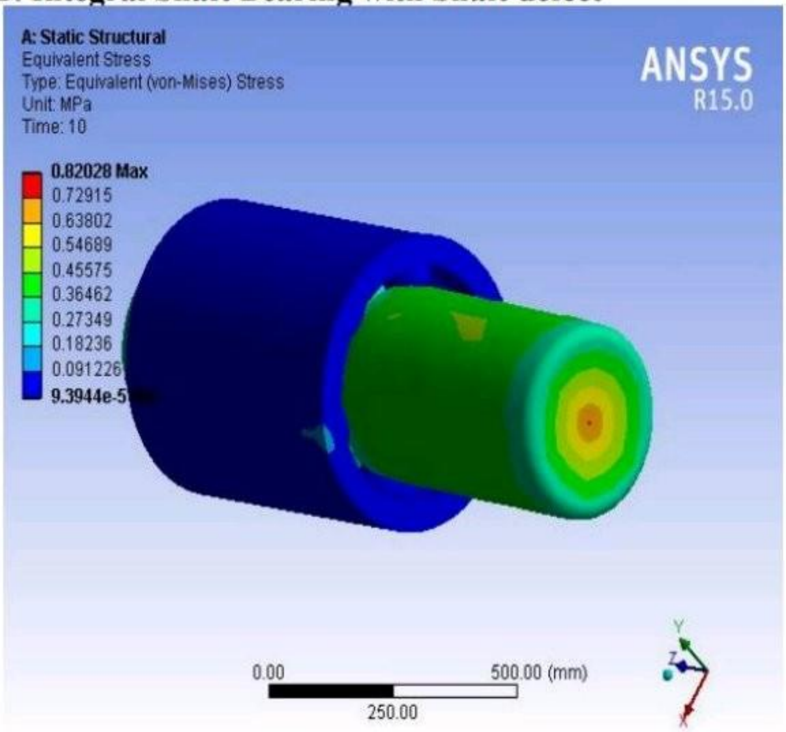
(c)



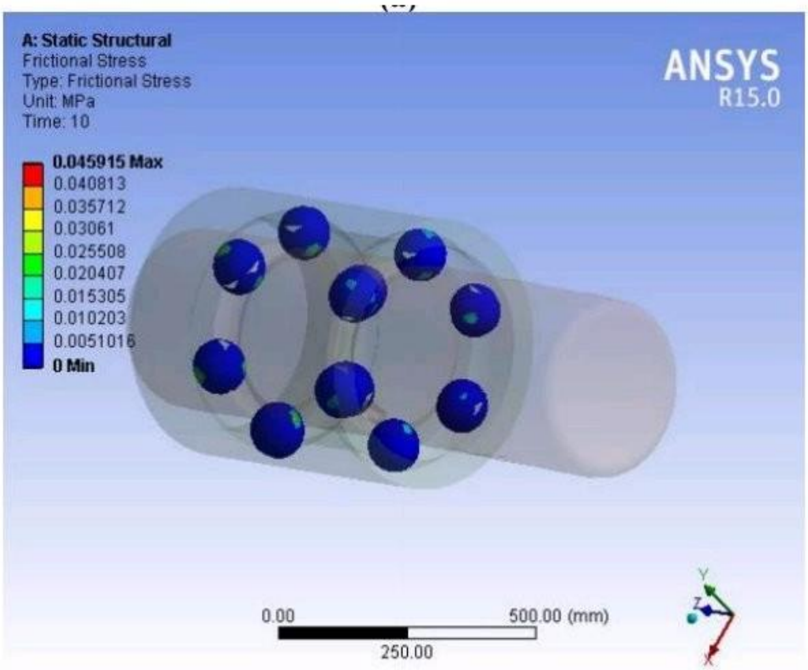
(d)

Fig.3. (a) Equivalent Stress (b) Frictional stress (c) Pressure (d) Total Deformation.

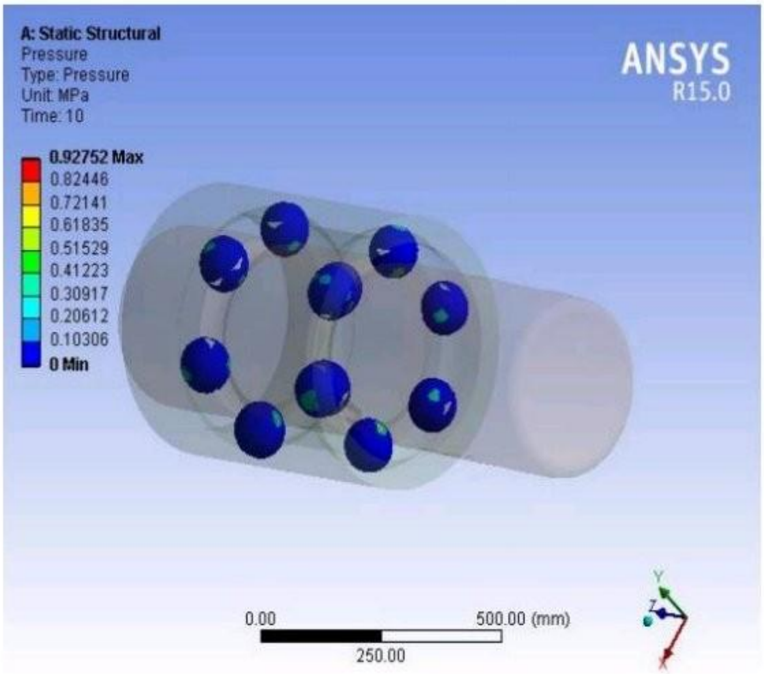
B. Integral Shaft Bearing with Shaft defect



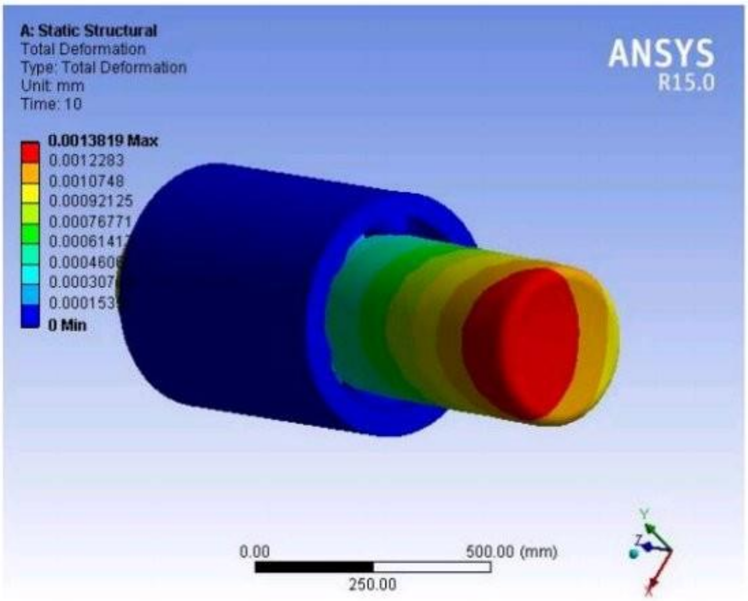
(a)



(b)



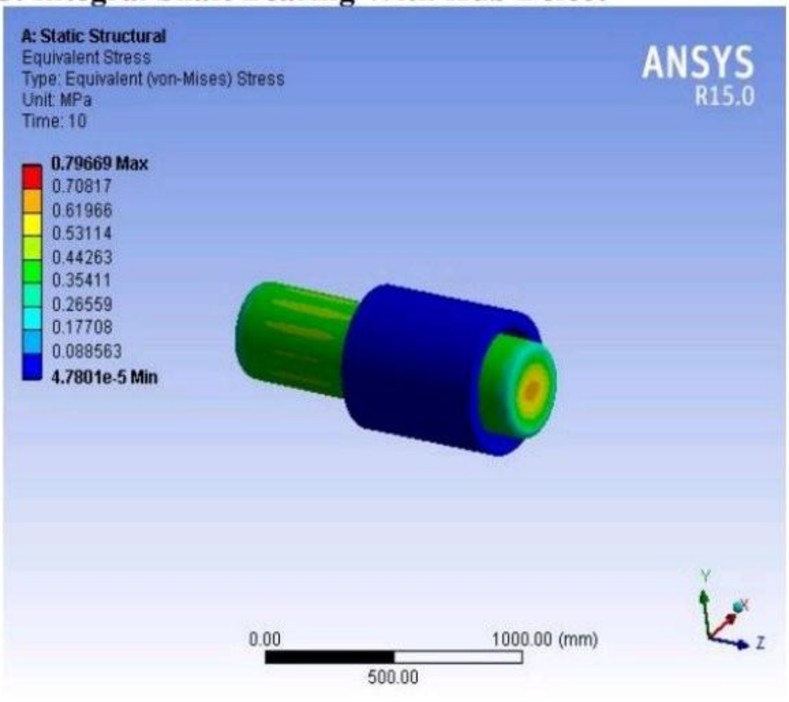
(c)



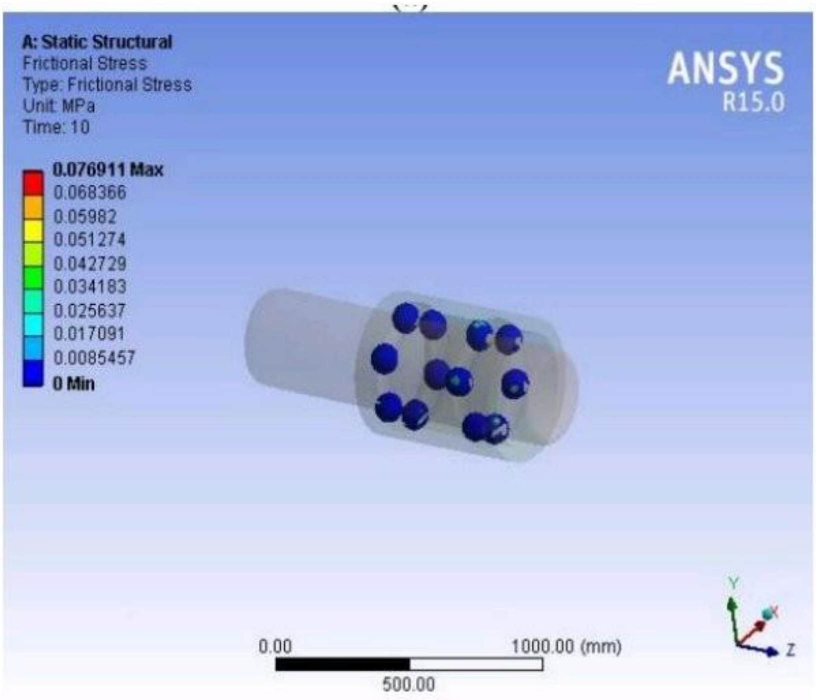
(d)

Fig.4. (a) Equivalent Stress (b) Frictional stress (c) Pressure (d) Total Deformation.

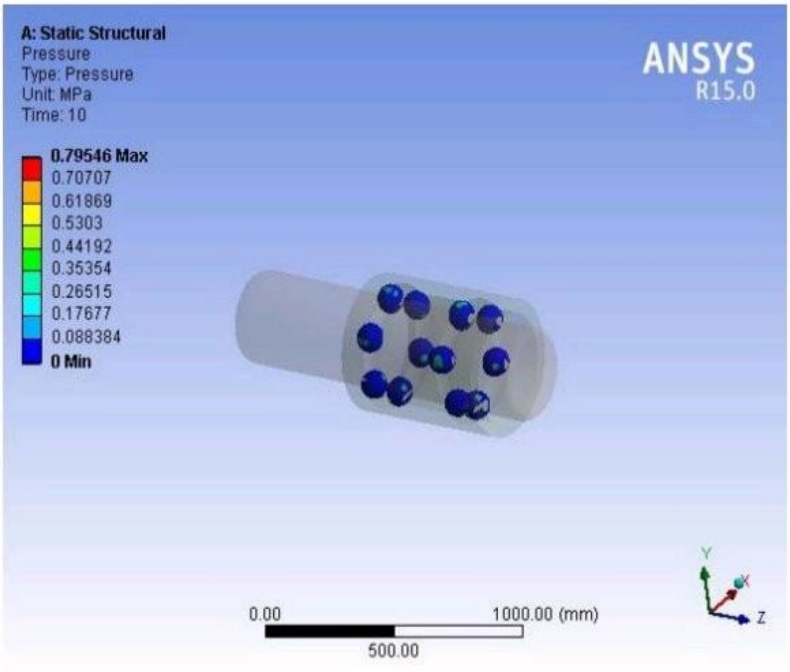
C. Integral Shaft Bearing With Hub Defect



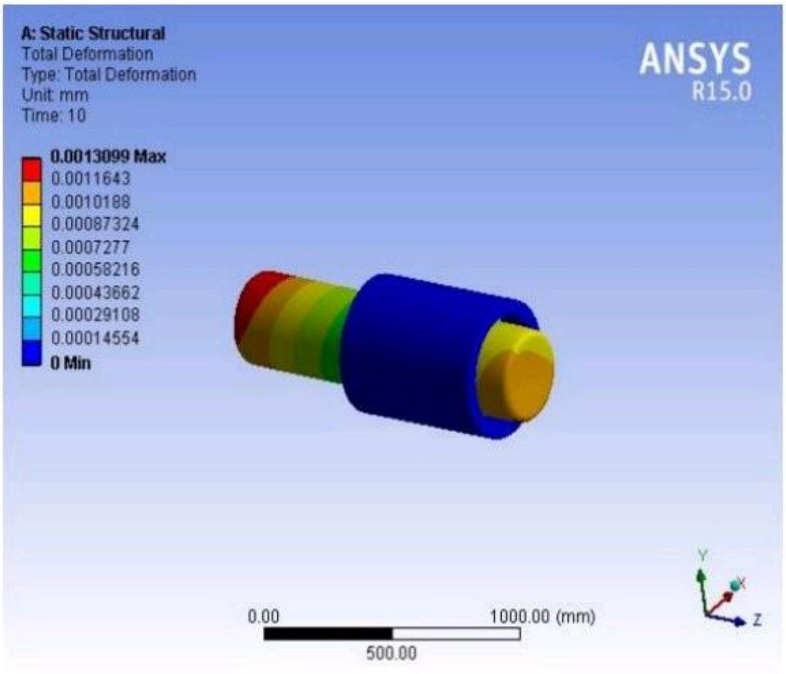
(a)



(b)


A: Static Structural
Pressure
Type: Pressure
Unit: MPa
Time: 10
0.79546 Max
0.70707
0.61869
0.5303
0.44192
0.35354
0.26515
0.17677
0.088384
0 Min
ANSYS
R15.0
0.00
1000.00 (mm)
500.00
Y
X
Z

(c)


A: Static Structural
Total Deformation
Type: Total Deformation
Unit: mm
Time: 10
0.0013099 Max
0.0011643
0.0010188
0.00087324
0.0007277
0.00058216
0.00043662
0.00029108
0.00014554
0 Min
ANSYS
R15.0
0.00
1000.00 (mm)
500.00
Y
X
Z

(d)

Fig.5.

TABLE 1. RESULTS

Condition of bearing system	Equivalent Stress (MPA)	Total Deformation (mm)	Friction-al Stress (MPA)	Contact Pressure (MPA)
Healthy	0.6478	0.00139	0.0477	0.8258
Shaft Defect	0.8202	0.00138	0.04591	0.9275
Hub Defect	0.7966	0.00130	0.07691	0.7954

V. CONCLUSION

From the structural analysis it is showed that the model is under safe design limits. The analysis is the comparison of a healthy integral bearing to the bearing with shaft defect and hub defect. The equivalent stress is high for the bearing with shaft defect whereas frictional stress is less, deformation is high and contact pressure is high. Thus it is observed that the bearing with shaft defect causes high damage in running conditions of the bearings.