Design and Development of Journal Bearing Experimental Setup for Determining the Pressure Distribution Due to Hydrodynamic Action

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Abstract

In hydrodynamic lubrication, the pressure condition of the fluid is critical to ensure good performance of the lubricated machine elements such as journal bearings. In the present study, an experimental work is conducted to determine the pressure distribution around the circumference of a journal bearing due to variation in Speed and Loads. It is concluded after observation that the location of the maximum pressure for the given operating conditions is close to the position where radial clearance between journal and casing is minimum. Our study deals with a design of journal bearing apparatus to determine the pressure distribution along the periphery and along the length of the journal bearing. By adding the weight also we can take the readings at various speeds.

Keywords- Hydrodynamic, Journal Bearing, Pressure distribution

I. INTRODUCTION

A. Wear

Due to rotating motion of journal the bearing friction occurs. Due to friction wear of bearing and journal is occurred. To reduce wear hydrodynamic lubrication is used.

Fig. 1: Wear

B. Lubrication

Lubrication is the science (process and technique) employed to reduce friction and wear of one or both surfaces. Fig shows hydrodynamic lubrication. Left side figure shows static position of journal, middle figure shows starting position of journal and right side figure shows Running position of Journal.

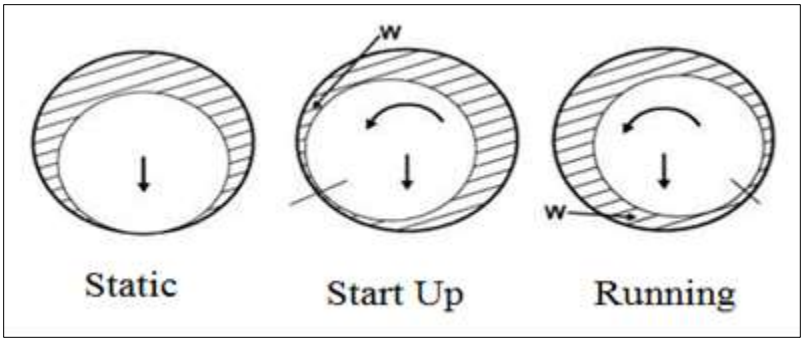

Fig. 2: Lubrication

C. Experimental Setup

Journal Bearing is to be tested using the journal Bearing test rig. The both bearing and shaft is made up of mild steel. This journal bearing is tested using SAE30 Oil. The Dimmer stat is provided to adjust the speed of shaft and 0.5 HP DC motor is provided. This motor shaft is connected to the journal using coupling and braring is mounted on the journal shaft. The Pedestal bearing is also provided to support the journal shaft.

In this test rig total 16 nos of tubes are provided i.e. 12 tubes on periphery of journal and 4along the axial direction. The hose nipples are provided to connect tubes and journal shaft. The length to diameter ratio was kept 1.8 that is length is 90mm and diameter is 50mm. This setup is tested under the specified operating conditions at different Speeds and loads.

Fig. 3: Journal Bearing test rig

D. Details of Assembly Parts

1) Journal Bearing

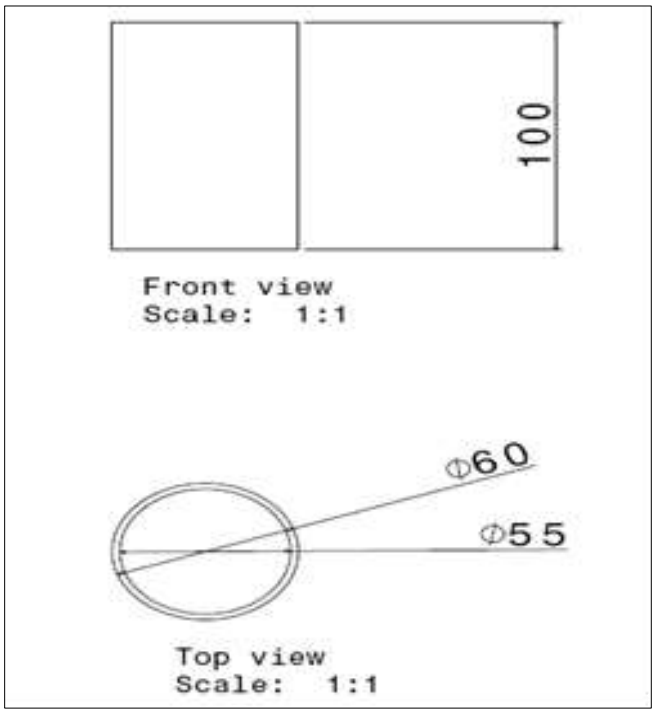

Fig. 4: Journal Bearing

2) Frame

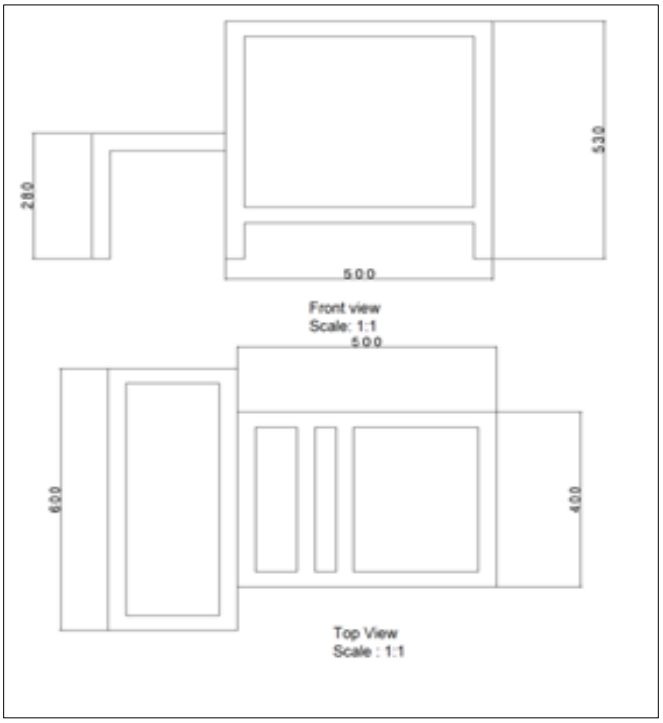

Fig. 5: Frame

3) Panel with Pipes

Fig. 6: Panel with pipes

4) Pedestal Bearing

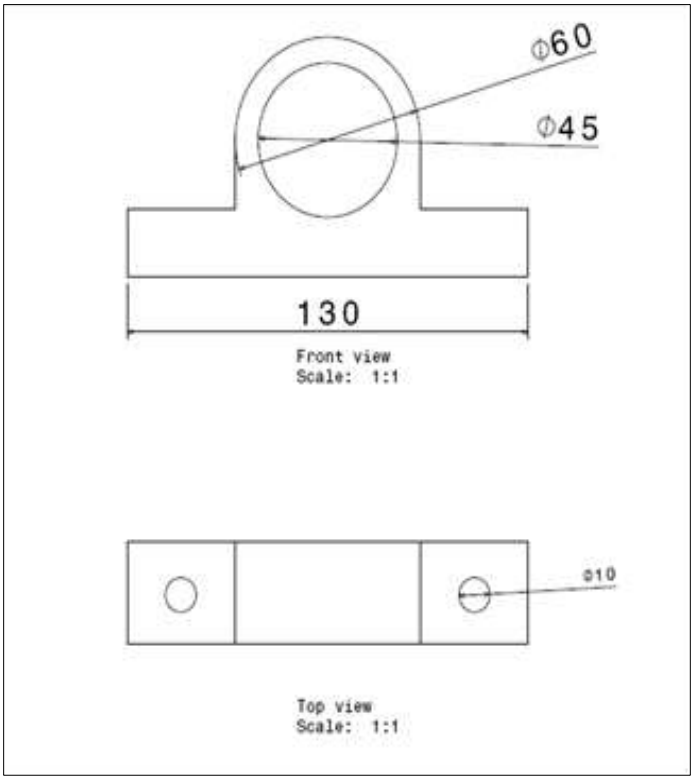

Fig. 7: Pedestal Bearing

5) Oil Tank

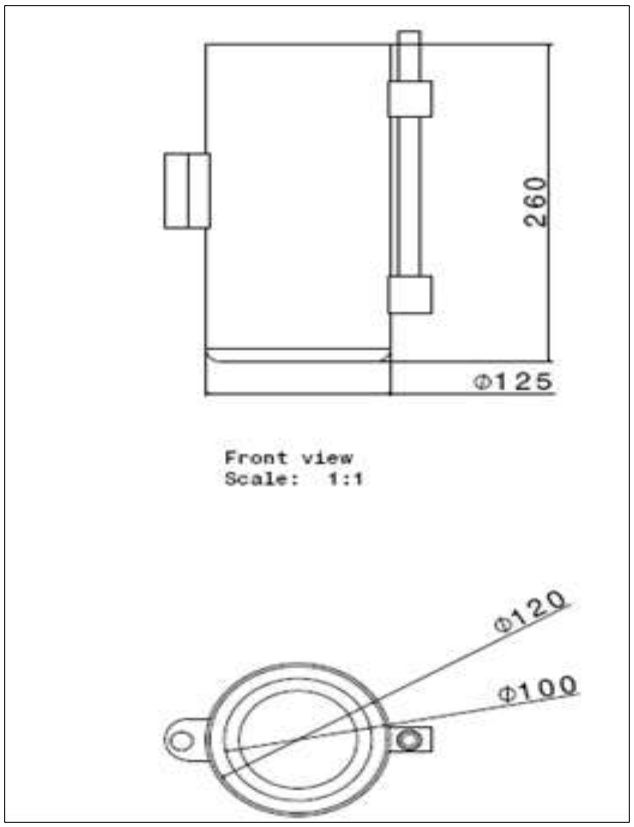

Fig. 8: Oil Tank

6) Motor

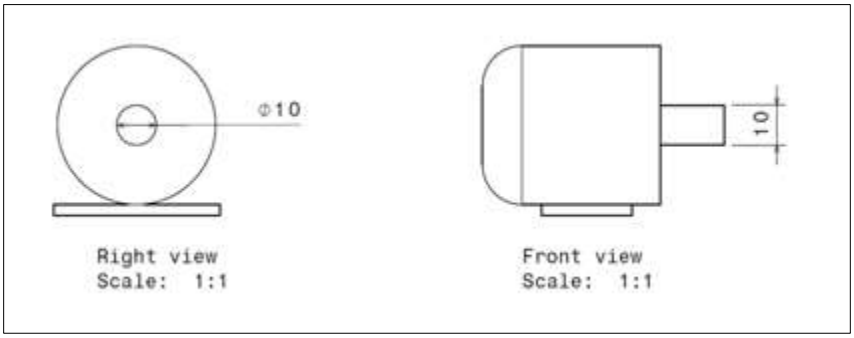

Fig. 9: Motor

E. Readings

1) Pressure Head 'P'

Reading No.		*01*	*02*	*03*	*04*
Speed (rpm)		*138*	*155*	*102*	*136*
Mass(kg)		*-*	*4900.470*	*0.470*	*0.800*
Datum (mm)		*1210*	*1085*	*1085*	*1075*
	1	*1257*	*1015*	*1070*	*980*
	2	*943*	*630*	*918*	*690*
	3	*1125*	*845*	*1030*	*845*
	4	*1220*	*963*	*1087*	*960*
	5	*1271*	*1027*	*1120*	*1055*
	6	*1309*	*1070*	*1142*	*1070*
	7	*1338*	*1110*	*1160*	*1100*
	8	*1370*	*1140*	*1180*	*1145*

TUBE NO.	*9*	*1415*	*1200*	*1208*	*1195*
	10	*1425*	*1285*	*1255*	*1280*
	11	*1620*	*1440*	*1344*	*1440*
	A	*1653*	*1500*	*1363*	*1500*
	B	*1715*	*1580*	*1400*	*1575*
	12	*1760*	*1630*	*1485*	*1630*
	C	*1705*	*1585*	*1395*	*1510*
	D	*1622*	*1462*	*1345*	*1460*

2) Pressure Difference

Pressure Difference = Datum Level Reading – Actual Tube Reading
= $P - P_o$

Reading No.		*01*	*02*	*03*	*04*
Speed (rpm)		*138*	*155*	*102*	*136*
Mass(kg)		*-*	*4900.470*	*0.470*	*0.800*
Datum (mm)		*1210*	*1085*	*1085*	*1075*
TUBE NO.	*1*	*57*	*-70*	*-15*	*-95*
	2	*-257*	*-458*	*-167*	*-385*
	3	*-75*	*-240*	*-55*	*-190*
	4	*20*	*-122*	*2*	*-115*
	5	*71*	*-57*	*35*	*-50*
	6	*109*	*-15*	*57*	*-5*
	7	*138*	*25*	*75*	*25*
	8	*170*	*61*	*95*	*70*
	9	*215*	*115*	*123*	*120*
	10	*285*	*200*	*170*	*205*
	11	*420*	*355*	*259*	*362*
	12	*560*	*545*	*350*	*555*

II. RESULT AND CONCLUSION

A. Reading No. -0

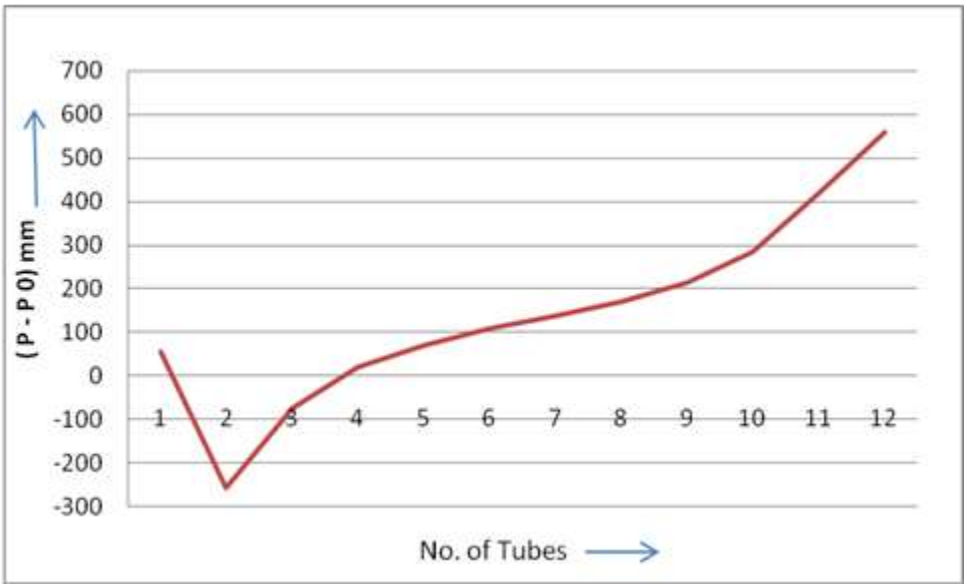

Fig. 10: Linear Graph

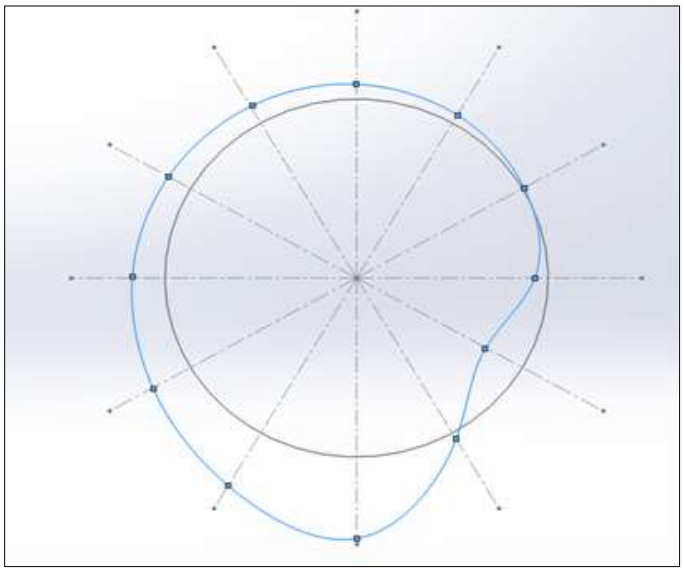

Fig. 11: Polar Graph

B. Reading No. -02

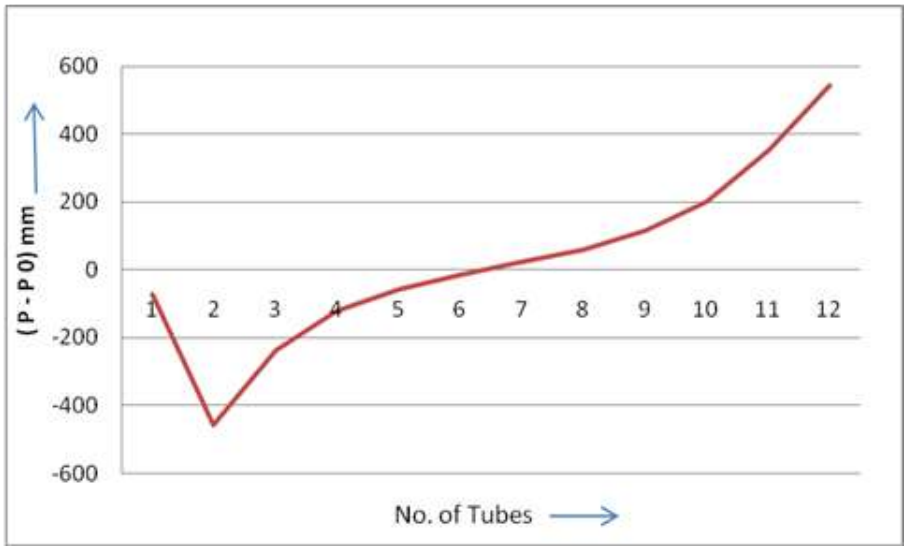

Fig. 12: Linear Graph

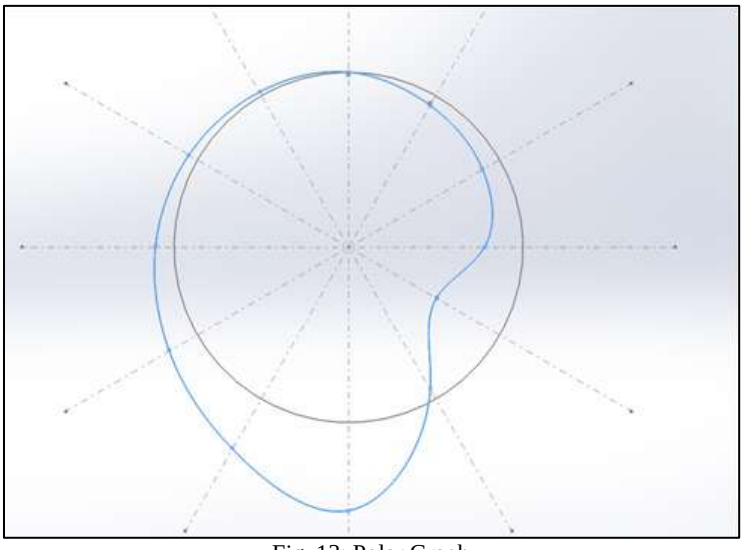

Fig. 13: Polar Graph

C. Reading No. -03

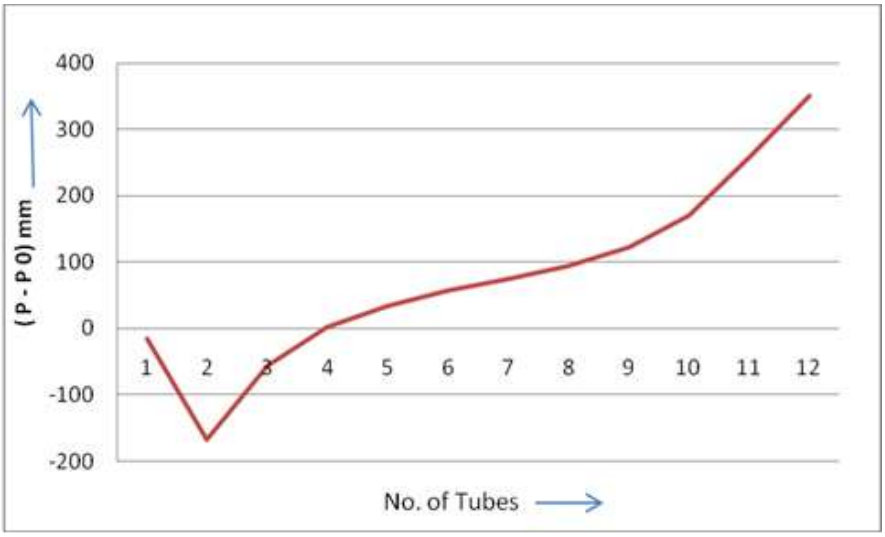

Fig. 14: Linear Graph

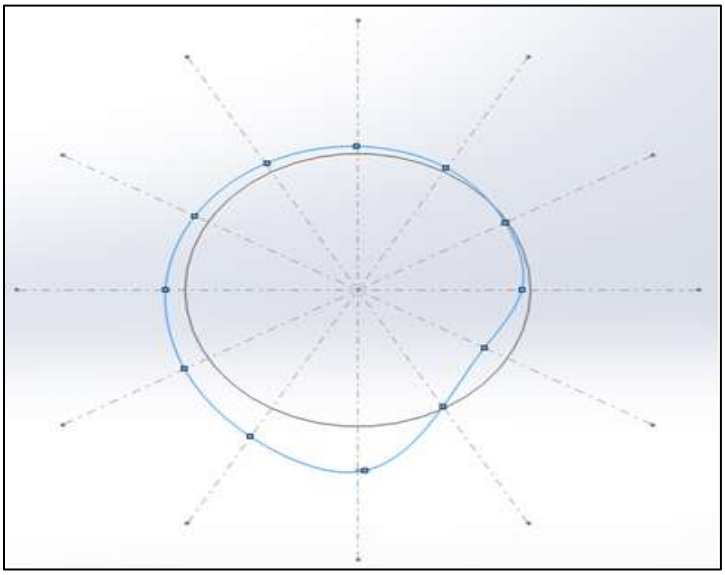

Fig. 15: Polar Graph

D. Reading No. -04

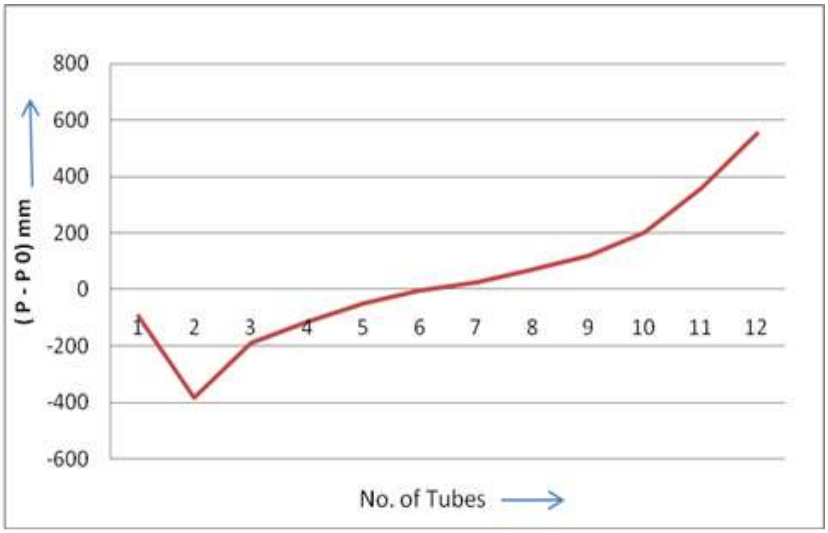

Fig. 16: Linear Graph

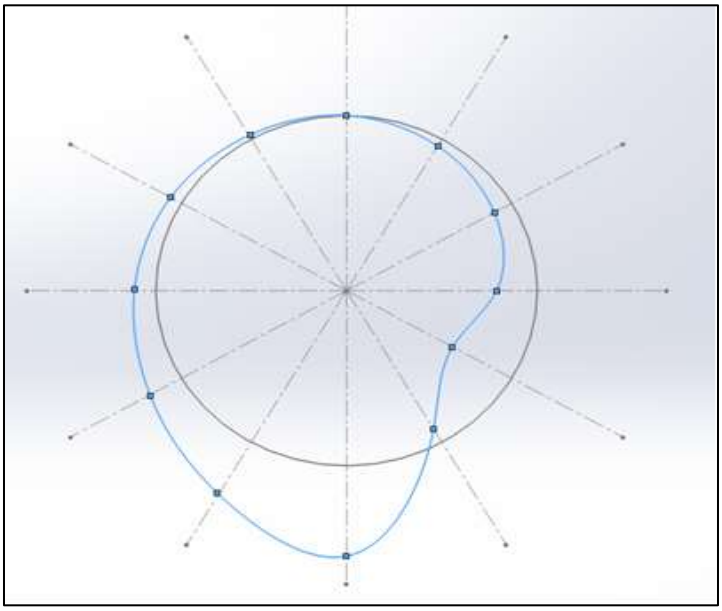

Fig. 17: Polar Graph

III. CONCLUSION

Hydrodynamic journal bearing which create load supporting fluid film according to shape and relative motion of the sliding surface, which avoid the metal to metal contact between the shafts and bearing .Hence, no friction will be occurred and pressure profile is created to load action on journal bearing.

Hydrodynamic bearing are suited for high load and high speed condition particularly from considerations of long life also noise created by hydrodynamic journal bearing is lesser as compared to other bearing. Frictional loss is only at the starting condition and after that certain speed power loss due to friction is lower.

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