Review Article
Tharesh Gawande, IJPRET, 2014; Volume 2 (6): 33-40

ISSN: 2319-507X
IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN OF TEST RIG FOR GEAR INSPECTION: A REVIEW

THARESH K. GAWANDE, PROF. A. S. BOMBATKAR

1. Student of CAD/CAM, Mechanical Engineering Department, KGIET, Darapur.
2. Assistant Professor, Mechanical Engineering Department, KGIET, Darapur.

Accepted Date: 13/01/2014 ; Published Date: 01/02/2014

Abstract: In order to check the combined tooth error different types of gear testing machines are used. Various machines have its ability to check specified parameters only. Highly precise machine required special installation and space. For the purpose of checking gear in machine shop while performing machine required such an arrangement which is robust and quick one. This purpose can be solved using gear test rig. This type of gear test rig can be used for mass production of gears of a particular gear box.

Keywords: Gear, test rig, inspection

PAPER-QR CODE

Corresponding Author: MR. THARESH K. GAWANDE

Access Online On:

www.ijpret.com

How to Cite This Article:

Tharesh Gawande, IJPRET, 2014; Volume 2 (6): 33-40

INTRODUCTION

Gears have been in use for hundreds of years and it will be continue for few more years. Sometime these gears are manufactured in mass production like manufacturing the gears of a specific machine's gear box. Gear performance depends on various parameters such as material, design, manufacturing, operation and environment. Manufacturing of the gear is a very important step which decides the accuracy of the gear. This requires the inspection at various steps. Also this inspection should not consume too much money in terms of labour and time. That's why it should be easy to inspect and operate.

Gear test rig is such arrangement which simplifies the measurement and saves the labour time and labour cost with greater accuracy. In gear test rig all the gears will be mounted on a plate which may be fixed or stationary as per the requirement of the measurement. While measuring the one gear remaining will act as a master gear. This will help in finding the composite error. This test rig can be used in shop floor as it requires less space and operator can use it as per need without wasting much time. The test rig can be developed for different parameter as per measurement requirement. There are various test rigs which can be used for that particular designed condition.

Some research work related to test rig are as follows:

1. **M.E. Niza et al**., A test rig to evaluate the performance of a micro involute gear with a diameter below 1 mm has been developed. In this research, the measurement and adjustment method of gear assembly condition and an in-situ observation system of gear condition are proposed, that are appropriately designed for micro gears. The meshing condition of micro involute gears is investigated experimentally.

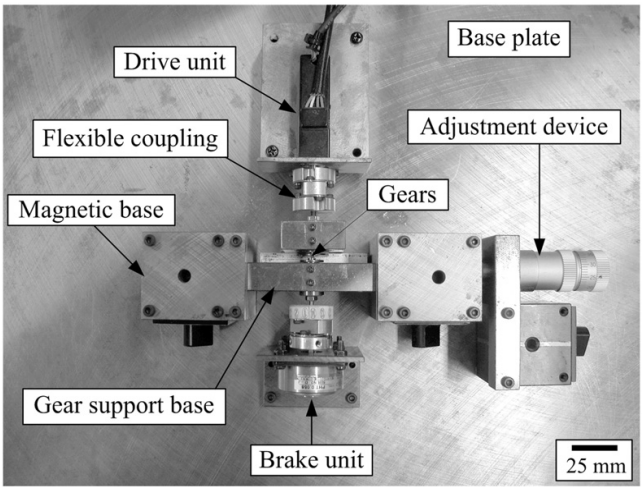
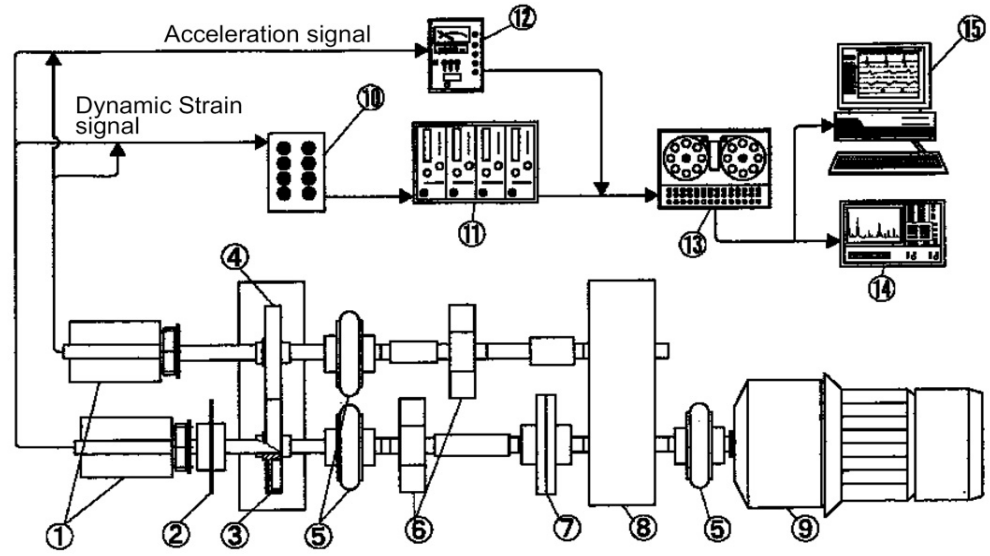


Fig.1. Overview of developed micro gear test rig.

One-sided support structure of large diameter gear shaft and ball bearing with preload is proposed as an appropriate support method of micro gear in terms of stiffness and rotational accuracy. Measurement method of gear assembly condition is proposed by using laser displacement sensor and XY stage. Relative position and posture of the drive and driven gears are estimated through fitting the theoretical 3-D form into the measured one. Gear support base integrated with magnetic base is presented, which has advantages in multi degree of freedom (DOF) adjustment and high stiffness. For the in-situ observation system, a high power stereo microscope integrated with digital camera is introduced, which enables the observation of the gear tooth condition without disassembling the gear parts.

2. **Shuting Li,** This paper is a fundamental study on resonance frequency behaviour of three-dimensional, thin-walled spur gears from experimental tests and finite element analyses. ‘‘power-circulating form’’ test rig is built for vibration tests of the thin-walled gears at the speed range 500–3000 rpm and then strain phase method is presented in this paper to identify the resonance mode shapes of the thin-walled gears when they are running in a complete resonance state. In recent years, these gears have been finding wide applications in general machines for weight reduction and compact design. Though applications of the thin-walled gears are increased in general machines, vibration and dynamic strength design problems of the gears have not been solved so far. This paper attempts to solve some of these problems stated above through experimental investigations and FEM analyses. In this paper, firstly, ‘‘Power-circulating Form’’ gear test rig is built to test resonance frequencies, mode shapes and dynamic load factors of two thin-walled spur gears with different wall thickness in speed range 500–3000 rpm. Dynamic behaviour of the thick-walled gears in the test rig is also investigated at the same time for comparisons.



(1)Slip ring (2)Gear for speed test (3)Test gear (Thin-walled gear) (4)Solid gear
(5)Rubber coupling (6)Bearing support (7)Torque-loading coupling (8)Power circulating gear box
(9)Speed-variable motor (10)Bridge box (11)Dynamic strain amplifier (12)Acceleration amplifier
(13)Data recorder (14)FFT analyzer (15)Personal computer

Fig.2. ‘‘Power-circulating form’’ test rig.

3. ***N.A. Wright, S.N. Kukureka,*** this paper focuses on the aspects of the performance of polymeric gears have been studied by a number of workers and efforts have been made to simulate the contact conditions during gear running. However, until now the wear performance of gears made from polymer matrix composites has not been studied systematically. While such materials have been studied using pin-on-disc or twin disc roll/slide wear techniques, no attempt has ever been made to directly compare the results from such studies with those from gear tests. This paper attempts to explain the comparative methods of measurement of various polymer matrix composite gear materials and to relate their performance to results obtained in contact simulation experiments by other workers. Methods of wear testing are compared including direct gear testing and disc testing, together with electronic (displacement) measurement, weight loss and direct measurement. A new method of characterising the wear of gears is presented, which relates actual contact conditions and gear tooth wear. This co-ordinate measurement technique provides wear rates as a function of roll angle, and hence load, sliding speed and slip ratio. It allows comparisons between gear tests and a simpler test configuration, the twin disc roll/slide test.

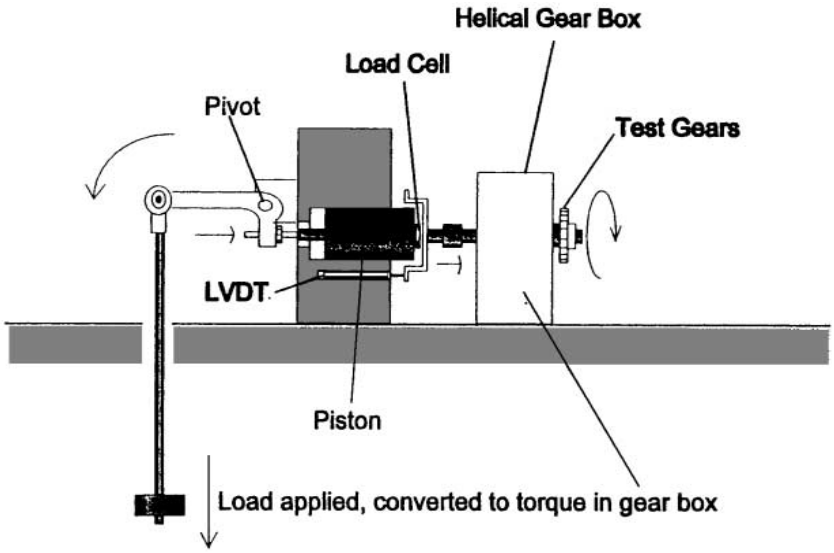


Fig.3. Gear test rig

4. **Mats Åkerblom,** A gear test rig has been designed and built. The test rig will be used for gear noise and vibration testing. In addition to noise and vibration testing the gear test rig can be used for gear life testing and measurement of efficiency. The measurement of efficiency is possible by measuring the torque and rotational speed of the shaft from the electric motor. Specification of gear and pinion used in test rig are shown in table.

	pinion	Gear
Number of teeth	49	55
Normal module (mm)	3.5	3.5
Pressure angle	20º	20º
Helix angle	–20º	20º
Centre distance (mm)	191.9	191.9
Face width (mm)	35	33
Profile shift coefficient	+0.038	–0.529
Tip diameter (mm)	191	209

Table1. Technical data for test gears.

Finite element analysis has been used to predict the natural frequencies and mode shapes for individual parts and for complete gearboxes. Experimental modal analysis has been carried out on the gearbox housing and the results show that the FE predictions are in good agreement with measured frequencies.

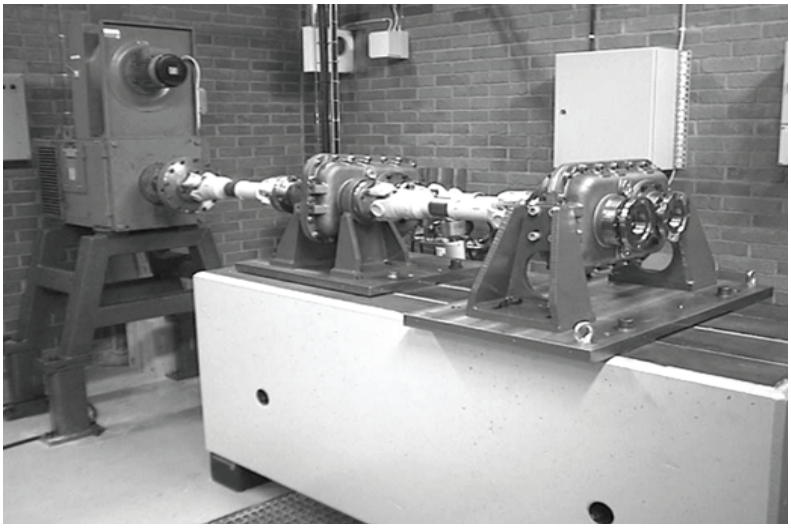


Fig.4. Gear test rig.

5.Parkinson's Gear Tester, principle of this gear tester is to mount a standard gear on a fixed vertical spindle and gear to be tested on another similar spindle mounted on a sliding carriage, maintaining the gears in mesh by spring pressure. Movement of the sliding carriage as the gear rotated are indicated by a dial indicator. This dial indicator gives the reading of movement of gears or it may be said that dial gauge gives the measurement of gear variations. These variations are a measure of any irregularities in the gear under test.

Gears are mounted on two mandrels so that they are free to rotate without measurable clearance. Master gear is mounted on a fixed plate while gear under test is mounted on sliding carriage. These two plates are connected under spring pressure. There are screws for limiting the movement of sliding carriage. This tester is used for only single gear. In this gear a disadvantage may be considered as its only restricted with single gear measurement so meshing condition of all gears of a gear box can not be analysed. So for analysing the meshing condition of all gears in a single test is not possible.

Fig.5. Parkinson's gear tester

CONCLUSION

From the above study it can be concluded that there are various test rig which are used for measurement of particular parameters. Design of test rig differs as per the requirement of application and as per requirement of parameter to be tested. Studying this research paper, design and development of new test rig can be done for the required parameters.

ACKNOWLEDGMENTS

Our sincerely thanks to all the authors who worked on development of test rig for gear testing and inspection.

REFERENCES

1. M.E. Niza et al. "Test rig for micro gear and experimental analysis on the meshing condition and failure characteristics of steel micro involute gear and metallic glass one" Mechanism and Machine Theory 45 (2010) 1797–1812

2. Shuting Li, "Experimental investigation and FEM analysis of resonance frequency behaviour of three-dimensional, thin-walled spur gears with a power-circulating test rig" Mechanism and Machine Theory 43 (2008) 934–963

3. *N.A. Wright, S.N. Kukureka,* "Wear testing and measurement techniques for polymer composite gears" Wear 251 (2001) 1567–1578.

4. Mats Åkerblom, "gear test rig for noise and vibration Testing of cylindrical gears" Volvo Construction Equipment Components AB SE–631 85 Eskilstuna, Sweden

5. R.K.Jain, "Engineering Metrology" Khanna Publishers, twentieth edition,2007

6. A. Rezaei, A. Dadouche "Development of a turbojet engine gearbox test rig for prognostics and health management" Mechanical Systems and Signal Processing 33 (2012) 299–311

7. V. Manoj, "Development Of A Power Re-Circulating Gear Test Rig" M.Tech Thesis, IIT Madras, 1999.