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## A Detailed Review on Gear Testers used in Automobile Industry

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### ABSTRACT

Constant change is observed in manufacturing sector in accordance with the trouble of passing on new arrangement into reality. New machines and the frameworks are being made constantly to makes diverse thing at less costly rates and with high precision. Automation is the creation and application of technologies to produce and deliver goods and services with minimal human intervention. The implementation of automation technologies, techniques and processes improve the efficiency, reliability, and speed of many tasks that were previously performed by humans. New machines and the framework are being made constantly to makes diverse things less costly rates and with high precision. Gear is the most important element in the power transmission method. The gear profile is very important factor of gear application at different area like automobiles, machine tools and other area power transmission. Hence the gear shape and accuracy is very important. The customer requirements for higher power density and lower noise demands more accurate gears. By the time, there were various gear testers has introduced in the field of gear testing till now. In this paper, we will see the work done by various researchers and the evolution that we got to see in gear measuring equipments in the previous years.

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**Keywords:** Gear, Gear testers, Accuracy, Automation, Efficiency

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### INTRODUCTION

In the present world of engineering, gears are used for offering an elegant solution to the problem of effective power transmission. Gear is the internal part of machine which transfer power from one to other elements and helps to reduce and increase as per requirement speed and torque due to reliability factor. Manufacturing of machine element required greater accuracy with zero defect detection of fault and measurable reduction in the chances of failure of product during service life. In era of modernization, humans are more inclined towards comfort and modern lifestyle. It creates more challenges to World of engineering. Manufacturing of articles required cost-effective advance and precise machineries and automation. With the rapid development of modern industrial technology, gear design, manufacturing, and testing levels have been a hot issue in the engineering field. With the Continuous progress of measurement technology, gear measuring instruments have undergone great changes. Over the years, hundreds of gear measuring devices have been developed. Some of these measurement methods require manual operation and high work intensity..

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### LITERATURE REVIEW

**Tharesh K. Gawande et al. [1].** 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.

**International Gear Conference 2014, 1st Edition [2].** This book presents papers from the International Gear Conference, held in Lyon, 26th-28th August 2014. Mechanical transmission components such as gears, rolling element bearings, CVTs, belts and chains are present in every industrial sector and over recent years, increasing competitive pressure and environmental concerns have provided an impetus for cleaner, more efficient and quieter units. Moreover, the emergence of relatively new applications such as wind turbines, hybrid transmissions and jet engines has led to even more severe constraints.

The main objective of this conference is to provide a forum for the most recent advances, addressing the challenges in modern mechanical transmissions. The conference proceedings address all aspects of gear and power transmission technology and range of applications (aerospace, automotive, wind turbine, and others) including topical issues such as power losses and efficiency, gear vibrations and noise, lubrication, contact failures, tribo-dynamics and nano transmissions.

Then **Omkar B Agashe et al. [3]** have discussed that Gear roll testers are used to measure and analyses functional performance of gears. Gear testing is a technique that has been used in the gear industry to identify potential manufacturing defects in the design intent of the gear. It is a practical, fast and effective screening tool that can identify when the gear manufacturing process has deviated from an ideal condition or an unwanted noise and vibrations in a gear mesh therefore, in the present work it was decided to develop a gear roll tester to analyses effects of different types of defects in gear on its functional performance in terms of run out, pitch errors, backlash, profile errors, noise and vibration. For the present work a spur was selected with the specifications matching with the gear used in automobiles. A test rig was designed and developed for the functional testing of spur gears.

They have presented that Parkinson gear tester is most suitable equipment which can be used to measure deflection of gears. In this they use plastic gears in order to reduce material cost and also by using manually adjustable spring load errors could be defined. They conclude that in case of dry condition of gear mating part friction is more which gives more deflection.

We observe a Parkinson gear tester to be extending gear life and reducing error, stated by **ShindeTushar. B. et al. [4]**. Their work aims to understand the accuracy of flank surfaces. This test rig is useful to find out the flank surface and irregularities in gear tooth with ease. 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. With the continuous progress of measurement technology, gear measuring instruments have undergone great changes. Over the years, hundreds of gear measuring devices have been developed. Some of these measurement methods require manual operation and high work intensity, and they are greatly affected by human factors; some require expensive equipment, and for contact measurement, different gear surfaces require path planning and probe radius compensation. It may even damage the surface of the workpiece.

Moreover, **L. Qiu [5]** presented a gear non-contact laser measuring device, where the measuring data is sampled by placing the laser beam through the gear rotating center. With the advantages of low cost, high precision, and universal applicability, a non-contact measuring method for the radial runout of cylindrical gear tooth profile is proposed only using a single laser displacement sensor in this paper. A theoretical optimization model is established according to the measurement principle and the laser sensor characteristics, and the optimal installation position and angle of the laser sensor are presented for measurement arrangement.

But, **A. Zbrowski & K. Matecki et al. [6]** stated that According to laser displacement sensor's measurement principle and working characteristics, this measuring method will cause the laser spot on gear tooth profile to be elongated, thus affecting the sensor's measurement accuracy seriously. The article presents the methodology, test stand and results of noncontact tests conducted using a laser sensor-equipped system for measuring displacement. The tests were carried out in an attempt to determine the sensitivity of the measurement system to the angular position of the sensor against the surface onto which the laser spot was projected.

The tests were executed in the measurement range between 5 and 50 mm taking into account 5 angular positions of the laser sensor. The readings of the laser head were referred to the value of displacements adjusted with the use of a micrometric head. In the case of the tested system, the dispersion of measurement deviations was estimated as a function of the measured distance. In continuation of this, as the gear tooth profile's optical characteristics are mainly mirror reflection, there is a case where laser displacement sensor cannot obtain the measuring signal, presented by **B. Sun et al. [7]** During this in 2017, **DattatrayKnannavare** came up with "Modified Parkinson's gear tester" [8]. They have presented Modified Parkinson gear tester. In order to check the combined tooth errors, different types of gear testing machines were used. Various machines have its ability to check specific parameters only. They used springs and slider table with roller these will provide flexibility of checking composite error of different types of gears. This concludes that modified test rig can check composite error with higher accuracy. This gear test rig will check the gear in minimum time which results in decrease of Productive time & improve efficiency of inspection.

**NishantDevkate et al. [9]** have presented that Parkinson gear test rig is the easiest to use equipment for checking any irregularity in gear tooth. In Parkinson test rig, three rectangular plates were used which is mounted on linear guide ways. In working condition of test rig, the movements of the plate will response the error in gear. It was observed that the locking and jamming of gears can be easily detected from this technique. Gears are the crucial element of any transmission system which generally used for power transmission. Such type of part must be check by using the highly accurate methodology in order to assess its functional performance in advance. The inspection methodology of gears should be accurate with less time-consuming procedure for its inspection. This gear test rig will check the gear in minimum time which results in a decrease of non-productive time and improves plant efficiency.

The benefits and need of gear test rigs were discussed by **Ganesh Bagade et al. [10]**. Gears are the crucial element of any transmission system which generally used for power transmission along with other applications depending upon working requirements. Such type of component must be check by using highly accurate methodology in order to assess its functional performance in advance. The inspection methodology of gears should be accurate with less time-consuming procedure for its inspection. This objective is easily obtained by using Gear Test Rig.

**GawadeTanmay, “Automation of Parkison’s Gear Tester” [11]** have discussed that constant change is observed in manufacturing sector in accordance with the trouble of passing on new arrangement into reality. New machines and the frameworks are being made constantly to makes diverse thing at less costly rates and with high precision. Gear is most important component in to the power transmission method. The gear profile is very is important factor of gear application at different area like automobiles, machine tools other area power transmission. Hence the gear shape & accuracy is very important. Model of Parkinson gear tester testing includes the gear tooth profile through dial indicator. It can be very useful for gear testing laboratories, gear modification industries.

**V Shinde et al. [12]** aims to understand the accuracy of flank surfaces. They have presented that the various test rig which is used for measurement of particular parameter like gear tooth alignment, gear tooth surface and pitch circle these are to be tested. This test rig differs as per the requirement of application and as per requirement of parameter to be tested.

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## CONCLUSIONS

Our intent behind all of this was to make you aware of how the evolution has taken place in field of gear testing and what should be done to achieve higher accuracy as well as precision in gear testing equipment.

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## REFERENCES

- [1] Thares K. Gawande, Prof. A. S. Bombatkar, —Design of Test Rig for Gear Inspection| International journal of pure and applied research in engineering and technology, 2014.
- [2] International Gear Conference 2014: 26th-28th August 2014, Lyon,1st EditionOmkar B Agashe, —Design & Development of Gear roll tester|, International journal of recent research in Civil & Mechanical Engineering- Vol. 2, Issue 1, (2015)
- [3] ShindeTushar. B, Shital D. Tarawade,Design& Development of Parkinson Gear Tester for Spur Gear to Check the Flank Surface|. International Journal of Advanced Research in Mechanical Engineering & Technology, Vol. 1, Issue 1 (2015)
- [4]L. Qiu, Device and Software System Development of Gear Laser Precision Measurement Master dissertation, 2017
- [5] S.P. Radzevich, Dudley’s Handbook of Practical Gear Design and Manufacture, second ed., CRC Press, Boca Raton, 2012.
- [6] L. Xiang, N. Gao, Coupled torsion-bending dynamic analysis of gear-rotor-bearing system with eccentricity fluctuation, Appl. Math. Model. 50 (2017) 569–584
- [7] E. Muto, G. Nishimura, Single flank gear mesh tester, J. Japan Soc. Precis. Eng. 29 (336) (1963) 53–60
- [8] S. D KalanderSaheb and K. Gopinath, —A comprehensive survey of gear test rigs|, Report No 6, IIT Madras, Dec [1990] A STUDY OF GEAR NOISE AND VIBRATION, M. Akerblom and M. Parssinen, 2002
- [9] S. Ito, W. Gao, —Pitch deviation measurement of an involute spur gear by a rotary profiling system|, Precis. Eng. 39 (2015) 152–160
- [10] T.X. Wang, L.D. Wang, —Technology of tooth pitch deviations measurement for master gears of precision grade 11, Adv.Mater. Res. 189–193 (2011)
- [11] Mats Åkerblom, —gear test rig for noise and vibration Testing of cylindrical gears Volvo Construction Equipment Components AB SE–631 85 Eskilstuna, Sweden
- [12] V. Manoj, —Development of A Power Re-Circulating Gear Test Rig| M. Tech Thesis, IIT Madras, [1999]
- [13] AGMA 931-A2 calibration of gear measuring instruments and their application to the inspection of product gears. 2002
- [14] ISO 18653:2003 Gears - evaluation of instruments for the measurement of individual gears. 2003
- [15] AGMA ISO 10064–5–A06. Code of Inspection Practice, Part 5: Recommendations Relative to Evaluation of Gear Measuring Instruments, July 18, 2006
- [16] N.A. Wright, S.N. Kukureka, —Wear testing and measurement techniques for polymer composite gears| Wear 251 (2001) 1567–1578