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An Approach to Analysis of Automobile Gear Designed for Air Ventilation Nozzle

***Amit Kumar Gupta*[1]**

[1]Department of Mechanical Engineering, Institute of Engineering & Technology, DAVV, Indore

Email: [1]akgupta@ietdavv.edu.in,

ABSTRACT

In the case of ventilation of building the windenergyisusedtodriveairintobuildingby smallopening.Inlowvelocityregime,continuityequationgoverns by the nozzle processes. The optimization of different nozzle shapeis must as a requirement of large driving force as well asminimum energy losses due to different minimumair leakage from main air stream. In the present work, I am dealing with various geometry and literature review of gears.

Keywords: Gear, Natural Ventilation, Nozzle

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 theContinuous 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.

LITERATURE REVIEW

In **"Gear technology, gear inspection and measurement" [1],** The purpose of gearinspection is to: Assure required accuracy and quality, Lower overall cost of manufacture by controlling rejects and scrap, Control machines and machining practices and maintain produced accuracy as machines and tools wear, determine heat treat distortions to make necessary corrections.

G. Goch, "Gear metrology‖ [2] states that Gear drives represent key components for all kind of vehicles, machine tools, aircrafts, household appliances as well as a broad variety of industrial equipment. This paper reviews the state-of-the-art of gear metrology. It summarizes new modelling and measuring principles, enabling a superficial description and inspection of gears. It reports the actual accuracy limits of gear measurements. It points out that a significant reduction of the standards and instruments is an urgent need for the production of high-precision gears.

Frazer RC. "Measurement uncertainty in gear metrology" [3] has mainly discussed about the role of gears and why there is necessity of bringing certainty in gear measurements. Gears play an important role in mechanical power transmission systems. They enable the prime mover characteristic (a gas turbine for example) to be matched to the characteristic of the driven load (say, a slow speed propeller), thus reducing the cost of both manufacturing and operating the system. The customer requirements for higher power density and lower noise demands more accurate gears.

This imposes more stringent requirements on the measuring equipment that controls the quality of the manufacturing machines. Thus, the need to accurately quantify the measurement uncertainty of inspection machines is of paramount importance if costly mistakes are to be avoided. The work was mainly experimental in nature.Gear precision is the key factor that influences behavior in mechanical transmission.

Palermo et al. [4] demonstrated that gear transmissionerror is often considered as the main cause of gear whine. Different errors may be introduced in each link of gear manufacturing. Gear Transmission Error (TE) is often considered as the main cause of gear whine. TE represents the difference between the perfectly kinematic transmission of motion and the one actually achieved. TE vibrations are extremely small and pose significant measurement challenges. This article demonstrates how low-cost digital encoders can be successfully used together with the Elapsed Time Method to simplify TE measurement with respect to the traditional Direct Method. A precision gear pair test rig is exploited to compare the two methods from a theoretical and an experimental point of view. Following the observations drawn from such comparison, a measuring chain is set up to validate the proposed procedure on a real case all-electric vehicle gearbox.**Palermo et al.** told us that different errors may be introduced in each link of gear manufacturing.

A.Olofsson et al. [5] specify that the quenchingtreatment of gears may lead to the problem of gears radial runout (eccentricity). Gear radial runout is a positioning error, which determines the precision of the upper tooth position or tooth position of the gear, thus affecting the transmission precision. Runout refers to the radial position of the gear relative to the circular pitch error. It is the maximum difference between the nominal or theoretical radial position of all the teeth and the actual measured position, as indicated in

"Dudley's Handbook of Practical Gear Design and Manufacture, second ed. [6]. Dudley's Handbook of Practical Gear Design & Manufacture, Third Edition, is the definitive reference work for gear design, production, inspection, and application. This fully updated edition provides practical methods of gear design, and gear manufacturing methods, for high, medium, and low volume production. Comprehensive tables and references are included in the text and in its extensive appendices, providing an invaluable source information for all those involved in the field of gear technology.
N. Gao et al. [7] the radial runout (eccentricity) should be controlled within a reasonable range and then an available high precision measurement is very important in the production process.

Muto, G. Nishimura et al. [8],Here they told how they obtained an efficient mesh tester. By using only one set of datum circular plates, the single flank gear mesh test can be done easily and efficiently for any kinds of gear ratios of test gears and also for all types of test gears such as circular and noncircular gears. The present tester can be used for testing fine pitch gears, testing medium size ones, and furthermore it is able to reduce remarkably the time necessary for testing.

S. D KalanderSaheb and K. Gopinath et al. [9] have done a survey in which they have performed the gear testing experiment and concluded that this test rig is the easiest to use equipment for checking any irregularity in gear tooth.

M. Akerblom"A STUDY OFGEAR NOISE AND VIBRATION" [10], mainly investigated the influence of gear finishing method and gear deviations on gearbox noise in this experimental study. The surface finish and geometry of the gear tooth flanks were measured. Transmission error, which is considered to be an important excitation mechanism for gear noise, was predicted and measured. LDP software from Ohio State University was used for the transmission error computations. A specially built test rig was used to measure gearbox noise and vibration for the different test gear pairs. The measurements show that disassembly and reassembly of the gearbox with the same gear pair can change the levels of measured noise and vibration considerably. The rebuild variations are sometimes in the same order of magnitude as the differences between different tested gear pairs, indicating that other factors besides the gears affect gear noise.

Most of the experimental results can be understood and explained in terms of measured and predicted transmission error. However, it does not seem possible to find one single parameter, such as measured peak to peak transmission error, that can be related directly to measured noise and vibration.

S. Ito, W. Gao et al. [11] presented gear pitch deviation measurement for an involute spur gear. A rotary profiling system, which consists of an air-bearing spindle and a displacement sensor with a diamond stylus, was employed to measure gear pitch deviation. In measurement of gear pitch deviation, an eccentric error between a gear axis and a motion axis of the rotary stage in the profiling system would affect accuracy of gear profile measurement. In this paper, at first, the influence of the eccentric error on measurement of gear pitch deviation is estimated in computer simulation based on a geometric model of the profiling system. For compensating distortions in the measured gear tooth profile, which are induced not only by the eccentric error but also by a probe offset introduced by the proposed scanning method, a self-calibration and compensation method is applied. To verify the feasibility of the proposed method, measurement of gear pitch deviation of a master involute spur gear with a certificate data is carried out. Measurement uncertainty of the proposed method is also analyzed.

V. Manoj [12], it is stated that with the rapiddevelopment of modern industrial technology, gear design, manufacturing, and testing levels have been a hot issue in the engineering field. Especially in the military and aerospace industry, the demand for precision gear is increasing, which is both an opportunity and a challenge for the gear manufacturing industry. In order to solve the difficult problem of detection of pitch deviations of high-precision master gears, a new measuring instrument is developed. Detail description about measuring apparatus of pitch deviations developed for master gears was presented in the paper. Computer aided technology was used to deal with data collected by computer, and error analysis about the measuring apparatus was introduced, which affected measurement accuracy. The results confirm that the measuring apparatus is able to meet measurement requirement and improve efficiency through the measuring experiments on master gears of precision grade 2 and 1 with modulus 2 mm and 2.5 mm, respectively. And the uncertainties of single pitch deviation and total cumulative pitch deviation are 0.07and 0.26, respectively.

Mats Åkerblom et al. [13], has designed the test rig which 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.

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.

Whereas nearby 1999, **V. Manoj et al. [14],** states that Parkinson gear tester is most suitable equipment which can be used for determination of errors in flank surfaces.

In order to evaluate the performance of gears, a power re-circulating test rig has been designed and developed. The test rig consists of one pair of test spur gears and one pair of helical loading gears. The variation in gear loading is achieved by axial loading of the helical gear using a pneumatic actuator. The no load-starting feature in the test rig reduces the size of the motor. The features of the test rig and advantages are discussed in detail in this paper.

AGMA 931-A2, "Calibration of gear measuring instruments and their application to the inspection of product gears" [15] have highlighted the drawbacks of ISO standards and presented a new calibration method in 2002. The ISO standard regulating gear-rolling measurement does not specify in detail the calibration and verification procedures for this type of equipment. This may be one of the reasons for the lack of reproducibility in these rolling tests. The uncertainty budget method, which is the most appropriate way to know the accuracy of this dynamic measurement, shows that the measuring sensors‘ accuracy is only a part of the total measurement process uncertainty. In this work, a new calibration and verification procedure for a worm gear rolling tester is presented, based on machine tool, coordinate measuring machine and gear measuring instruments‘ calibration techniques.

And then in 2003, **ISO 18653:2003 [16]** also specifies methods for the evaluation of measuring instruments used for gear measurements of involute, helix, pitch and runout. It is applicable both to instruments that measure runout directly and to those that compute it from index measurements. It also gives recommendations for the evaluation of tooth thickness measuring instruments and, of necessity, includes the estimation of measurement uncertainty with the use of calibrated gear artifacts.

In 2006, **AGMA ISO 10064–5–A06. Code of Inspection Practice [17]** specifies methods forthe evaluation of measuring instruments used to measure cylindrical gear involute, helix, pitch and runout. It includes instruments that measure runout directly, or compute it from index measurements. Of necessity, it includes the estimation of measurement uncertainty with the use of calibrated gear artifacts. It also gives recommendations for the evaluation of tooth thickness measuring instruments. The estimation of product gear measurement uncertainty is beyond its scope (see AGMAISO 10064-5-A06 for recommendations). This standard is an identical adoption of ISO 18653:2006. It replaces ANSI/AGMA 2010-A94, ANSI/AGMA 2110-A94, ANSI/AGMA 2113-A97 and ANSI/AGMA 2114-A98.

M.E. Niza et al. [18] developed the test rig to evaluate the performance of a micro involute gear with a diameter below 1 mm. 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.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.

Power-circulating form‘‘ test rig is built for vibration tests of the thin walled gears by **Shuting Li** [**19].** This paper is a fundamentalstudy 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.

N.A. Wright et al. [20], 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 characterizing the wear of gears is presented, which relates actual contact conditions and gear tooth wear.

Stewart Denny, "Test Gear and Measurements" [21] book provides a clear introduction to test gear in the field of electronics. As well as being a first guide to test gear and its use, the book includes much practical information and reference material for the more experienced electronics enthusiast or student. Details of all the common (and some not-so-common) items of test gear are included, alongside information regarding its use in various measurement situations.

R.K. Jain et al. [22], have presented Parkinson gear tester as an efficient one for checking the flank surfaces of the gear and determine the error significantly. For efficient performance of the gear, this test rig is used they have performed three levels of test experiments.

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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