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# Gear Error Detection by Photo Image Processing

**Sahil Raghatate, Kaustubh Pawar, Virendra Tahakale, Mrs. P. M. Sawant**
Smt. Kashibai Navale College of Engineering, Pune

**Abstract:** *A sampling method of gathering representative data from a group. For example, a manufacturer might check only 2 or 3 gears from a batch of 100 gears. Due to which the whole lot gets rejected if any gear in between has error in it. Thus, we need to check each and every gear in the batch but manually this process is time consuming. In our project we are designing and manufacturing a system which will be checking each and every gear. We use a conveyor belt for movement of gear, a camera for capturing and checking the gear parameters for its error by comparing the parameters stored at the back end. If the parameters are matched with the stored parameters, then it goes to the accepted lot otherwise with the help of shooting gun it goes toc the rejected lot.*

*Precision measurement of gears plays a vital role in gear measurement and inspection. The current methods of gear measurement are either time consuming or expensive. In addition, no single measurement method is available and capable of accurately measuring all gear parameters while significantly reducing the measurement time. The aim of this paper is to utilize the computer vision technology to develop a non-contact and rapid measurement system capable of measuring and inspecting most of spur gear parameters with an appropriate accuracy. A vision system has been established and used to capture images for gears tobe measured or inspected.*

*The introduced vision system has been calibrated for metric units then it was verified by measuring two sample gears and comparing the calculated parameters with the actual values of gear parameters. For small gears, higher accuracy could be obtained and as well as small difference.*

**Keywords:** *gear parameters*

## I. INTRODUCTION

Gear manufacturing, an indispensable element of machinery production, is an intricate process that under pins the functionality of countless mechanical systems, from automobiles and industrial machines to marine vessels and power plants. However, the gear production industry faces a critical real-time challenge :ensuring the quality and precision of gears while managing the ever-increasing demand for efficiency and cost-effectiveness. Traditional methods of gear inspection, often reliant on manual labor, are not only time-consuming but also prone to human error, potentially leading to the rejection of entire batches of gears due to a single fault. In response to this dilemma, our project emerges as a solution that bridges the gap between the need for meticulous gear inspection and the imperative to enhance efficiency.

The heart of our endeavor lies in leveraging a fusion of cutting-edge technologies, primarily image processing and machine learning. The existing methods of gear measurement, often cumbersome and costly, struggle to simultaneously and accurately measure all gear parameters while curtailing measurement time. Our aim is to revolutionize gear quality control through the deployment of computer vision technology to create a non-contact and rapid measurement system capable of inspecting the majority of spur gear parameters with unparalleled accuracy and speed. This innovation not only promises to reduce inspection time but also to bolster the overall precision of the process.

The vision system we've established captures detailed gear images, which undergo meticulous calibration for metric units and are then verified through comparison with actual gear parameters. The system is calibrated to measure critical features, including outer and inner diameters, tooth count, tooth height, pitch circle diameter (PCD), and module. These parameters hold the key to gear functionality and effectiveness, making their precise measurement of paramount importance. Furthermore, our system ensures that these measurements are scalable, accommodating smaller gears with exceptionally high accuracy.


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## II. LITERATURE SUERVEY

[1] Haque Nawaz, Himat Ali , "Gear Measurement Using Image Processing in Matlab", 'International Journal of Innovative Technology and Exploring Engineering (IJITEE)', 2014, Volume-3,pp43-47.

Gear Measurement has been carried out by focusing two features of gear image object. The problems are to measure the gear features of gear image object, in the sense the measurement of the Area of the gear image object and as well the teeth of the gear will be counted. We have used Matlab tool and development code which overcome these problems and measured the area as well as teeth of the gear image object counted. To accomplish this task we have measured five different gear image objects area and counted the teeth by using image processing.

The gear Area calculated and teeth counted by using image processing in the matlab tool. This paper having the five gear image objects which are processed from developed matlab code, all gear image objects found having different value of area and varying teeth with another. These have been measured through the same developed matlab code. In this paper each experimental work figure of different gear objects measured with the help of matlab tool by using image processing.

[2] Cheng Pengfei and Feng Changyong Henan , "Characteristic Value Extraction of Gear Defect Based on Image Processing", 'Journal of Multimedia', 2013, Volume- 8, pp 198-205.

Based on the two different image expressions of defect forms, this paper abstract defect are ratio as well as the characteristic value and abstract contrast with gray co-occurrence matrix as image characteristics. In order to verify the abstracted image characteristic for evaluating pitting and wearing effectiveness, we use the neighboring method to construct are cognition model, and analyze the collected image samples. The result is correct, but the recognition accuracy needs to be improved. At last, eccentricity ratio and circularity is abstracted as the characteristic value based on image morphological characteristics.

Digital image processing processes and evaluates images through computer with particular algorithm. At present, image processing techniques have been applied and researched in various fields with great achievement. Digital image processing can divide into: image transformation, image intensification and restoration, image segmentation, image analysis, image recognition and other technique branches. MATLAB as one kind of high-level computer language, it has a powerful data processing ability that obtains widely application in digital image processing. This paper takes advantage of MATLAB image processing for gear defect detection. Gear shows different defect forms during the using process. Corrosive pitting and attrition is the most important type. Different defect forms will create different image characteristics. We can effectively distinguish and decide the defect type through these image characteristics. An image processing toolbox of Matlab has great functions. It has an abundant supported image format, and this software provides 15 types of image processing function which includes all the research findings of image processing methods in recent day. Take the advantages of these image processing toolboxes and combine the powerful data handling capacity, it is necessary to pay attention to image format, read-write, display and other details. Instead, we can focus on algorithm research, which greatly improve the working efficiency. Moreover, when testing these algorithms, we can conveniently get the statistical data and view the graphical representation.

## III. CONCLUSION

The utilization of image processing techniques in MATLAB has proven to be instrumental in gear inspection, facilitating efficient measurement of gear area and teeth count. Through the developed MATLAB code, gear objects from five different images were processed, revealing varying area values and teeth counts. This approach not only enables swift gear inspection but also finds applications across diverse industries such as nut and gear manufacturing, quality control departments, automobile manufacturing, and both small and large-scale industries. The versatility of this technology extends beyond gear inspection, encompassing fields like space exploration, medical research, remote sensing, and computerized photography. In conclusion, image processing technology holds significant potential for enhancing productivity and accuracy across various industrial sectors and scientific domains.

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