A Literature Study on Performance Analysis of Thread Inspection Machine

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Abstract— Visual inspection and thread checking is very important in manufacturing that requires high quality presentation. For accurate automated inspection and visual inspection has been deployed widely in manufacturing. Human workloads, human efforts and labor costs can be reduced by accurate automated inspection and classification increasing the throughput. In present study a inspection of threaded hole diameter machine performance is undertaken. This project is based on the product development and performance analysis using CAD and FEA techniques as we will be accumulating all the essential and necessary data that is being required or used in thread inspection process from the available sources. Then we will generate the CAD model of thread inspection machine and perform analysis of the machine on FEA. After that results will be discussed and design will be finalized.

Key words: Inspection, FEA, Thread Inspection

I. INTRODUCTION

The demand for inspection has grown rapidly, because of its benefits of promoted efficiency and higher precision. Instead of manual projection measurements, measurement performance and efficiency can be obviously enhanced by the inspection systems system.

Inspection is the most common method of attaining standardization, uniformity and quality of workmanship. Usually inspection meant that, at certain or some stages in the course of production, a comparison is made between what has actually been produced and what should have been produced. In present scenario, manual inspection is largely replaced by automated inspection as errors are reduced to great extent by automation of the process. Automated inspection is defined as the automation of one or more steps involved in the inspection procedure.

Economic automated inspection system depends on whether the savings in labour cost and enhancement in accuracy will be more than the investment and/or development costs of the system. Automated or semi-automated inspection can be deployed in the number of alternative ways.

Inspection of production process: The operation of inspection is done while the production process is simultaneously going on. Inspection is performed at various work centres of men and machines and at the critical production points. This had the advantage of preventing waste of time and money on defective units and preventing delays in assembly.

On-line/In-process and On-line/Post-process Inspection Methods: Online inspection is the task of inspection done as the parts are manufactured. There are two variants of on-line inspection. The inspection performed during the manufacturing operation, is called on-line/in-process inspection. The inspection performed immediately following the production process, is called on-line/post-process inspection.

Some of the examples of online inspection are inspection probes. These probes can be used in a number of ways. For example, they can be mounted in holders, inserted into machine-tool spindles, or can be stored in a tool magazine to be exchanged by an automatic tool exchanger. In flexible manufacturing system machine tools spindle mounted probes are commonly used. The primary inspection elements of the probes are sensors. Signals are transmitted to the controller as the contact is made with the part surface. Numerous technologies are available for transmitting the signals. Some of them are direct electrical connection, induction coil, infrared data transmission. The task of the data processing and interpretation is facilitated through the controller.

II. LITERATURE REVIEW

Fu Bengang Cheng Weiiming Shang Wei [1] The mechanical fixture for thread measurement is designed with SolidWorks. The overall design scheme, 3D design process of main components, the structure characteristic and using method of the fixture are introduced in this paper. It also describes the way of thread measurement, hardware design of mechanical fixture and the software development process. The practicability and rationality of the fixture are verified by virtual assemble.

Osama Mohammed Basmage [2] This thesis describe the design and development of an automatic inspection system for threaded components. The system consists of a mechanical sensor, which is interfaced to a PC and the operational tracing cycle of the system is controlled to carry out the following operations.
1) Belix path inspection.
2) Thread form inspection.

The results of the helix path and the thread form tracing are presented for the ISO metric thread: (M6), (M8), and (M16), together with the operational cycle.

Prasad Bapat, Prof. J.Y. Acharya [3] Special purpose machine tools are designed and manufactured for
specific jobs and such never produced in bulk such machines are finding increasing use in industries the techniques for designing such machine would obviously be quite different from those used for mass produced machine. A very keen judgment is essential for success of such machines. This paper explains a case study of designing special purpose machine and manufactured at ABC Company which found beneficial in increasing production quantity & reducing manpower.

Chen Sheng, Zhao Dongbiao, Lu Yonghua [4] For measurement of existing thread parameters using profile scanning, system error increases as pitch diameter, difference between the calibrating thread and measuring thread increases with the single gauge calibration method. There are several alignment deviations affecting the measurement of pitch diameter. To reduce the system error, a compensation method using two standard thread gauges to calculate the alignment deviations is proposed here. Finally, the theoretical and experimental comparisons between the single gauge calibration method and the proposed method are presented. The results demonstrate that the two gauges calibration method can effectively reduce the system error.

Randal J. Hunsicker, John Patten, Alton Ledford, Cathie Ferman, Michael Allen, Clark Ellis [5] This paper describes considerations and techniques used in the development of a vision system for measurement and inspection of male screw threads. A two-stage process was developed to calibrate the imaging system. This procedure uses a calibration gauge pin to calibrate the vision system's pixel scale and two pitch standards (max, min) to correct for lighting and image distortion. New and enhanced imaging techniques were used to determine outer and inner diameters for each thread pair. Pitch measurements were obtained using cross sections of each thread pair in the image. The dark and light (crest and root) areas were examined to deduce pitch diameter very precisely. Measurement techniques for overall thread length and full thread length were found to be beneficial to the part inspection process. Lab results as well as production line measurement results using the vision system are compared to optical comparator, micrometer, and gauge measurements. Overall accuracy was within ± 0.0005” of gauge measurements. Some measurements exceeded this accuracy in lab tests and on the production line. The thread measurement system was demonstrated to be extremely beneficial during the manufacturing process.

Sergey Kosarevsky, Viktor Latypov [6] in this paper, a new method is proposed to automatically detect screw threads in 3D density fields obtained from computed tomography measurement devices. The described method can be used to automate many operations during screw thread inspection process and drastically reduce operator’s influence on the measurement process resulting in lower measurement times and increased repeatability

III. PROBLEM FORMULATION
The thread has wide application in machinery manufacturing, aerospace and other industrial fields. Due to the big influence of precision and accuracy on threaded parts characteristics such as interchangeability, reliability and airtightness, the thread accuracy detection becomes an important part of thread measurement technology. The traditional method of thread detection are pass/check gauge calibration method, three stitches, micrometer method, etc.

This project is based on the automation of thread inspection process:
- Thread inspection is the essential process for the company. They inspect the type of thread in the product i.e. it will be M6 or M8. So they have to check that all the threads is either M6 or M8.
- Currently they use metal rod to check the type of thread manually.
- Checking the thread by inserting the rod on every hole is time consuming process.
- It lags the production process.

So the company needs to design a semi-automated thread inspection machine.

Fig. 2: Product with threads

IV. METHODOLOGY
In present study we have studied different literature regarding thread inspection. Although a lot of work has been carried out in automation industry for inspection but there still remains a scope for thread inspection. In progress we will be accumulating all the essential and necessary data that is being required or used in thread inspection process from the available sources. Then we will generate the CAD model of thread inspection machine and perform analysis of the machine on FEA. After that results will be discussed and design will be finalized.

V. CONCLUSION
By concluding the details we have researched and studied number of literatures available from the internet sources until now about thread inspection and automation the above discussed project will be useful and, the company will be directly benefited as performance analysis of thread inspection machine will help the company to improve their process and maintain accuracy in their operations. The machine will also increase the production rate and minimize the time required for the process.

REFERENCES
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