Retraction

Retracted: Precision Analysis of Noncircular Gears Based on CNC Machining Technology under Cloud Computing Platform

Shock and Vibration

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Dai, W. Xu, and F. OuYang, "Precision Analysis of Noncircular Gears Based on CNC Machining Technology under Cloud Computing Platform," *Shock and Vibration*, vol. 2022, Article ID 1359084, 12 pages, 2022.

Research Article

Precision Analysis of Noncircular Gears Based on CNC Machining Technology under Cloud Computing Platform

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In order to solve the problem of machining error of noncircular gears, a method based on the analysis and research of the accuracy of noncircular gears based on CNC machining technology under the cloud computing platform is proposed to further improve the technical accuracy of noncircular gears. The error and error items are analyzed mainly, and a model framework based on cloud computing platform is proposed on this basis. The architecture of the system is deeply analyzed, focusing on the dynamic integration method of gear cloud measurement system resources based on cloud platform, building a gear cloud measurement system based on cloud computing platform, and testing needs to use Hadoop to install the software that needs to be prepared: virtual machine version, VMware Workstation-14.0.0 build-6661328, Linux version. The results show that the technical support of the cloud computing platform can effectively improve the accuracy of noncircular gears.

1. Introduction

The development of industrialization and the emergence of digital industrialization are inseparable from the progress of technology. Especially for the construction and manufacturing industry, the emergence of technologies such as intelligent manufacturing and intelligent processing provides technical support for industry transformation and technological progress. Noncircular gears have been widely used in modern aviation, instrumentation, machinery, and other related fields. Throughout the development history of gear measurement technology, with the advancement of technology, from the measurement principle, measurement technical means, to the measurement results, it shows the progress and leap of technology. The noncircular gear mainly transfers the motion and power between any two shafts in the space by converting the transmission ratio. On this basis, it also has the advantages of the cam mechanism and the cylindrical gear structure, which can be better through technical optimization. It is precisely based on this advantage that noncircular gears have been widely used in many mechanical-related fields. However, from the perspective of noncircular gear processing, there are still transmission errors, rotary axis position errors, tool errors, and other errors. These errors can be summarized as systematic errors and random errors. Therefore, how to reduce the machining error of noncircular gears and improve the operation accuracy with the help of technological progress and optimization is the focus of this paper. Therefore, based on the cloud computing platform, this paper deeply analyzes the machining error of noncircular gears and proposes a gear cloud measurement technology model and data processing dynamic integration method based on the cloud computing platform.

2. Literature Review

Gear measurement is based on the theory of precision. Fan and Ye said that gear accuracy theory covers gear error dynamics theory, gear error kinematics theory, and gear error geometry theory [1]. Wei et al. said that Chinese and foreign scholars and scientific researchers have developed

nearly a hundred kinds of gear measuring instruments based on the above three theories: in the early days, the German universal involute inspection instrument and the universal helical inspection instrument, the British grating type single represented by the gear overall error measurement technology proposed by NieYi and China Chengdu Tool Research Institute, the high-precision measurement of gears, and the overall control of gear quality are realized [2]. Li and others said that in the development process of the gear measurement principle, it was first "comparative measurement," then "measuring motion measurement," and then "modeled measurement" [3]. Zheng et al. said that for the realization of the measurement principle, the early stage was "mechanical-based," followed by "electromechanical integration," and finally developed into the comprehensive integration of "optical-mechanical-electrical" and "information technology" [4]. Li et al. said that the acquisition of measurement results: from "reading from the indicator table with the naked eye" to "the recorder records the processing reading" until "the computer automatically analyzes and feeds the results back to the manufacturing system" [5]. Li et al. said that the cloud manufacturing model is an innovative application of cloud computing in the manufacturing field, and it is also the development of the network manufacturing model [6]. Fan and others said that in 2010, some scholars proposed cloud manufacturing based on the concept of cloud computing [1]. Chinese foreign research institutes and universities have systematically studied a series of issues such as the intervention and adaptation of cloud manufacturing service platforms, the perception of manufacturing equipment, the virtualization of manufacturing resources, and the establishment of cloud manufacturing systems. Research on cloud manufacturing platform for gear industry, it provides new ideas for cloud manufacturing research from the aspects of manufacturing mode, manufacturing strategy, and mode architecture. Compared with traditional measurement methods, network-based gear measurement has great advantages, but there are still some shortcomings in the current measurement methods; especially, it is difficult to achieve precise measurement, evaluation, measurement services and collaboration for machining process analysis, in-service dynamic characteristics, etc. Soyoye said that in China, the research on the measurement of noncircular gears has used the double-sided meshing method, the single-sided whistle method, and the polar coordinate method for measurement [7]. Hao et al. said that the biggest difference between the gear single-sided whistle method and the double-sided meshing method is whether the tested gear has backlash during the whistle-coupling transmission process [8]. Among them, the measurement method of gear single-sided congruence is to use two gears that are in contact with each other, one is the measured noncircular gear, and the other is an ideal and accurate standard cylindrical gear. Under the nominal center distance, only one-sided, side the meshing transmission of the gap reflects the tangential comprehensive error of the measured noncircular gear by measuring the angle error of the measured noncircular gear. Han et al. said that the noncircular gear double-sided whistle-fit

measurement method is to use the above two gears, under the nominal center distance, to perform meshing transmission with both surfaces in contact and without backlash, by measuring the actual center distance of the measured gear. Corresponding changes are generated according to the change of the pole diameter of the pitch curve of the noncircular gear, reflecting the radial comprehensive error of the measured noncircular gear. The polar coordinate measurement method is a method of measuring the polar coordinates established by the polar diameter and polar angle [9]. The precision analysis and research of noncircular gears based on CNC machining technology under the cloud computing platform is shown in Figure 1.

3. Methods

According to the form of error, the machining error of noncircular gear is mainly divided into systematic error and random error, and its specific classification is shown in Figure 2.

According to the noncircular gear machining process, the nature of the coupling between the tool and the gear and the variation law are classified, as shown in Figure 3.

The process of gear hobbing processing spur noncircular gears can be regarded as the whistling of the rack and the processed noncircular gears. During the whistling process, the two pitch curves are pure rolling without sliding, and the tooth profile of the noncircular gear is the relative motion of the two is enveloped by the tooth profile of the rack, and the principle of hobbing is shown in Figure 4.

In the process of cutting with a gear hob, the movement of the hobbing is as follows: the gear hob rotates to form the cutting speed, and the tool translates along the axial direction to form the translation of the tool rack; while the teeth are still rotating, its center moves up and down in the direction perpendicular to the pitch line of the rack, changing the center distance. The whole machining process can be abstracted into the machining process of the tool rack. The schematic diagram is shown in Figure 5.

In the above figure, the pitch line of the rack is x, and it moves horizontally to the left during processing. In order to ensure the tangent pure rolling of the pitch curves of the rack and the noncircular gear, the center of the gear is 0_1 up and down while the gear is rotating. The machine tool coordinate system is P_{xy}, and the polar coordinate equation of the noncircular gear pitch curve is shown in

$$r = r(\phi). \tag{1}$$

When set at the starting position, the pitch curve of the noncircular gear and the rack is tangent at point a, and the coordinate of point a is (r_0, ϕ_0), and μ_0 is the angle between the tangent line at point a and the radius vector of the noncircular gear pitch curve $\overline{0_1 a}$. As shown in formula (2),

$$\mu_0 = \arctan \frac{r_0}{(dr_1/d\phi_1)_{r_0}}, \tag{2}$$

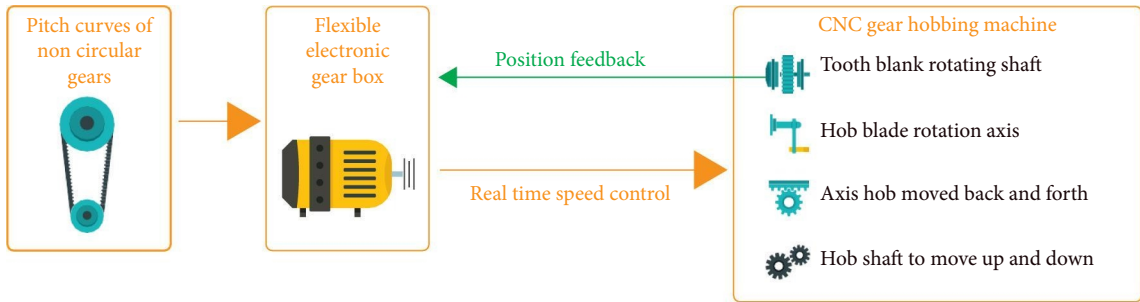where $dr/d\phi$ is the value of the derivative of the r pair at r_0.

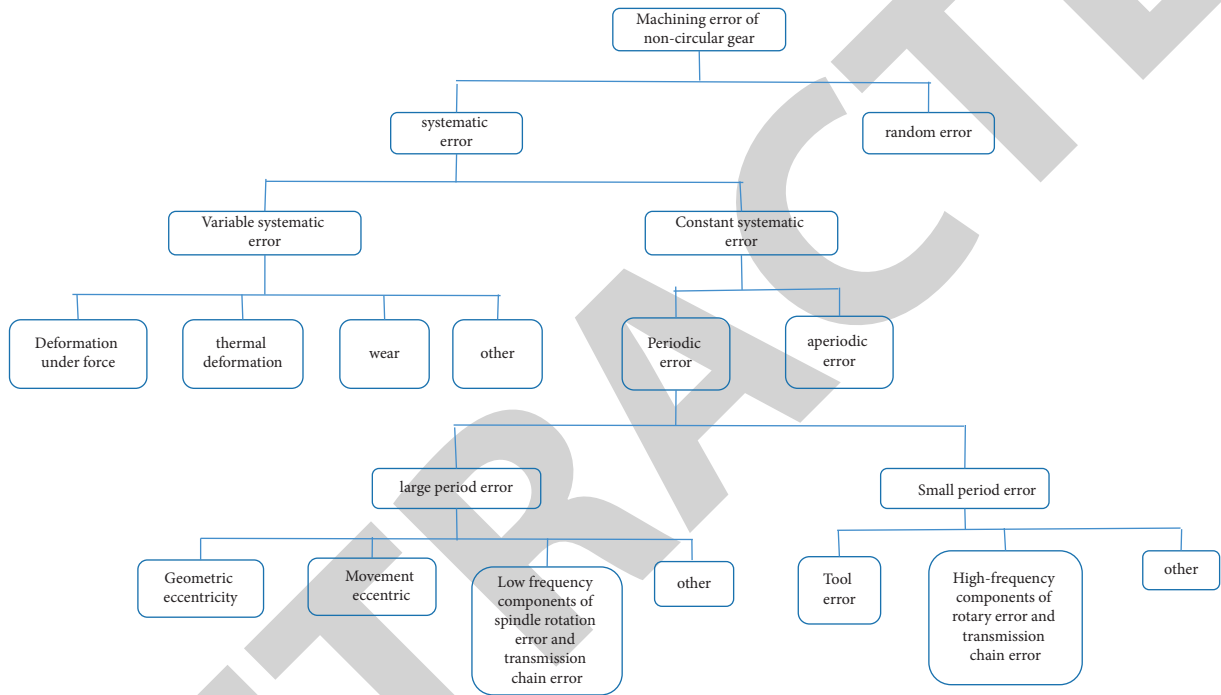Figure 1: Analysis and research on the accuracy of noncircular gears.

Figure 2: Classification diagram according to the manifestation of noncircular gear machining error.
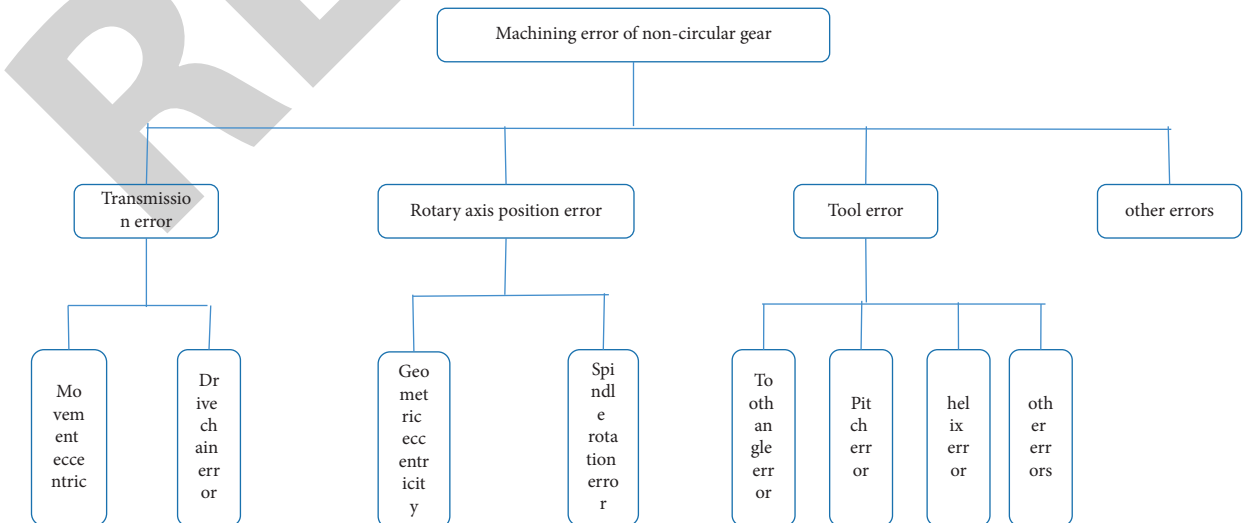

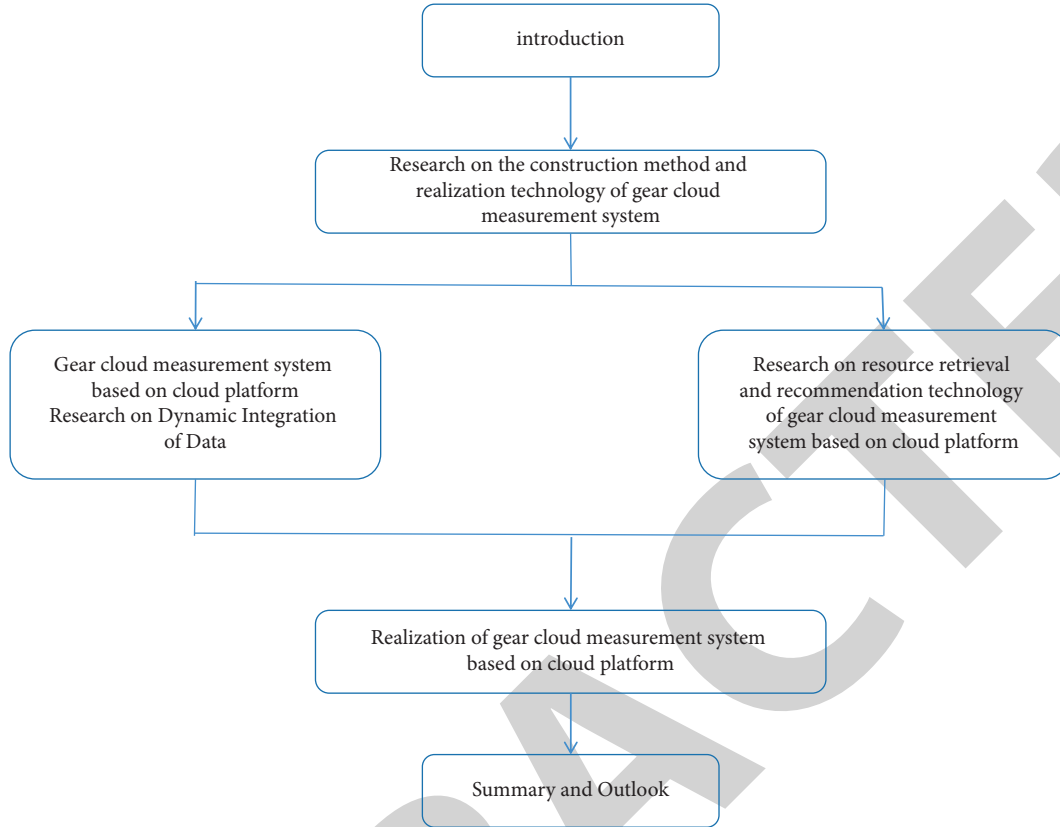Figure 3: Classification according to the nature of the compound.
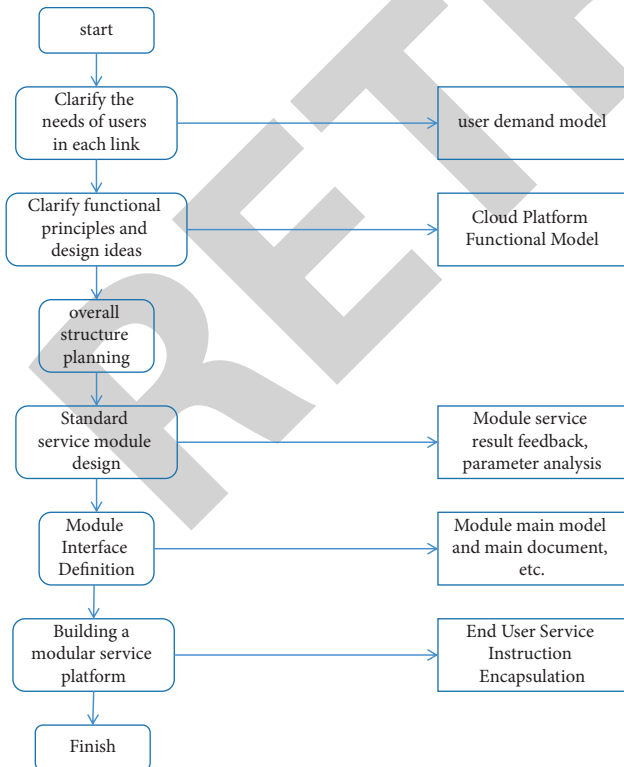
Figure 4: Schematic diagram of gear hobbing.

Figure 5: Schematic diagram of noncircular gear machining.

At the starting position, the tangent of point a completely coincides with the x-axis, so the distance from point a to axis y_1 is shown in

$$r_0 \cos \mu_0. \tag{3}$$

At any position, suppose the noncircular gear rotates through the angle θ_1, and the tangent point of the two curves is b, then the angle between the tangent at point b and the radial vector is shown in

$$\mu_1 = \arctan \frac{r_i}{(dr/d\phi)_{r_i}}, \tag{4}$$

$$bP = r_i \cos \mu_1. \tag{5}$$

The instantaneous center distance is shown in

$$a_i = r_i \sin \mu_i. \tag{6}$$

The arc length between a and b is shown in

$$l_i = \int_{\phi_0}^{\phi_1} \sqrt{r^2 + \left(\frac{dr}{d\phi}\right)^2} \, d\phi. \tag{7}$$

As can be seen from the figure, the rotated θ_1 angle is shown in

$$\theta_i = \phi_i + \mu_i - (\phi_0 + \mu_0). \tag{8}$$

The horizontal distance that the rack moves to the left from the starting position is shown in

$$x_i = l_i + r_0 \cos \mu_0 - r_i \cos \mu_i. \tag{9}$$

Combining formulas (8) and (9), it can be seen that the machining model of the hob machining noncircular gear is completely determined by the pitch curve of the noncircular gear.

Machining errors in noncircular gears and installation errors in transmission mechanisms mainly affects the quality of use of noncircular gears. In the process of processing noncircular gears, the combination of various errors will cause errors in the final noncircular gears manufactured. These errors include machine tool error, tool error, fixture error, tooth return error, and thermal error. Based on the reason that the processing methods of noncircular gears and cylindrical gears are basically the same, by analogy to cylindrical gears, the machining errors of noncircular gears can also be considered to be summarized from the following four aspects, as shown in Figure 6 [10, 11].

In the working state, on the circumference where O is the center of the circle, the distribution of the teeth of the gear is not as uniform as in the nonworking state, which leads to the unevenness of the rotation angle and errors [12]. The angle error can be represented by the meshing line increment of the left and right tooth surfaces of the gear. This is because the variation law between the two has a certain quantitative relationship, and the meshing line increment of the left and right tooth surfaces can be obtained by the following formula:

$$\begin{cases} \Delta_1 F_L = e \sin(\varphi + \alpha), \\ \Delta_1 F_R = -e \sin(\varphi - \alpha). \end{cases} \tag{10}$$

Among them, $\Delta_1 F_L$ is the left meshing line increment, $\Delta_1 F_R$ is the right meshing line increment, e is the geometric eccentricity, φ is the rotation angle of the gear, and α is the pressure angle of the gear.

When the measured noncircular gear meshes with the ideal gear on both sides, due to the geometric eccentricity of the measured noncircular gear, fixing the axis position of the measured noncircular gear and the ideal gear will produce radial displacement as shown in the following formula:

$$\Delta R = \frac{\Delta_1 F_L + \Delta_1 F_R}{2 \sin \alpha} = \frac{e \sin(\phi + \alpha) - e \sin(\phi - \alpha)}{2 \sin \alpha} = e \cos \phi. \tag{11}$$

When the rotated angle of the tested gear satisfies the following conditions,

$$\phi = 0°, \phi = 180°. \tag{12}$$

The radial runout of the gear will be generated as shown in the following equation:

$$\Delta F_r = 2e. \tag{13}$$

The resulting radial runout can be used to represent the geometric eccentricity in the radial machining error as shown in Figure 7.

The installation error on the hobbing tool is mostly reflected in the runout in a single radial direction and a certain amount of skew [13, 14]. When the hobbing cutter is processing spur gears, the installation error of the hobbing cutter usually leads to the tooth profile error. In the process of gear operation, the tooth profile error will reduce the stability of the gear transmission and also reduce the contact area of the tooth height when the gear meshes. When machining helical gears, the waviness of the contact line between the tool and the helical gear is shown in Figure 8.

The tangential machining error is for a machine tool working with the generation method. The tangential machining error is mainly caused when the generative motion of the tool and tooth is destroyed. Some tangential machining errors may also be caused by indexing errors, because some machine tools have their own indexing mechanisms [15]. The transmission error and difference of the rod in the processing process, or the error of the machine tool indexing plate, and the final error of the indexing pot and rod pair are the main sources of tangential errors in the kinematic chain of the machine tool. The tangential error is a constant value along each contact line. It is the characteristic of gear hobbing to process by means of continuous indexing motion and generating motion. In such a processing method, from the tool to the gear burr, the tangential error of gear hobbing is caused by the accumulation of errors in the entire kinematic chain [16]. The main reason for the tangential error is the pot wheel and rod pair that performs indexing motion. The error generated by the pan wheel pot rod pair causes the noncircular gear to be processed to move eccentrically. The movement eccentricity is caused by the periodic change of the speed of the tooth return and the tool during the machining process compared with the speed of the generating movement. The movement eccentricity is reflected on the tooth return as shown in Figure 9.

In the longitudinal plane, the inclination error of the tool post guide of the machine tool will mainly cause a certain taper of the machined gear, as well as the contact line error and the helical line error. The existence of the guide rail error of the tool post of the machine tool will ultimately affect the stability of the gear transmission process and the uniformity of the load distribution, as shown in Figure 10.

The contact line error of the guide rail caused by the inclination amount y in the longitudinal plane is given by

$$\Delta F_b = \frac{y}{l} b \sin \alpha_n. \tag{14}$$

The tooth orientation error caused by the inclination amount y is shown in

$$\Delta F_\beta = \frac{y}{l} b \tan \alpha_n. \tag{15}$$

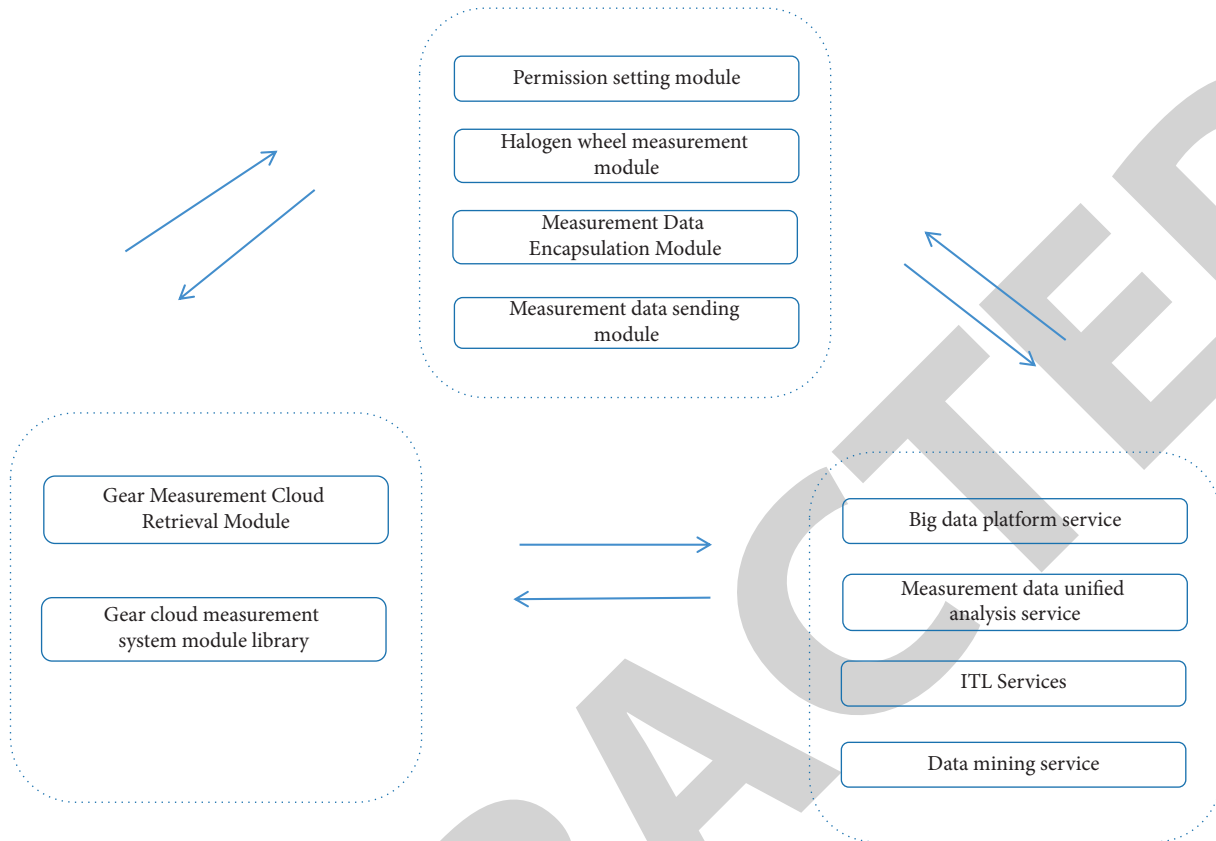The taper on the gear width caused by the inclination amount y is given by

Permission setting module

Halogen wheel measurement
module

Measurement Data
Encapsulation Module

Measurement data sending
module

Gear Measurement Cloud
Retrieval Module

Gear cloud measurement
system module library

Big data platform service

Measurement data unified
analysis service

ITL Services

Data mining service

Figure 6: Four types of errors during hobbing of noncircular gears.

Gear detection mechanism 1
Gear detection mechanism 2
...
Gear detection mechanism n

Information
Sharing

gear maker 1
gear maker 2
...
gear manufacturer n

Inform
ation
Sharing

Cloud service platform

Informa
tion
Sharing

Industrial Cloud Platform 1
Industrial cloud platform 2
...
Industrial Cloud Platform 3

Information
Sharing

Gear measurement and
measurement room 1
Gear measurement and
measurement room 2
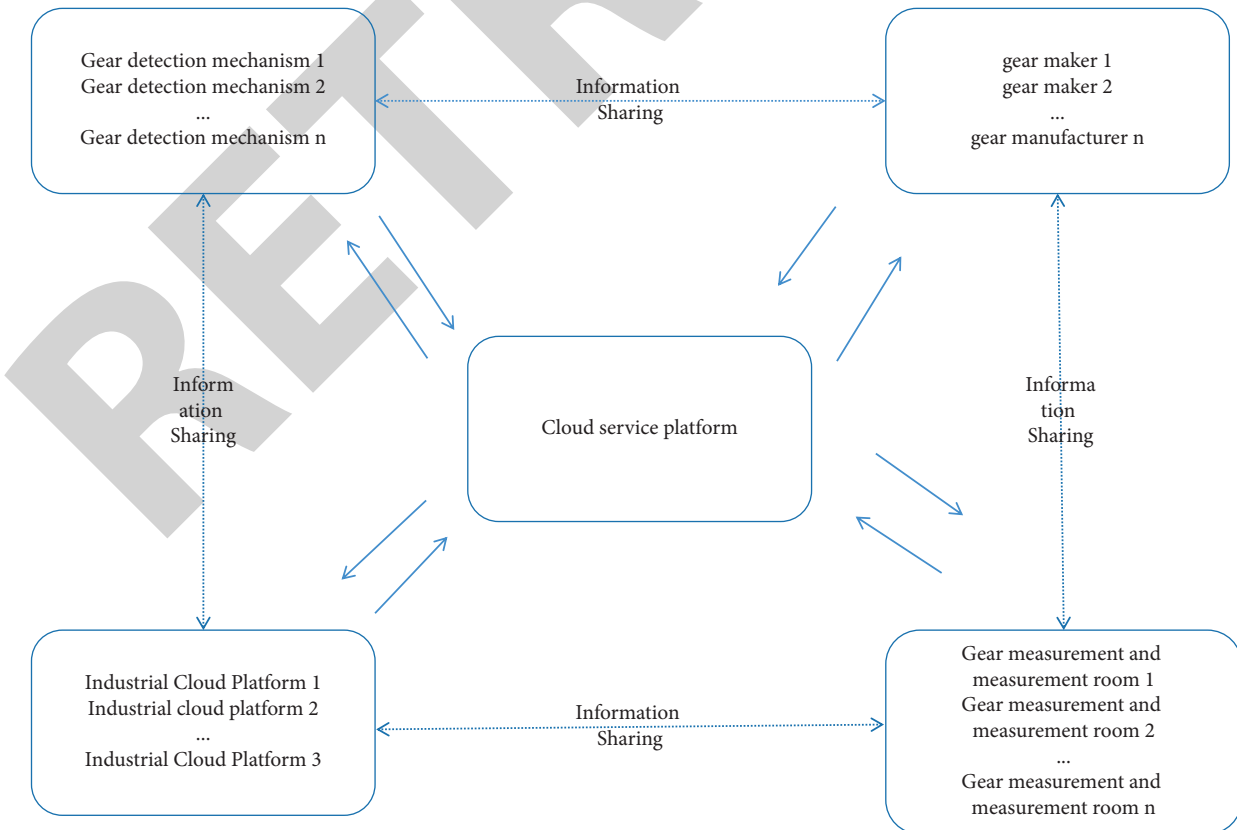...
Gear measurement and
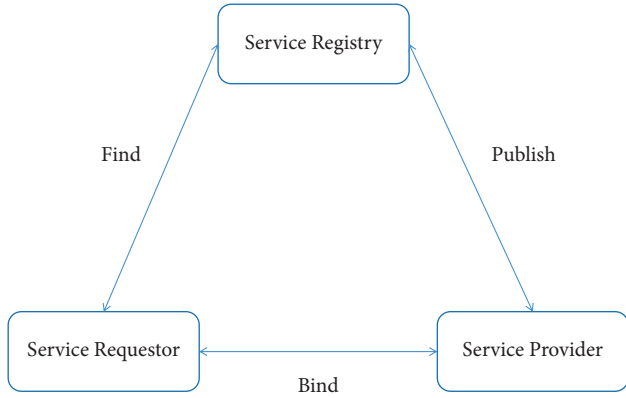measurement room n

Figure 7: Geometric eccentricity.

Figure 8: Tooth profile error and contact line error caused by hob installation error.

$$\Delta H = \frac{y}{l} b. \tag{16}$$

In the transverse plane of the machine tool, the error caused by the inclination of the tool holder guide rail in the direction of the contact line is shown in Figure 10, as shown in

$$\Delta F_b = \frac{x}{l} b \cos \alpha_n. \tag{17}$$

Then, the tooth direction error of the processed gear is shown in

$$\Delta F_\beta = \frac{y}{l} b. \tag{18}$$

Therefore, the expression of tooth direction error caused by inclination x and y is shown in

$$\Delta F_{\beta z} = \sqrt{\Delta F_{\beta x}^2 + \Delta F_{\beta y}^2}. \tag{19}$$

Although the tooth direction error of the gear is constant in one revolution of the gear, the errors caused by x and y can be distinguished. The tooth direction error caused by x shows that the left and right tooth surfaces are equal, and the symbols are the same; Unlike the tooth alignment error caused by x, the symbol of the tooth alignment error caused by y is no longer the same [17, 18]. Therefore, when the two appear at the same time, they are offset on one tooth surface and strengthened on the other tooth surface, as shown in Figure 11.

When the tooth reduction axis is skewed relative to the gear machine tool, the runout of the tooth reduction reference end face is generated. The runout error of the tooth reference end face will produce a variable tooth direction error of the cut gear, and the tooth direction error has a great impact on the longitudinal contact of the gear, as shown in Figure 12.

4. Experiment and Analysis

We completed the construction of the gear cloud measurement platform, in which the cloud computing platform is realized by Hadoop technology. Because the distributed operation has not been fully applied in the Windows system, the Linux system is used to provide support for platform development. Among them, the experimental network topology of Hadoop cluster fully distributed mode in cloud platform is shown in Figure 13.

According to the specific architecture of Hadoop, when building clusters, they can be divided into master and slave roles. Master mainly manages namenode nodes and job-tracker nodes, while slave mainly manages datanode and tasktracker nodes [19].

This paper uses VMware Workstation virtual machine to provide Linux environment in the Windows system, then deploys Hadoop cluster in the Linux operating system, and uses Hadoop cluster with high availability to build a small cloud computing platform. Software to be prepared for Hadoop installation: virtual machine version: VMware workstation-14.0.0 build-6661328; Linux version: centos-6.8-x86_ 64-bin-DVD1. Iso; JDK version: jdk-8u144-linux-x64.0 tar. gz; Hadoop version: hadoop-2.7.2 tar. gz; You also need to install ssh and rsync software. The cloud platform is built in the fully distributed mode of Hadoop cluster. The cluster is composed of three Linux system servers created by virtual machines. The relevant environment and configuration information of each server node are shown in Table 1.

First prepare 3 clients in the virtual machine, set static IP and host name, then install JDK and Hadoop, respectively, and configure their environment variables; finally, configure ssh, group, and test the cluster [20].

In the Linux system, after the Hadoop cluster is built, it can provide distributed storage, computing services, and corresponding resource management services. In order to realize the functions of data collection, analysis, and storage of cloud platform, it is also necessary to build other services supporting Hadoop cluster to improve the development environment. The planning of other services supporting Hadoop cluster in the three nodes is shown in Table 2.

In order to enable the cloud platform to meet the data entry requirements of as diverse data sources as possible, the cloud data acquisition module deploys Flume, Sqoop components, and custom interceptors, respectively. The biggest feature of Flume component is that it can read the data from the local disk of the server in real time and write the data to HDFS. Through the configuration of the Agent in Flume, it helps to realize the rapid entry into the cloud of the log files and sensor network port data generated by the measurement site in the data collection link of the cloud platform. Sqoop component can make data migrate back and forth between traditional relational database and HDFS, Hive, and HBase, so as to ensure safe and efficient import and export of data in different systems [21]. The user-defined interceptor is used to preprocess the collected data and prepare for subsequent data analysis. This part of the work is introduced below. The data acquisition module deploys Flume to collect multiple data sources, including text data, port monitoring data, and console data. After Flume is successfully deployed, Sqoop is used to export and store the traditional relational database My SQL and Oracle data as HDFS or data warehouse Hive. Next, test it, import the new table companydatas of My SQL database into the HDFS file
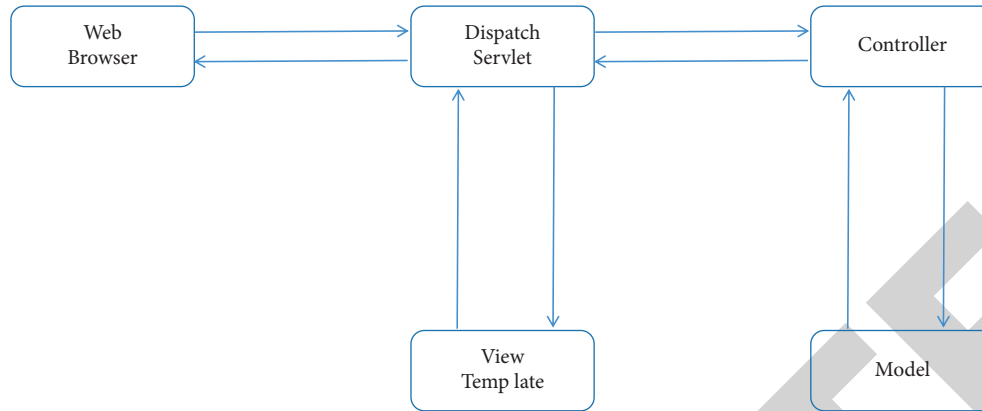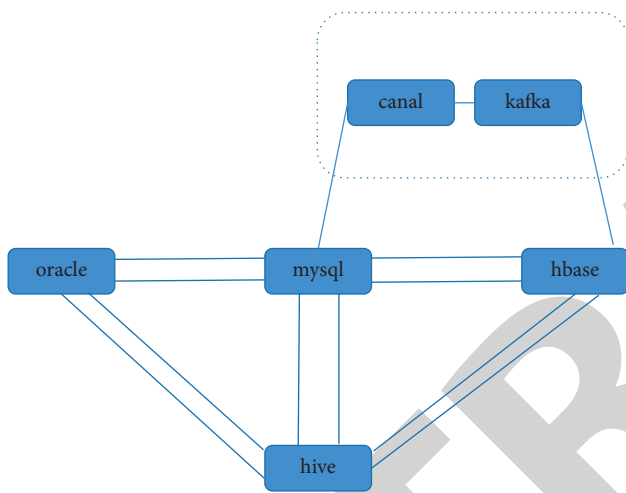
Figure 9: Motion eccentricity.

Figure 10: Inclination of the tool holder guide towards the front of the workpiece.

system, and save it in the path of/user/hpu. Hive has built a set of data warehouse based on cloud distributed storage. The data enter the distributed storage through the cloud platform data acquisition channel, and then extract and process the collected data in the data warehouse. Information about hive startup. Among them, it contains the version information of Hive and the version information of Hive running engine tez. To verify Hive's availability, perform the following tests. The data in the txt file of the distributed system are loaded into the data table of the data warehouse, and the first ten data in the table are queried through the query statement. Put the custom parsing function in cloud distributed parsing into the Java project built with maven, make a jar package, deploy it to the hive folder in the main node, add the jar package to Hive's class path through instructions, and create a temporary function to associate with the Java class developed by the user. In the cloud distributed data retrieval module, deploy and test Elasticsearch and Kibana. The Elasticsearch version is elasticsearch-7.4.2, and Kibana version is kibana-7.4.2. The distributed search engine deployed in this paper is an Elasticsearch cluster composed of three nodes. After its

installation, configuration, and deployment, you can access the corresponding service port through the browser to view the health and node status of the test cluster. The configuration of the gear measuring system is mainly verified by uploading the data generated by the three probe measuring system and the gear measuring system to the cloud measuring system. The CMM system is mainly composed of measuring probe, measuring machine host, control system, and computer [22].

The gear cloud measurement system processes the measurement data in the cloud based on the cloud platform. The service process of the gear cloud measurement system is that the user logs in through the browser, controls the user's operation and access rights to the page content in the system according to the user role relationship and role menu relationship, and fills in the resource information, supplier information, measurement items, and measurement content according to the measurement resource information table provided on the terminal page, and publish resources on cloud platform [23]. Inside the enterprise, you can enter the data monitoring interface to view the measurement data in real time by clicking the corresponding data directory, or retrieve and view the historical data and the monitoring standards in international and Chinese enterprises. In addition to online verification of measurement data, when the CMM detects one or a batch of gears, it can also upload the data file. Users can view the comprehensive measurement results or single measurement indicators of a measurement item through the terminal page. The terminal system provides cloud storage service. The data generated by CMM and other gear measurement instruments are stored on the cloud platform and stored in different areas according to time or content classification, and Users can also access, use, and view data in corresponding ways through the cloud [24].

Measurement data integration management is a multi-user oriented data resource sharing service and a heterogeneous data processing service. The data processing service includes data classification and definition, source data characteristic coding, model and diagram document management service, etc. For the measuring instruments connected to the platform, users can log in to the client of the cloud platform to view the corresponding content [25, 26].
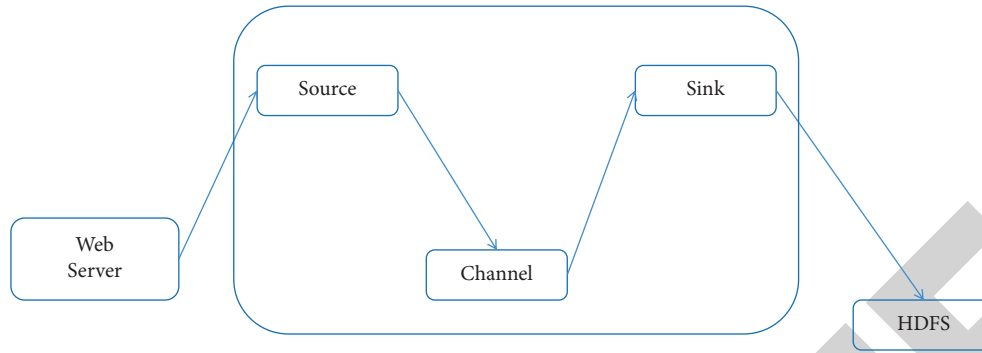
FIGURE 11: Inclination of tool rest guide rail to the left and right of workpiece.
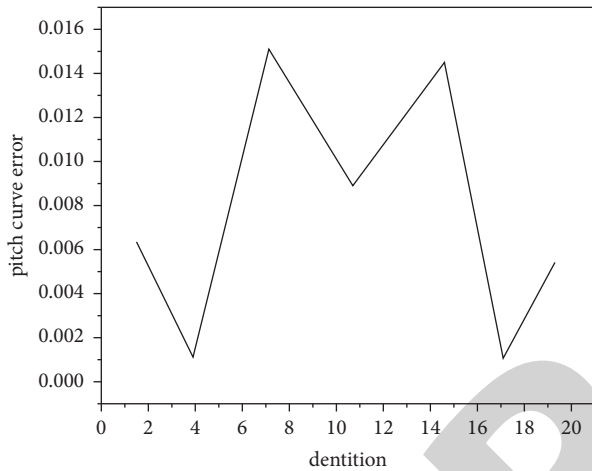

FIGURE 12: Tooth profile error caused by circular runout of workpiece end face.

TABLE 1: Environment configuration information of each service node in the cluster.

Type of environment	Master node	Slave node①	Slave node②
Operating system	CentOS-6.8	CentOS-6.8	CentOS-6 8
CPU	8 Nuclear	8 Nuclear	8 Nuclear
RAM	7G	4G	4G
Disk	50 GB	50 GB	50 GB
JDK Version	1.8	1.8	1.8
IP Address	192.168.174.102	192.168.174.103	192.168.174.104
Hadoop Version	hadoop-2.7.2	hadoop-2.7.2	hadoop-2.7.2

- ■ Accumulated error of needle pitch
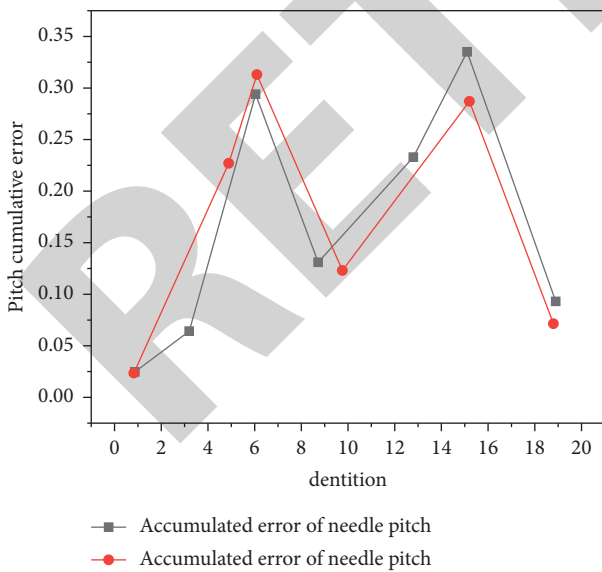- ● Accumulated error of needle pitch

FIGURE 13: Experimental network topology of Hadoop cluster fully distributed mode in cloud platform.

In this section, the data collection of the laboratory CMM by the cloud platform is realized by uploading text files. The specific steps are to log in to the gear cloud measurement terminal system by using the user account and password. After logging in, click the "gear measurement data integration management" column of the navigation menu on the side bar of the page to enter the data upload directory. The measurement data generated by the CMM is uploaded to the server by dragging the file or clicking the select File button. The data acquisition channel collects the data through the monitoring of the server disk folder and then completes the data acquisition, processing, and processing in turn through the system data process designed by the cloud platform transmission and storage processes. During data transmission on the web page, the JSON format is used to define the measurement data. After processing the data uploaded by the CMM, enter the measurement index analysis directory. On this page, you can click the gear error item according to the different measurement indexes to access the error monitoring status, data, and content. The user can select the date through the date and time selector in the upper left corner of the page, by calling the error curve generation service, the measurement results of gear radial runout are obtained, with the tooth number as the abscissa and the radial distance of the stylus center as the ordinate.

Upload, analyze, and store the data collected from CMM, which provides support for the management of measurement data. The processed data information has the same data structure and standard, which can be operated and processed through the page. The data management service in the data integration of the gear cloud measurement platform manages it through a specific database according to the name, data content, and data type of the measurement

Table 2: Construction and testing of the gear cloud measurement system based on cloud platform.

Service name	Master node	Slave node①	Slave node②
K afka	✔	✔	✔
Flume(collection)	✔		
Zo okeeper	✔	✔	✔
Flume(Consumption)			✔
Hive	✔		
MySQL	✔		
Sqoop	✔		

platform. The data obtained by the cloud platform from the CMM are placed in different data tables of the same database. The user invokes the encapsulated service instructions in the form of buttons on the page to realize the operation of data management.

When the cloud platform collects measurement data through CMM and other measurement resources, in order to ensure the integrity of the data, it also encapsulates and manages the measurement resources. In addition, the resources in the cloud platform are jointly maintained by registered users with a basic material database, such as integrated measurement data, gear part library, equipment resource information, and document information, to provide support for all stages of gear measurement [27].

In the process of gear measurement, various problems may be encountered. At this time, the retrieval module of the terminal system can be used to search for specific solutions or relevant information, such as the retrieval of gear parts information or measurement methods. The retrieval process is a process in which users actively pull data from the system. The terminal system will also provide offline recommendation service and real-time recommendation service according to different recommendation algorithms, so as to realize auxiliary decision-making and improve measurement efficiency.

Firstly, this chapter introduces the deployment of cloud platform development environment, including the hardware facilities and software configuration built by distributed cluster, and gives the operation status of each node. Then, the deployment and testing of relevant functional modules are carried out to prepare for the data acquisition, data analysis, and data retrieval of the platform. Finally, the case application of the terminal system is carried out, and the functions of the terminal system are verified according to some functional modules.

5. Conclusion

Under the background of the continuous integration and development of traditional industry services and new generation information technology, this paper studies the gear cloud measurement technology based on cloud platform. Taking the cloud platform as the carrier, this paper proposes a gear cloud measurement solution based on big data cloud computing platform, which realizes the collection, storage, and analysis of measurement data in different places, as well

as the management and visual display of error parameters in measurement indicators. Firstly, from the perspective of the overall requirements of the gear cloud measurement system, the functional requirements and overall architecture of the gear cloud measurement platform are analyzed and designed. According to the corresponding functional level, the cloud platform is divided into cloud data acquisition and transmission module, cloud data analysis and conversion module, and cloud data retrieval and push module. Next, the above modules are developed, deployed, and implemented one by one. The main research contents and achievements of this paper are as follows:

(1) The architecture of the gear measurement terminal system based on cloud platform is studied

Under the traditional mode, the information exchange in gear measurement and other links in its life cycle is usually within the department and enterprise. At the same time, the traditional software development adopts the chimney system architecture, which also increases the difficulty of data sharing. Through cloud computing technology, the contradiction between the global optimization requirements of gear measurement and fragmented collection can be well solved. The service-oriented cloud architecture and cloud data center solve the problems of software system closure, data fragmentation, and data island, promote the sharing of data, the unification of system technical architecture, and the agile development and deployment of applications, and realize rapid response and service innovation through rich front-end applications.

(2) The resource dynamic integration method of the gear cloud measurement system based on cloud platform is given

In resource collaboration, application collaboration, and data collaboration, it is necessary to integrate the distributed resources of enterprises and institutions into one by some means to form a cloud data center and provide data and other services uniformly and transparently. The cloud data center gathers the resources of different enterprises and institutions to analyze and manage the received data through certain rules. Moreover, the virtualization of the cloud data center encapsulates the distributed physical resources of network, computing, and storage for the use of the cloud platform.

(3) The information retrieval technology of gear measurement terminal based on cloud platform is introduced

Firstly, this paper discusses the resource retrieval and recommendation technology of the gear cloud measurement system based on cloud platform, describes the retrieval process of surveyors on cloud platform, and analyzes several mainstream retrieval strategies and calculation methods of sorting retrieval results. Finally, the recommendation technology of the gear cloud measurement system based

on cloud platform is discussed, and the cloud platform recommendation model and collaborative filtering recommendation algorithm based on argot model are analyzed.

(4) Implementation of the gear cloud measurement system based on cloud platform

Finally, the experimental environment, deployment, and testing of the cloud platform in this paper are introduced, the functional modules and components of the gear cloud measurement system are tested, and the final effect of the gear cloud measurement platform is summarized.

Data Availability

The labeled data set used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

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