Application of Maintenance Simulate System of NC Machine Tools in Teaching

Xin He[1,a], Guosheng Xu [2,b], Ping He [3,c], Jiming Tan [4,d], Lifang Zhang[5,e] and Huili Zhang[6,f]

Tianjin vocational technology normal university, Tianjin 300222, China
Email:[a]3576554862@qq.com,[b]13820526206@163.com,[c]13110009352@126.com,[d]tanjiming69@163.com,
[e]876898092@qq.com,[f]545278910@qq.com

Abstract. The project design is the foundation of training, which can insure the usefulness of human resource development system. The Training Project Maintenance Simulate System of NC Machine Tools is presented based on analyzed contradiction between supply and demand. This paper introduces several scheme of Maintenance Simulate System of NC Machine Tools.

Keywords. NC Machine Tool, maintenance, simulation system.

1 CNC machine maintenance personnel status quo

The numerical control technology is one of the important development directions of the machinery manufacturing industry today. It is the basic industry related to the national strategic position and comprehensive national strength, and its level is the core symbol of a country's manufacturing modernization.

China's CNC machine tool industry is lagging behind foreign advanced countries is an indisputable fact, about 100 million US dollars each year of imports and exports of millions of dollars highlights the seriousness of the problem. At present, many users to buy foreign CNC machine tools, the purpose is to ensure high-quality and guaranteed after-sales service, but the actual situation is often affordable, repair can not afford, foreign experts to spend a huge time. If the domestic CNC machine tools have high-quality maintenance services, this alone can make the majority of users to buy domestic CNC machine tools have incomparable advantages, at least in the mid-range CNC machine tool market can make CNC machine tools import and export ratio improved significantly, Which can save tens of millions of dollars of foreign exchange, and can make domestic CNC machine tool manufacturing industry access to valuable development funds to enable the industry to enter a virtuous circle. High-quality, low-cost maintenance personnel a steady stream of supply, will completely change the domestic CNC machine tool after-sales maintenance of poor image.

The Ministry of Education organized the relevant units to carry out the "NC personnel on the demand and numerical control education reform," the research task. The results are shown in Table 1.

The research results show that the utilization rate and the intact rate of NC equipment are generally low in our country, besides the insufficiency of production task due to the pervasive production task, the lack of maintenance power and programming ability are the main reasons for the underemployment, And 17.2% respectively. CNC equipment, the main reason for the failure rate of maintenance is insufficient, accounting for 38.4%. Thus, NC maintenance and NC programming and maintenance personnel is currently in urgent need of CNC talent.

Survey data also show that 59.16% of the CNC technology professionals for the technical secondary school and the following qualifications, 31.25% for the tertiary education, only 8.58% for undergraduate education, undergraduate or higher education accounted for only 1%. This situation is difficult to meet the technical needs of enterprises, so training a large number of undergraduate level of numerical control equipment maintenance personnel has been very urgent.

2 CNC maintenance personnel training training program

Today's CNC machine tool failure is completely not the traditional sense of machine failure, modern CNC machine tools using the latest power electronics technology, motor technology, test technology and computer technology and other technologies, so the operation of CNC machine tools, maintenance and management The new, completely different from the requirements of traditional machine tools.

At present, most of our CNC machine tool users are still using the master apprentice and short-term training in the way of training CNC machine tool maintenance personnel, and the proper use and maintenance requirements of the machine is not commensurate, and this is the low level of reliability of CNC machine tools One of the main reasons.

Today's CNC machine tools more to reflect the knowledge rather than experience, if the mechanical technology-based traditional machine tool use and maintenance can still be accumulated through the experience and short-term learning to make up, today's CNC machine tools across the machinery, (Sensors), electromagnetic interference and a lot of computer expertise, it is impossible to be short-term training to be quick. However, to establish a FANUC, SIEMENS and CNC systems such as NC numerical control machine tool repair training center, the school needs to invest about three to four million in education funding. This is difficult for most institutions, so it is necessary to develop a simulation system for CNC machine maintenance.

In the process of CNC machine tool training, most institutions have adopted a CNC machining simulation system. It can be a mountain of stone attack jade! Learning from successful experience, we can also develop a maintenance simulation system. In the training process, let the students operate the computer simulation system, in the grasp of the overall structure of CNC machine tools based on the familiar fault points and fault characteristics. And then let the students in the NC maintenance training on the experimental platform to master each CNC system and the spindle drive system, feed system, turret and limit switch electrical connections; Finally, let the students on the light machine for mechanical installation, electrical connection, Mechanical and electrical intermodulation, assembly of economic CNC lathes.

Students practice the simulation system on the computer for future training links have a very important role. CNC machine tools in the electrical cabinet in the 380 V power supply and 220 V switching power supply. If the students do not understand the wiring in advance is likely to be life-threatening, and may also damage the NC system and servo drives and other weak electrical equipment, so that the training schedule was interrupted, increase training equipment, capital investment.

Table 1. NC technical personnel status table.

Scope of investigation	NC talent sources			Educational background				Job type			
	From the school to recruit fresh students	Recruitment from the community	Self-cultivation operatives	Bachelor degree or above	Undergraduate	Specialist	Secondary and below	NC programming	System maintenance	Machine Operation	Above can be engaged
North-west area	71.10%	17.20%	11.70%	1.40%	17.80%	48.90%	31.90%	13.2%	16.7%	69.9%	0.2%
North China	60.20%	11.80%	28%	2%	8.50%	24.65%	65.40%	16.2%	10%	68.2%	6.9%
Central China	25%	10%	65%	0.60%	1.90%	26.20%	71.30%	16%	12%	67.0%	4.0%
North-west region	44.20%	13.65%	42.15%	0.80%	6.90%	33.60%	52.70%	6.7%	4.4%	77.9%	11%
Southwest Region	65.40%	16.90%	17.70%	1.60%	12.20%	29.10%	57.10%	12.2%	13.7%	74.1%	0
Huadong Region	29.30%	16.20%	54.50%	0.70%	6.70%	40.50%	52%	12.3%	19.5%	62.2%	5.6%
South China region	42.90%	22.30%	34.80%	0.80%	6.00%	15.70%	77.50%	9.9%	10.4%	71.6%	8.1%
Average	48.30%	15.44%	36.26%	1.0%	8.58%	31.25%	59.16%	12.6%	12.44%	70.13%	4.82%

3 CNC maintenance simulation system to achieve program

With reference to the successful experience of related fields at home and abroad, three feasible schemes are summarized:

(1) draws the numerical control processing simulation system development a set of numerical control maintenance simulation system.

The modeling of each part of CNC machine tool is made by ProE, then the friendly user interface is compiled with VC ++ and the model database and fault database are built with Access.

(2) draw lessons from Kingsoft and other software ideas to develop a set of CNC machine tool fault maintenance manual.

Using VC ++ to compile friendly user interface, using Access to build model database and fault database. Combined with data mining technology to write a fast intelligent search algorithm.

Data Mining (DM-Data Mining) is one of the most active research fields in recent years. It is a combination of artificial intelligence and database technology. It uses special algorithms to extract effective patterns from the data, Discover potential laws to extract useful information. It shows great vitality in the analysis of association rules, classification, prediction and clustering of massive data [2]. Therefore, the combination of data mining technology and CNC machine condition monitoring and fault diagnosis is conducive to break through the bottleneck of traditional condition monitoring and fault diagnosis system knowledge acquisition, so that the whole system development and application into a new stage of development.

(3) the use of interactive electronic manuals in the maintenance of weapons and equipment in the application of the development of interactive digital electronic maintenance manual [3-4].

IETM-Interactive Electronic Technical Manual (IETM-Interactive Electronic Technical Manual) is the development of technology of information network, multimedia computer, database, artificial intelligence expert system and electronic publishing. It meets the requirements of technical information management of mechanical equipment, realizes data interoperability and Highly shared technical information support system. It is able to equip the electronic equipment with a large amount of technical information and data, including technical specifications, maintenance manuals, commissioning manuals, external interface protocols, electrical schematics, cable connection diagrams, wiring tables, wiring diagrams, accessories and tools. Maintenance, maintenance manuals and other organically combined into one, based on electromagnetic media and a high degree of interaction with the ability of digital technology documents, so as to establish a paperless, intelligent, man-machine harmony and automated maintenance Environment, for technical staff to provide timely, appropriate and appropriate operational guidance and information support. The use of IETM technology can effectively improve the mechanical fault diagnosis and maintenance capabilities. Therefore, the IETM technology into the field of CNC machine maintenance, the establishment of a fully user-friendly and highly interactive electronic information maintenance environment for the maintenance of CNC machine tools to improve student ability, has a very important practical significance.

IETM includes product assurance data and product definition data. It not only emphasizes the interoperability and sharing of data, but also emphasizes the interaction between data and users. Internationally IETM is usually divided into five, five IETM, the most basic one is a (Class 1), the most advanced is five (Class 5). But as a complete IETM, it should have the following basic functions:

①IETM content includes product design, drawings, use, maintenance and other data.

② good access and interactive features. IETM provides a variety of information retrieval, search path, and can give users real-time response to the operation, accurate and timely help and guide users to operate.

③diversified display style. It can display technical information in various forms such as text, table, graphics, image, video, animation and virtual reality technology, and provide users with detailed, vivid and easy to understand technical information.

④ information real-time maintainability. For the technical staff to provide information update mechanism, so that technicians based on maintenance experience and equipment maintenance routine information, with the necessary Notes, update, enrich technical data and information.

⑤ with the computer information system of organic integration. IETM based on network and database can realize the integration with computer information system, and can easily interact with digital library, information center and technical data processing system in different places (or different places) to realize information sharing.

⑥ flexible and diverse storage media and application forms. It can be used in various types of electronic media, such as CD-ROM, hard disk, floppy disk, and tape, which can be used in desktop computers, laptops and even handheld computers, or in the form of web on the Internet.

To complete the basic functions, IETM should include at least three modules: product data database, expert system database, human-machine interface and interface program modules.

The product data base is the most important part of the system. It is based on the random electronic version of the drawing data. The contents of the electronic version of the drawing are: technical specifications, maintenance instructions, commissioning manual, external interface protocol, electrical schematics, cable connection Diagrams, wiring diagrams, wiring diagrams, accessories and tools summary table, list of components, photo albums, maintenance software and maintenance manuals, etc., is to support the use of operation and maintenance of important tools and resources. If there is no ready-made electronic version of the electronic version of the drawings, on the one hand through various channels to the development, production units to purchase, on the other hand, the organization of professional and technical personnel will be random paper data using computer keyboard or scanner input and computer processing, Paper manuals and document digitization. At the same time the organization of professional and technical personnel to carry out technical research, testing electronic equipment important nodes of the electronic technical parameters, the formation of graphics or tables to enrich the product information database content.

The expert system database is one of the important technical components of IETM. The contents of the expert system database are complex. The main contents include: specific failure phenomena, analysis of the phenomenon, possible causes and specific elimination steps. Through the analysis of the reasons for the failure to explain, and for different reasons are given troubleshooting methods, troubleshooting troubleshooting process may be difficult to answer. There are two ways to access it: browsing and finding. Browse is characterized by a list of all the symptoms in a table, followed by the current failure analysis. The user in the failure of the table and possible causes of failure to choose to find the corresponding symptoms and possible causes and solutions. As for the search, it is through the user input keywords automatically by the system to find fault and analyze the reasons and the exclusion method. The content of the fault diagnosis database will be enriched and renewed according to the change of the fault state of the NC machine tool, so that the fault diagnosis system has the memory ability. The knowledge update of the fault diagnosis system adopts the way of combining manual updating with system automatic updating.

The friendly man-machine interface and the effective management of the database are the necessary conditions for constructing IETM. Because IETM emphasizes "interactivity", it is necessary to provide users with a convenient access route. Users must use the efficient man-machine interface management program to link the data and data of the users interested in the database and show them to the users by computer multimedia technology.

4 Summary

In order to alleviate the pressure of lack of NC maintenance personnel, the author's teaching and research department opened the "CNC machine tool repair and testing" undergraduate professional, and a year ago applied for "CNC machine maintenance simulation system research and development" project. The author hopes that this article can serve as our country 's national conditions of NC maintenance personnel training program as soon as possible to play a role.

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