DEVELOPMENT OF COMPUTER NUMERICAL CONTROL INTEGRATION TECHNOLOGY

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Abstract: This article summarizes the development status of computer numerical control interfaces at home and abroad, and briefly describes the structure of computer numerical control integrated systems. elaborated based on DNC Based on the development background of integrated systems, several development trends of computer numerical control integration technology are proposed.
Keywords: Computer; Numerical control; Computer integrated manufacturing production; Management computer control

1 Introduction

Flexible manufacturing system FMS It's from an automated machining workshop. One of the important components. In the past ten years, To realize the machine The automation of machining workshops puts a lot of energy into FMS. because For its special historical reasons, FMS The development of not only focuses on information flow integrated, More emphasis is placed on the integration and automation of material flows. Logistics automation Equipment investment throughout FM S occupies a considerable proportion of the investment, And FMS The operational reliability of normal operation of the automation equipment. Proven in practice, FMS Although lucky It has the advantages of high efficiency and high degree of automation, However, investment risks are high and Slow-acting, can Reliability compare Difference. DNC (Distributed Numerical Control or Direct Numerical Control) distributed number Control or computer direct numerical control, is realized CAD/ CAM and computer Auxiliary production management system (abbreviation CAPMS) integrated link, yes Yet another form of machine shop automation. DNC emphasis letter Integration of information and automation of information flow, Material flow control and execution Can involve a lot of human-computer interaction. relatively FMS For example, DNC It's investment Multiple CNC processing equipment with small investment, quick results, and good flexibility integrated control system. therefore, In recent years, domestic and foreign opinions on the DNC system research is quite active.

2 Development status of computer numerical control interface

Current CNC machine tools DNC The main functions of the system are:
(1) Input, output, storage, editing of part programs and data, Copy and other management functions.
(2) Activate NC and CNC and PC Program control starting conditions, receive status reports, Convert part programs into machine tool control instructions and other components. Distribution function of software programs and data.
Because of computer technology, number of designs and production in the past Most of the control systems have limited memory. In order to meet the needs of real-time data processing such as surface processing, According to the production requirements of particularly frequent transmission, many companies at home and abroad now Most of them adopt the method of each CNC machine tool DNC Interface with a computer Machine-phase connection to form isomorphic DNC system, processing at the same time The method of transmitting data meets the needs of surface processing. For workpiece input Integrated production management of delivery,

storage, simultaneous processing and assembly activities and the execution of production plans, generally an external process computers and DNC The system is connected.

at present, CNC machine tools DNC There are three types of interfaces: Computer direct numerical control, tape reader bypass BT R(Behind the Tape Re ader) and network interface.

Computer direct numerical control is mostly used for the transformation and automation of old CNC machine tools. A new type of CNC system developed by the master. at this time DNC computers will take over Most of the control rights of the CNC device directly control the servo system of the machine tool. system. This kind of DNC The essence of the interface is the communication interface of the computer. mouth.

Tape reader bypass BTR yes DNC The more common form of interface. All CNC systems provide tape reader interfaces. And most of them are consistent with International Standard (Such as RS 232C, RS - 422 wait) common interface. This kind of CNC machine tool DNC Interface suitable for point-to-point or star integrated control system. in smaller DNC Integrated control broadly used.

foreign 90 CNC systems from the 1990s, such as Fanuc 18 etc. have been provided can satisfy the United States General Motor Co. proposed network standards MAP (Manufacturing Automatic Protcol) The network interface option, once selected, can be realized IEEE802. 2(TCP/ IP) of communication. This kind of network DNC The interface performance is better and local area net LAN The topology can also have multiple choices, Such as star, bus, Ring and hybrid structures.

3 DNC INTRODUCTION TO THE STRUCTURE OF INTEGRATED SYSTEMS

DNC Integrated system architecture includes hardware connection architecture and Software system functions. Hardware connection architecture for different DNC The interface has changed, based on domestic and foreign data. Host computer through network media, to each different network topologies and NC Machine tools are connected. NC Machine Tools and Networks There are three typical connection methods for network media connections. The first type is mainly used for New style of 90 's NC Machine tools, this category NC Machine tools are provided with MAP standard DNC Network interface options; The second category is mainly based on "DNC" Device" or "CNC machine tool integrator" etc. and single CNC machine The bed is connected, and the computer at the processing workstation is NC between machine tools NC transfer of program, Complete machine tool status collection and reporting and part production management; The third category is the most common method at this stage. its owner The main feature is an industrial control PC Machine and single NC Machine tools are connected, Finish NC Transfer of programs and data.

DNC Integrated system software functions generally include: (1) NC program and data transmission, with some communication protocol (like 3964R etc.) accomplish Communication function; (2) Machine tool status collection and reporting; (3) According to production plan Draw, automatic allocation NC Program and data to the corresponding machine tool; (4) Distribution and transfer of tool data; (5) Tool and fixture preparation plan, Real-time control of tools, fixtures, etc. within the system; (6) According to the process plan and Production planning, realizing DNC consisting of a variety of CNC machine tools system, using DNC The system realizes the integration of automated machining workshops It provides a quick and effective way to optimize production management.

4 DEVELOPMENT TRENDS OF COMPUTER NUMERICAL CONTROL INTEGRATED SYSTEMS

4. 1 Research Focus Shifts from Communication to Production Management Software Technology

Famous CNC system manufacturers in the world have invested in the development of DNC Communication Interface, Provide compliance with MAP standard DNC network access port options and communication software. therefore, What will happen to the DNC in the future? Integrated system Research focus will shift from communication technology to DNC Integrated production management Software system technology. Its key technologies will mainly focus on improving NC machine bed utilization, shorten processing auxiliary time, and improve the overall DNC system flexibility, improve reliability, Reduce workers' labor intensity and other aspects.

4. 2 Realize the Transfer of Protocols from Intelligent Hardware to Software Plug-In Technology

In order to realize the integrated management of heterogeneous CNC systems, the current world CNC system manufacturers from various countries are actively looking for a solution to the communication protocol ways to discuss standardization issues. Before communication protocols were standardized, very The integrated control problems of CNC machine tools in multi-machining workshops can only be solved By developing specialized" DNC device" to achieve, Such as Fanuc and Siemens communication among heterogeneous systems. According to the data, At this stage Domestic and foreign DNC Device research focuses on developing smart hardware devices and interface standards, Mainly relies on intelligent hardware devices to implement heterogeneous systems communication protocol, For applications such as IBM Wait for the microcomputer, software as
main technical means, To achieve integrated management of heterogeneous systems Research attention is not enough.
Today, the performance of microcomputer hardware is getting better and better, and the interface expansion is convenient. Prices are getting lower and lower. For heterogeneous CNC systems Research on communication and integration, It can be supported by a microcomputer, Select Different join standards (like RS 232C, RS - 465, RS - 422, RS 511, etc.) Based on soft plug-in technology, Concentrate Focus on researching integrated software for heterogeneous CNC systems." Ninth Five-Year Plan" Expect time, our country 863 A high-tech plan has been established to develop this DNC soft plug-in system. The application of this system will definitely greatly promote my country CAD/ CAM and computer-aided production management system
(CAPMS) The integrated development of For machine shop Automation and integrated production management have important theoretical and practical value value.

4. 3 Mass Transplantation of Flexible Manufacturing Technology

Domestic and foreign data show that the DNC Integrated production management system Most of the research is aimed at specific objects and the composition and process of CNC machine tools. The plan is more relevant. Recently, some researchers are planning to conduct research in Johor over the years sexual manufacturing system FM S A large number of research results in production management and
Logistics real-time control, Practical experience in realizing workpiece transportation, storage, and synchronous processing is applied to heterogeneous CNC machine tools DNC within the integrated system. Integrated production management of activities such as assembly. This technical route can be used by those who have been engaged in it for a long time in the past FMS Research most DNC The integrated system only includes the first three functions, Still Not common.

4.4 MAP Promotion and DNC Development of Platform Products

Factory automation LAN standard proposed by General Motors Accuracy is being promoted and applied around the world, industry worldwide world's attention. pass MAP makes it easy to

connect machines on the shop floor People, NC Machine tools and other CNC equipment are connected to the factory network, Reality Integration of current information and automation of information management.

At present, there are many kinds of CNC systems in the world. These numerical control systems The communication protocols between the system and the outside world are also different. Such as Cincinaati use RSIO protocol; Fanuc and Siemens Using 3964R Agreement; FIDIA use XON/ XOFF protocol. In order to realize a variety of numerical control system integration, Many research institutions at home and abroad are researching and developing flat Platform , Trying to use one platform product to face various purchasing CNC equipment using different communication protocols, end with a common data structure and human-machine interface to face users. In the early 1990s, many large foreign companies Companies such as HP, DEC and IBM Companies have launched their own platforms product." Eight- fifty period, The National Science and Technology Commission has established a project to develop our own of DNC Development Platform.

4.5 Development of High-speed Data Communication Technology and Fieldbus (Field Bus) A Large Number of Applications

In the past, CNC machine tools only needed to store a few hundred meters of paper tape. processing and use, But for the large amount of surface processing data in automobile molds Storage, most CNC systems cannot meet the storage requirements. In order to process complex curved surfaces, most of them use processing and transmission at the same time. way. The data passed at this time must be correct and real-time. extremely high, Even small delays or errors can cause the machining process to An extremely short pause, thus affecting the manufacturing quality of the mold. Research on high-speed data communication technology above 14400 baud rate is used in many automobiles Attention is paid to mold manufacturing companies. in addition, To improve DNC set system reliability and openness, The point-to-point star topology of the past will become a thing of the past. Instead, a new communication structure))) Fieldbus. We think the future 10 years DNC integrated system It will be the fieldbus era.

4. 6 CNC Systems Strive to Use High-Performance Microcomputers

In order to improve the integration capabilities of CNC systems, Various CNC systems Manufacturers strive to adopt common High performance microcomputer system. so, Ready-made universal microcomputer network technology can be widely used. like Fanuc In the original CNC device of each gear on the basis of MM C (MAN Machine Controller), Group Made by CNC, PMC and MMC Composed of three control function modules The new trinity CNC system.

in addition, Various CNC system manufacturers use a large number of distributed control technologies; adopt open, modular, multi-processor structures, and use virtual machines to As a public data area, To achieve communication between modules; in CNC Tie The system began to add MAP interface; Use neutrality in information exchange Language description. For example, the United States recently allocated US\$ 100 million joint research plan Draw The Next Generation Work -station/ Machine Con- t roller Architecture Program, Functions of the machine tool controller One of the requirements is that information is exchanged in neutral language NML (Neu - tral Manufacturing Language) describe. These measures are big Greatly improved DNC System integration capabilities.

In short, DNC integration technology is moving toward high flexibility, intelligence, and high Develop in the direction of efficiency and easy integration, DNC The functions of the integrated system are also provided by Pure communication is tilted towards production management. As you can imagine, a set the new kind of DNC The integrated system will fully cover both information integration and FM S function, It can also avoid heavy investment in material flow automation. investment risks. Predictably, the DNC integrated technology research and DNC

The development of platform products is of great significance to our country's CIMS push Wide application will play an important role.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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