

Application of automation technology in mechanical design and manufacturing

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Abstract: In the context of intelligent manufacturing, big data, cloud computing and artificial intelligence technologies are widely used in the manufacturing field, enabling the transformation and development of mechanical design and manufacturing enterprises, and the advantages of automation technology are increasingly prominent. In the field of mechanical design and manufacturing, based on microcomputer, computer control technology and specific program instructions, automation technology can replace a large number of manual operations to realize the automation of mechanical production, which can not only reduce the errors caused by manual operations, ensure the continuity and safety of production, but also reduce the consumption of human resources and reduce the labor intensity. Based on this, this paper focuses on the needs of the transformation and development of the mechanical design and manufacturing industry, expounds the application advantages of automation technology from four aspects of production efficiency, safety performance, pollution emissions and management function, and discusses the specific application of automation technology in mechanical design and manufacturing, so as to promote the development of the mechanical manufacturing industry in the direction of intelligence.

Key words: Mechanical design and manufacturing; Automation technology; application

Introduction

Under the strategic background of building a manufacturing power, how to transform cutting-edge scientific and technological achievements and promote the development of intelligent manufacturing industry has become an important issue in the innovation and development of enterprises. Automation technology radiates many disciplines and fields, has a strong comprehensiveness, and integrates the advantages of microcomputer and computer technology. From the perspective of composition structure, mechanical automation technology includes main control operation system, information processing system, command system, sensor system and transmission system. The main control operating system contains the core program and coding, and is responsible for analyzing data according to the program and carrying out automatic operation; The information processing system collects information uniformly and transmits instructions to the next system; The instruction system mainly supports system operation and issues instructions; The sensing system is responsible for signal receiving and sending, with automatic signal receiving function; The transmission system is responsible for secondary transmission of information to ensure the reliability of information transmission. With the support of the five information systems, machinery manufacturing enterprises can give full play to the advantages of automation technology, combined with specific production, manufacturing, processing, testing and other steps, improve the production efficiency of machinery manufacturing, reduce the error probability of engineers, improve the operation efficiency of production and processing lines, and reduce the pressure of manual management and operation.

1. Application significance of automation technology in mechanical design and manufacturing

1.1 Improve production efficiency

In the field of mechanical design and manufacturing, through the application and promotion of automation technology, enterprises can configure high-level automatic processing system, improve the production level and quality, so as to improve the economic benefits of mechanical design and manufacturing. With the support of automation technology, enterprises can liberate a large number of manual labor, use automation technology system to replace some manual operations, efficiently complete product design and manufacturing, and reduce product production time. At the same time, with the help of automation technology, machinery manufacturing enterprises can avoid some manual factors and better control product quality. In the production of mechanical and electrical equipment, the mechanical structure of some equipment has strong tightness. Engineering and technical personnel need to have high-level operating skills to process the internal parts and components of the structure according to high precision. If the production precision cannot be accurately controlled, it will lead to problems in the subsequent assembly of parts, which is difficult to meet the production and ex factory requirements. In addition, in the process of traditional mechanical design and manufacturing, each link has generated detailed working standards and requirements, and there are many operation steps, so it is difficult to completely avoid errors. Through the application of automation technology, enterprises can use computer control technology to automatically manage all production links and make up for the shortcomings of traditional manufacturing. It can not only reduce the investment of labor capital, but also improve the production accuracy and ensure the production efficiency.

1.2 Improve safety performance

Safety is an important issue in the field of mechanical design and manufacturing, which is mainly reflected in the personal safety of operators and the quality safety of mechanical products and equipment. In the process of traditional mechanical design and manufacturing, a large number of people are on the production line, linked and coordinated at all levels, which brings certain challenges to the safety management. Once there is an operational error in a certain link, it will lead to different degrees of problems in the production line, threatening the life safety of operators and product quality and safety. Through the introduction of automation technology, enterprises

can use computer systems and equipment to replace labor according to the needs of different production links, so that some workers can be separated from the environment in direct contact with equipment and protect their personal safety. At the same time, in the process of automatic production, the machinery operates according to the established instructions, which greatly reduces the error, avoids the problem of manual operation errors, and completes the independent detection task according to the module instructions at regular intervals, so as to discover and troubleshoot the faults in time and reduce the losses of the enterprise.

1.3 Reduce pollution emissions

Mechanical design and manufacturing will produce a series of wastes. Through the application of automation technology, enterprises can improve the use efficiency of raw materials and improve the environmental benefits of mechanical design and manufacturing. First, reduce waste of raw materials. In the process of mechanical automation production, the computer program can accurately calculate the required consumables, reasonably allocate the consumption of raw materials, reduce unnecessary material waste, and improve the product qualification rate. Second, reduce labor waste. Through the application of automation technology, enterprises can increase the number of automatic processing equipment, avoid a large number of labor concentrated on the production line, reduce the waste of human resources, and conform to the concept of sustainable development. In addition, reduce the discharge of waste materials. Compared with the traditional mechanical design and production, with the support of automation technology, enterprises can better control the cost of pollution, promote energy conservation and emission reduction, and promote the green development of machinery manufacturing industry.

1.4 Improve management functions

In the traditional mechanical design and manufacturing environment, enterprises rely heavily on labor. It is difficult to improve the production mode by adopting a single production mode, which requires a lot of time and energy to optimize the production process, resulting in the failure to complete the production task normally. Through the application of automation technology, enterprises can use new equipment, use limited time, control plant equipment, quickly introduce and increase production modules, easily upgrade the manufacturing system, and improve management functions.

2. Application of automation technology in mechanical design and manufacturing

2.1 Application in equipment design system

Mechanical design is the premise of mechanical manufacturing and processing. At present, there are many advanced design software in the mechanical field. Professional engineers construct the equipment model from the three-dimensional level with the help of CAD software. At the application level of subsequent drawings, professional engineers will hand over the drawings to operators, who will carry out equipment manufacturing and processing tasks according to the drawings, which will inevitably lead to some errors in the docking process. Through the application of automation technology, enterprise personnel can play the role of computer system, connect production equipment and design software, use front-line components and equipment, intelligently generate drawings and data, and present feasible design results. In this process, engineers and enterprises can eliminate factors affecting design and production, and improve design accuracy and production efficiency.

2.2 Integrated application in mechanical manufacturing

Different from the single technology operation mode, the integrated system accommodates a variety of advanced technologies, adopts the overall operation rules, and gives full play to the production and manufacturing functions of each part. Based on the theory of system engineering, through the use of automation technology, enterprises can make the integrated system have the functions of simplifying the mechanism and optimizing the manufacturing process, so as to achieve the purpose of integrated automatic processing. Based on the support of automation technology, machinery manufacturing enterprises can follow the principle of linear sequencing, integrate various production lines and production processes, configure different computer subsystems according to production requirements, combine various production links with automation technology, clarify the division of labor of each subsystem, and improve production quality. In the process of modern mechanical manufacturing, dynamic integration technology plays an important role. Enterprises can combine modern processing with NC management to comprehensively analyze the manufacturing and production dynamics.

2.3 Application in processing and assembly

When designing and manufacturing mechanical products, enterprises need to spend a lot of human resources to load, unload, process and assemble some engineering parts. Using automation technology and with the help of automatic or semi-automatic equipment, enterprises can save a batch of human resources and efficiently complete the removal and processing of parts. Especially for special parts, in the traditional manufacturing process, enterprises need to arrange a large number of enterprise operators to carefully polish products according to high-precision standards. In the process of modern machining and production, operators can use automatic processing equipment to realize batch production under the condition of ensuring the processing accuracy. A mechanical product is composed of multiple parts. In the process of mechanical manufacturing, enterprises can use automation technology to carry out assembly operations to improve the efficiency and quality of product assembly. In the common assembly production line, the computer system of the enterprise supports automatic transmission and assembly. With the help of automation technology, it gives instructions to the mechanical equipment, transmits the parts of the specified type of mechanical equipment to the corresponding assembly area, and completes the automatic assembly according to the steps of cleaning, classification, screening, loading, connecting and testing. Based on the assembly automation technology, enterprises can not only control the adverse factors caused by manual operation, reduce the production cost, but also improve the quality and speed of product assembly.

2.4 Application in mechanical product inspection

With the improvement of the processing standards of modern mechanical products, the requirements of the machinery manufacturing industry continue to improve, and the types of high-precision products that need to be processed are increasingly diversified. At the same time, the number of parts of some mechanical equipment increases, which brings some difficulties to the detection of mechanical products. The traditional manual detection method is inefficient and difficult to meet the detection requirements. In this regard, in order to enhance the accuracy of products, enterprises can use automation technology to establish an automated detection system for complex mechanical products, accurately detect the indicators of products, so as to ensure the quality of mechanical products.

2.5 Flexible application of automation technology

In mechanical design and manufacturing, enterprises can comprehensively use mechanical manufacturing technology and automation technology to enhance the relevance of various production links, upgrade the mechanical production process, improve the production mode and realize flexible production. At present, some enterprises have established flexible production lines, using electronic gears and cams to replace mechanical parts and connect each shaft in a flexible way. In order to enhance the linkage between production lines, technicians can establish the coupling relationship between equipment in each process section on the production line by using interlocking control and servo control technology. Based on the high-precision independent PLC servo controller, managers can control different production lines and process sections, and with the help of the integrated control system, transfer the production data information at any time to ensure the interactivity of information transmission between control systems, so as to understand the latest product production situation and improve the level of flexible management. If technicians only use mechanical parts, it is difficult to ensure the smoothness of information, so they should use automation technology to quickly debug production specifications, restore normal production, and ensure the continuity of mechanical manufacturing and processing.

2.6 Intelligent application of automation technology

In the context of intelligent manufacturing, enterprises should strengthen the research of automation technology, introduce a series of intelligent production equipment, such as industrial robots, CNC machine tools, on-site completion sensors, AGV intelligent logistics equipment, and build the Internet of things system covering the mechanical production line to realize the automatic control of mechanical manufacturing. Based on the above equipment conditions, mechanical design and manufacturing enterprises can specially design NC system modules according to the type of product processing, build multi module interconnected group control system, and analyze the production demand in an automated and intelligent way, so as to make reasonable production decisions. For example, enterprises can use adaptive technology to automatically identify the changes of various parameters, obtain feedforward control data and motor parameters in the way of adaptive operation, and complete automatic programming according to the control and adjustment requirements of production equipment. At the same time, based on automation technology, the control system can collect, analyze and process the data of multiple subsystems, and then according to the image and data results, the personnel can generate a manufacturing scheme that meets the needs of customers. Coupled with the Internet of things technology, enterprises can establish links between different device terminals, monitor product design and manufacturing at any time, and form an unmanned manufacturing process.

3. Concluding remarks

Advanced science and technology is the primary productive force that drives social development. Strengthening the application of automation technology in the field of mechanical design and manufacturing is related to the level of mechanical equipment manufacturing and the development of Intelligent Manufacturing in China. Therefore, relevant technical personnel and enterprises should follow the development trend of modern computers, combine the development needs of intelligent manufacturing, vigorously develop, apply and promote automation technology, input mechanical product drawings and product quality standards into the automatic control system, and promote the development of intelligent and green mechanical design and manufacturing.

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