

Application and practice of simulation 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 simulation technology are increasingly prominent. In the field of mechanical design and manufacturing, based on microcomputer, computer control technology and specific program instructions, simulation technology can replace a large number of manual operations to realize the automation of mechanical production, which can not only reduce the error caused by manual operation, 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 transformation and development needs of the mechanical design and manufacturing industry, expounds the application advantages of simulation technology from three aspects of production efficiency, safety performance and pollution emissions, and discusses the specific application of simulation technology in mechanical design and manufacturing, in order to promote the development of mechanical design and manufacturing in the direction of intelligence.

Key words: mechanical design and manufacturing; Digitalization; Intelligent development; Effective strategy

Science and technology is the primary productive force. In essence, the development of mechanical design and manufacturing towards intelligent and digital direction is closely related to the overall development level of China's mechanical design and manufacturing industry. Advanced technology plays a positive role in promoting the development of China's mechanical design and manufacturing industry, and vice versa. Starting from the current situation of mechanical design and manufacturing, it has gradually changed from traditional labor-intensive to highly intelligent operation. The labor cost related to the industry has been continuously reduced. The era of digital and intelligent mechanical design and manufacturing has come. In the future, there will be more advanced and precise intelligent and digital technologies that may be applied to all aspects of mechanical design and manufacturing. Therefore, this paper has important practical significance for the application of simulation technology in mechanical design and manufacturing.

1. Current development status of mechanical design and manufacturing industry

The main business direction of mechanical design and manufacturing enterprises is to provide industrial equipment to enterprises around the world and support enterprises to operate industrial equipment. In turn, the enterprises themselves can continuously optimize their business. The business scope of mechanical design and manufacturing enterprises is relatively wide, involving energy, automobile, consumer goods, medical and health care, transportation and other industries. At present, the market in China and even the world is dominated by B2B mode. The competition among enterprises is extremely fierce. Enterprises in the leading position cannot relax for a moment. They must create and innovate on the original basis in time. Only in this way can they not be eliminated. Similar to many industries, mechanical design and manufacturing enterprises have multiple vertical departments, such as R & D, sales, marketing, service, etc. usually, each department basically fights alone. However, there are many smart enterprises who are good at flexible application of advanced technologies and give full play to the advantages of big data to monitor, analyze and integrate the data of the whole supply chain in real time. Mechanical design and manufacturing has a long history in China. After entering the 21st century, with the continuous improvement of the intelligent and digital degree of mechanical design and manufacturing, mechanical design and manufacturing enterprises must firmly grasp the opportunity, vigorously promote technological change, and be good at relying on powerful data storage and transmission technology to achieve the purpose of prediction and analysis and make correct decisions.

2. Application value of simulation technology in mechanical design and manufacturing

2.1 Conducive to improving production efficiency

In the field of mechanical design and manufacturing, through the application and promotion of simulation 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 simulation technology, enterprises can liberate a large number of manual labor, use simulation 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 simulation technology, mechanical design and manufacturing enterprises can avoid some artificial 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 accuracy. If the production accuracy cannot be accurately controlled, it will lead to problems in the subsequent assembly of parts, which is difficult to meet the production and demobilization 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 simulation 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.

2.2 Conducive to improving 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. By introducing simulation 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, so as to discover and troubleshoot the faults in time and reduce the losses of the enterprise.

2.3 Conducive to reducing pollution emissions

Mechanical design and manufacturing will produce a series of wastes. Through the application of simulation 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 simulation 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 traditional mechanical design and manufacturing, with the support of simulation technology, enterprises can better control the cost of pollution, promote energy conservation and emission reduction, and promote the green development of mechanical design and manufacturing.

3. Application direction of simulation technology in mechanical design and manufacturing

3.1 Flexible application

In mechanical design and manufacturing, enterprises can comprehensively use mechanical design and manufacturing technology and simulation 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 components, 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. Therefore, simulation technology should be used to quickly debug production specifications, restore normal production, and ensure the continuity of mechanical design, manufacturing and processing.

3.2 Intelligent application

In the context of intelligent manufacturing, enterprises should strengthen the research of simulation 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 design and 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 a 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 simulation 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 equipment terminals, monitor product design and manufacturing at any time, and form an unmanned manufacturing process.

4. Application path of simulation technology in mechanical design and manufacturing

4.1 Application in equipment design system

Mechanical design is the premise of mechanical design, 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 in accordance with the drawings, which will inevitably lead to some errors in the docking process. Through the application of simulation 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.

4.2 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. By using simulation 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 design and manufacturing, enterprises can use simulation 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 simulation 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 assembly simulation technology, enterprises can not only control the adverse factors caused by manual operation, reduce product production costs, but also improve product assembly quality and speed.

4.3 Application in mechanical product inspection

With the improvement of modern mechanical product processing standards, the requirements of the mechanical design and 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 toad tablets, enterprises can use simulation 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.

Epilogue

To sum up, under the background of rapid development of the times and increasingly significant economic growth trend, the integration of mechanical design and manufacturing with intelligent and digital technology has become an inevitable trend of industry development. On the one hand, the introduction of simulation technology into mechanical design and manufacturing can further optimize the traditional production process and improve product quality and production efficiency. On the other hand, it can promote the integration of mechanical design and manufacturing with advanced technology and bring considerable development prospects. However, it is important to pay special attention to some key factors in the process of introducing new technologies and processes, so as to promote the mechanical design and manufacturing to be more accurate and integrated, and ultimately improve the overall competitiveness of the industry.

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