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Research on the Application of Computer Technology in the Design, Manufacture and Automation of Machinery

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Abstract. Mechanical design and manufacturing and its automation is to solve and deal with a series of complex technical problems in the field of modern engineering by exploring the process from the initial design to the final production of a variety of industrial mechanical equipment and mechanical and electrical products, and to realize the intellectualization of products. For a long time, mechanical design and manufacture and its automation have been a hot topic in China's industrial field. With the development of computer technology, mechanical design, manufacture and automation are developing in the process of combining with computer technology. The purpose of this paper is to study the application of computer technology in mechanical design and manufacture and its automation.

Keywords: Computer Technology, Design, Manufacture and Automation, CAD/CAM

1. Introduction

Automation refers to the process of machine equipment, system or process (production, management process) without the direct participation of people or less, according to the requirements of people, through automatic detection, information processing, analysis, judgment, manipulation and control, to achieve the expected goal. Automation technology is widely used in industry, agriculture, military, scientific research, transportation, commerce, medical treatment, service and family^[1-2]. The adoption of automation technology can not only liberate people from heavy physical labor, part of mental labor and harsh and dangerous working environment, but also expand the function of human organs, greatly improve labor productivity, enhance the ability of human beings to understand and transform the world^[3-4]. Therefore, automation is an important condition and significant symbol for the modernization of industry, agriculture, national defense and science and technology. The concept of automation is a dynamic development process. In the past, people's understanding of automation, or the functional goal of automation, was to replace human operation with mechanical action and automatically complete specific tasks. This is essentially the point of view that automation replaces man's manual labor. Later,



with the development of electronic and information technology, especially with the emergence and wide application of computers, the concept of automation has been expanded to use machines (including computers) not only to replace human physical labor, but also to replace or assist mental labor, so as to automatically complete specific work^[5-6]. The general connotation of automation includes at least the following points: in terms of form, manufacturing automation has three meanings: replacing human's physical labor, replacing or assisting human's mental labor, coordinating, managing, controlling and optimizing man-machine and the whole system in manufacturing system. In the aspect of function, it is only a part of the goal system of automation function to replace human's physical or mental labor. The function goal of automation is various and has formed an organic system. In terms of scope, manufacturing automation involves not only the specific manufacturing process, but also all processes of product life cycle.

2. Promotion of CAD system to automatic design

CAD computer aided design was the first computer drawing system in the United States in the 1950s, and passive computer aided design technology with simple drawing output function began to appear. In the early 1960s, the surface technology of CAD appeared, and the commercialized computer drawing equipment was introduced in the middle. In the 1970s, a complete CAD system began to take shape. In the later period, there appeared raster scan display which can produce realistic graphics, and many kinds of graphic input devices such as manual cursors and graphic input boards were introduced, which promoted the development of CAD technology. As Figure 1.

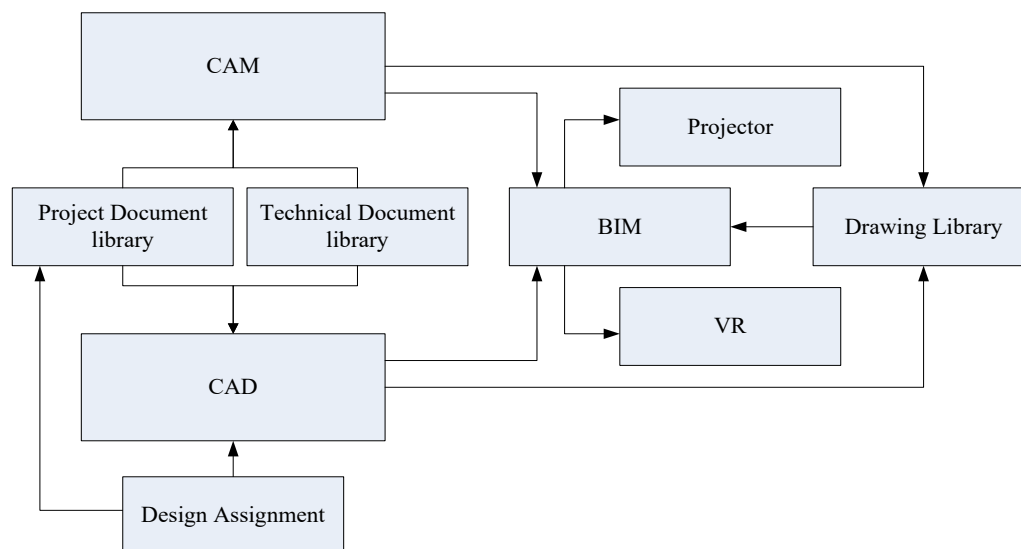


Figure 1. CAD + CAM work flow

In the 1980s, with the emergence of microprocessors and memory devices made of powerful VLSI, engineering workstations came out, and CAD technology was gradually popularized in small and medium-sized enterprises. Since the mid-1980s, CAD technology has developed towards standardization, integration and intelligence. Some standard graphic interface software and graphic functions have been launched one after another, which has played an important role in promoting the popularization of CAD technology, transplanting software and data sharing; the system structure has changed from a single function in the past to a comprehensive function, resulting in a computer-aided

design and manufacturing integrated manufacturing system; curing technology, network technology, multiprocessor and parallel processing The application of science and technology in CAD has greatly improved the performance of CAD system; the introduction of artificial intelligence and expert system technology into CAD has led to the emergence of intelligent CAD technology, which greatly enhanced the problem-solving ability of CAD system and made the design process more automatic.

CAD has been widely used in architecture design, electronics and electrical, scientific research, mechanical design, software development, robotics, clothing industry, publishing industry, factory automation, civil construction, geology, computer art and other fields.

3. Promotion of cam system to automatic production

In addition to the narrow definition of cam, the international organization for computer aided manufacturing (CAM-I) has a broad definition of computer-aided manufacturing: "through the direct or indirect interface between computers and the material resources or human resources of enterprises, computer technology is effectively applied to the management, control and processing operations of enterprises." According to this definition, computer-aided manufacturing includes three parts: enterprise production information management, computer-aided design (CAD), computer-aided production and manufacturing. Computer-aided production and manufacturing include continuous production process control and discrete parts automatic manufacturing. This kind of generalized computer-aided manufacturing system is also called integrated manufacturing system (IMS). Using computer-aided manufacturing of parts and components can improve the adaptability to product design and variety change, improve processing speed and production automation level, shorten processing preparation time, reduce production cost, and improve product quality and productivity of mass production.

In the CAD / CAM system, people use computers to complete product structure description, engineering information expression, engineering information transmission and transformation, information management and other work. Therefore, CAD / CAM system should have the following basic functions:

1) How to use the data (information) that can be recognized by computer to express and describe the product. For example, the description of product shape and structure, the description of product processing characteristics, how to describe the mesh and boundary conditions required by finite element analysis, etc.

2) Graphics and image processing in CAD / CAM system, graphics and images are still the main expression form of product shape and structure. Therefore, how to express graphics in computer, how to transform graphics, how to edit, how to eliminate hidden and how to deal with illumination are the basic functions of CAD / CAM.

3) Information storage and management design and manufacturing process will produce a large number of data, such as design analysis data, process data, manufacturing data, management data, etc. Data types include graphics, text, digital, sound, video, etc.; structured and unstructured data; dynamic and static data, etc. How to store and manage a lot of electronic information generated by CAD / CAM system is a necessary function of CAD / CAM.

4) Engineering analysis and optimization calculation volume, center of gravity, moment of inertia,

etc., mechanism motion calculation, dynamics calculation, numerical calculation, optimization design, etc.

5) Engineering information transmission and exchange includes information exchange between CAD / CAM system and other systems, and information exchange between different functional modules in the same CAD / CAM system.

6) In order to check the performance of products, simulation and simulation often need to carry out various tests and tests on products, special equipment and production samples, which are destructive, time-consuming and costly. This problem can be solved by establishing the digital model of products or systems and adopting computer simulation technology. For example, machining path simulation, mechanism motion simulation, collision and interference inspection of workpiece, cutter and machine tool, etc.

7) The data input of human-computer interaction, the choice of route and scheme, etc., all need the dialogue between human and computer. The way of human-computer interaction includes software interface and equipment (keyboard, mouse, etc.)

8) The input and output of information are man-machine interactive input and output and automatic input and output.

4. Summary

In computer aided design, interaction technology is essential. Interactive CAD system means that when users use computer system to design, people and machines can exchange information in time. With the interactive system, people can conceive, proofread and modify at the same time, and can see the display results of each operation from the graphic terminal screen at any time, which is very intuitive. CAD / CAM system consists of hardware and software system. Hardware system refers to touchable physical equipment, such as host equipment, terminal equipment, network and communication equipment, input and output equipment, CNC processing and control equipment, etc. Software system usually refers to the sum of programs and related documents. Software system is generally divided into system software, support software and application software.

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