

# Digital Design Characteristics and Technological Progress of Mechanical Products

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**Abstract:** With the progress of science and technology and the improvement of social and economic level, people put forward higher requirements on the quality and performance of mechanical products, which requires us to continuously improve the digital technology in the design process. Digital technology has been widely used in mechanical products, and its main feature is real-time analysis, calculation and simulation of parts by computer. This paper starts from the theoretical analysis to elaborate the current development status and trend of mechanical products; at the same time, this paper discusses its future development direction and problems and gives corresponding solutions with the practical application, through the above parts all provide reference and reference meaning for the future work in related fields.

**Keywords:** Mechanical Products; Digitalization; CAD Technology

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## 1. Introduction

Digital design is a computer-based product development process whose main purpose is to achieve effective integration of manufacturing information, including data processing capabilities, storage capacity and management and other information resources. As the process of social informationization continues to accelerate and people's living standards increasingly improve, based on the application of this technology in mechanical products need to take into account the following aspects: (1) Designers must have certain professional knowledge and skills to complete the digital design work; (2) The designer should conduct market research according to the user's needs and develop a corresponding plan with the actual situation, taking into account the changes in market demand in the design, so as to constantly adjust the product structure and improve production efficiency; (3) Designers need to analyze and study the feedback from users and develop corresponding plans to improve the problems in the work<sup>[1]</sup>.

## 2.The Meaning of Digital Design of Machinery

Digital design refers to the use of computer information processing technology, network communication technology and intelligent control and other advanced means of the overall structure of the product and data acquisition, and will be converted into readable output form, so that the product from the hardware equipment to achieve digital. In the actual production process applied to the CCD (electronic

screen), light intensity sensor (display) and image recognition software. Digital design is one of the methods and steps of information processing using computers. The advantages of digital design are the visibility, reliability and interactivity of the product structure, as well as its real-time control, thus increasing the efficiency<sup>[2]</sup>.

In the current social development needs, digital design technology is also gradually applied, and the main reason for this is that there is a large amount of data, information and other basic information in the production process of mechanical products. Therefore, this information must be processed and analyzed. One of the most critical is to combine digital design with traditional computer simulation systems to achieve the coordination between various functional modules required in the virtual reality environment. Secondly, through the use of relevant software to complete the actual work of machinery manufacturing enterprises in the application of all the technical parameters, so as to achieve the overall effect of the design, and then realize the production process of mechanical products, data information, parameters and other comprehensive and integrated management<sup>[3]</sup>.

### **3. History of Digital Design**

#### **3.1 Development of 2D CAD Technology**

2D CAD technology is computer-based and uses digital software to simulate human-machine interaction, further processing and analysis of data and graphic information by computer. In this process a mutual constraint relationship needs to be established between man and machine and machinery. (1) Design method in 3D virtual environment: A large number of real measurement tools are used in the product manufacturing stage to realize the modeling. When the actual production can not be directly applied to the two-dimensional model due to the accuracy of the equipment, the computer can be used to model and simulate it, so as to get more accurate results. (2) Two-dimensional drawing function and three-dimensional model combination method: the plane geometric information into three-dimensional graphics, and then through the virtual assembly to achieve the plane structure and spatial relationship simulation; the use of digital software to establish a parts library and data processing; use graphics tools to import the parts model into the computer, so as to generate product drawings. (For example, the various parameters such as dimensions shown in the CAD drawing are adjustable and can be optimized or modified. The 3D virtual simulation system design method has the following advantages over traditional CAD technology: In the product manufacturing stage, the real environment can be directly simulated using the computer, thus obtaining more accurate model information<sup>[4]</sup>.

#### **3.2 Surface Modeling Technology and Three-dimensional CAD System Development**

The design of modern industrial products relies more and more on three-dimensional modeling technology, especially in mechanical products, where surface modeling and geometric analysis are more widely used for research. In the computer application, surface modeling technology is a new three-dimensional design software, which can convert the product from two-dimensional space to three-dimensional space, and can carry out simulation, calculation and simulation. At present, many

domestic enterprises have started to use this advanced method to achieve digital production. However, its cost is high and cannot be promoted on a large scale. With the continuous improvement and development of technology and national policies, the market demand has increased and product quality requirements have become more and more stringent, so surface modeling technology has been rapidly improved and many surface modeling design methods have emerged. For example, virtual prototyping, prototype simulation and geometry-based modeling. In this paper, we analyze and study mechanical products as an example [5].

### **3.3 Solid Modeling Technology and Three-dimensional CAD System Development**

In mechanical product design, the application of 3D CAD system can simplify its function and make the whole structure more rational and three-dimensional. First, the part modeling process: the required materials and related technical parameters, etc. are drawn out in the form of 2D graphics according to the part diagram and process requirements, and then 3D software is used to establish the solid modeling and virtual modeling process. Second, the parts processing and manufacturing stage: (1) pre-assembly preparation: mainly including positioning datum selection, determine the clamping scheme and optimization of the assembly gap; in the assembly body, first determine the processing datum of the parts, and then in the assembly process to analyze the positioning error; the last is to complete the parts structure diagram and each component process design. (2) Post-assembly work: mainly includes the study of each component, modular structural parts and process parameters<sup>[6]</sup>.

### **3.4 Parametric Technology and Three-dimensional CAD System Development**

With the rapid development of computer technology, CAD system has also entered a brand new stage. In this field, digital design methods have become a current research hotspot. A series of software such as three-dimensional drawing, data analysis and processing, and virtual assembly have been widely used. (1) 3D parameterization is the process of geometric modeling and physical entity modeling based on product structural features and using them to optimize the design of the model; (2) Computer technology is applied to the traditional CAD system, so that the information interaction between the product structure and functional modules is realized, and the integrated design of product structure and function is realized; (3) Virtual assembly technology is based on CAD system software for solid modeling of parts and the use of 3D drafting tools to convert 2D planes into 3D three-dimensional models.

### **3.5 Development of Variable Technology and 3D CAD Systems**

At present, many research institutions and enterprises at home and abroad have begun to explore the development of variable technology and three-dimensional CAD system, the main purpose of which is to solve a series of problems such as data inaccuracy in the product design process. As a tool, 3D modeling software can realize the direct conversion between the product model and the assembly drawing, which also provides designers with a more convenient and fast solution, and also enables designers to use existing conditions to complete the analysis and modification of the required parts, thereby improving production efficiency, reducing costs and increasing revenue; Through the analysis and processing of data, we can

provide corresponding solutions to the problems encountered in the product design process, and improve the communication efficiency between designers and manufacturers<sup>[7]</sup>.

#### **4. Digital Design Technology Development Trend**

The development trend of digital design technology is mainly reflected in the following aspects: (1) computer-aided production systems will gradually replace the traditional mechanical product manufacturing methods, so that intelligent machines become the mainstream, and gradually towards automation, network development, which can not only improve efficiency and reliability; can also reduce costs. With modern industrial information technology and electronic information processing methods continue to mature as well as the application of the popularity of factors such as deepening the digital design technology in all walks of life to be widely used and promoted. (2) Based on computer-aided production systems will gradually replace the traditional mechanical manufacturing methods, making the production process of mechanical products more intelligent and efficient. Through the application of computer-aided design technology in industrial automation, this can improve efficiency and reliability, and reduce costs<sup>[8]</sup>.

#### **5. Conclusion**

Digital design is a comprehensive and multi-faceted technology, and its development will be more rapid as the times and the level of technology continue to progress. At present, China has some initial applications in intelligent manufacturing, but it is still in the primary stage. Therefore, we should further strengthen the research and exploration of computer networks and communications and other related fields of knowledge, and actively apply them to the production of products. At the same time, we also need to focus on a series of issues such as improving information transmission and processing capabilities and the degree of integration of design development and innovation, so as to achieve the goal of digital technology toward automation and multi-functional development.

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