Application Research of Mechanical Mold Design Based on Computer Aided Technology

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Abstract. There are many kinds of industrial products. Different industrial products play different roles in life. There is no doubt that they are indispensable in our life. We found that most of the production of industrial products rely on the mold industry[1]. Mold industry is also the foundation of mechanical design industry. However, the traditional mold design concept is very old. Moreover, the disadvantages of traditional mold design are also many. Based on this, the experts put forward the mechanical mold design supported by computer-aided technology. This paper presents the main application of computer aided technology in die design.

Keywords: Computer, Auxiliary Technology, Machinery, Mold Design, Application

1. Introduction
Today's society needs a large number of applied talents. The gathering of talents is bound to increase the competitive pressure of social employment. In the period of traditional industry, the production speed of many industrial products is very slow. This leads to the reduction of social productivity in China[2]. With the continuous progress of mechanical technology, China has introduced the concept of mold design. With the help of mould, we can also improve the production quality and benefit of industrial products. Now, we can also find a special way of product development through mold design. Therefore, mold is also known as the mother of China's modern industry.

As the basic equipment for the production of industrial products, mold manufacturing is also relatively difficult. Therefore, the precision of mold design is also very high. The shape of the mold will also determine the appearance of the product. Mold processing quality will also greatly affect the production quality of products (see Figure 1). With the increasing demand of social productivity in our country, many experts found the problems of traditional mold design. Therefore, the application of mold design based on computer aided technology has been developed. Based on this, this paper briefly describes the mold industry related design theory. Finally, this paper describes the application of computer-aided technology in mold design.

2. Analysis of the main problems in the process of traditional mold design

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2.1. Complex process content
The quality of products with low precision can not be guaranteed. Moreover, low quality products can not improve people's living standards. Therefore, we must improve the product design accuracy in time. This needs to improve the accuracy of mold design. However, the process of high-precision mold design is very complex. This will lead to a rapid decline in the overall efficiency of mold design.

2.2. There are many manual parts
Due to the limitation of the technology at that time, the traditional part of the mold design can not be completed by mechanical equipment. There are many things about manual processing. A lot of manual participation makes the problems in the process of mold design more complex. First of all, factories have to consider higher labor costs. Moreover, the factory must consider the technical level of workers. There is also a shortage of high-level talents.

![Computer aided two dimensional drawing design of mould](image)

**Figure 1.** Computer aided two dimensional drawing design of mould

2.3. High cost of repeated design
No engineer can guarantee that his first mold design can be applied to industrial production. After each design, we need to take the experimental way to verify the practicability of the mold[3]. However, the traditional design of the first mold must produce the real object to complete the experiment. Repeated modification will inevitably waste the material and cost of production experiment model. The problem of funds is difficult to adjust.

2.4. Unable to achieve mass production
According to the above description, we know that the content of mold processing is very complicated. This leads to a longer cycle of mold design. This also leads to the reduction of the efficiency of mold manufacturing. We know that the application of each mold has years. However, population growth needs to be supported by more industrial products. This requires a large number of mold supply. Traditional mold design can not meet the needs of mass production.
3. Analysis of the main characteristics of the mold design supported by computer aided technology

3.1. The design process depends entirely on the computer
The basic task of mold design is to write instructions. It also needs to draw corresponding drawings. The design of various processes also needs manual participation. Today's rapid development of the computer industry makes the efficiency of China's machinery industry is also booming. Today's mold design of various processes can completely rely on computer equipment. An engineer can even complete all the mold design tasks.

3.2. The production mode of suitable mould can be selected
In the early stage of designing the product, we need the design specification of the product. The contents of the manual include the mode of production of industrial products[4]. This includes small quantity production, medium quantity production and batch production. We can use computer-aided analysis technology to select the appropriate mold production method. For example, in the premise of mass production the first mock exam of four cavity mold can be chosen.

Table 1. Analysis of the method of computer aided die design

| Design methods           | Features                  | Frequency of use |
|--------------------------|---------------------------|------------------|
| Modular design           | Functional substitutability | 82.14%           |
| Complete parameter design| Personalized design        | 53.99%           |
| Standardized design      | National standard parts    | 93.47%           |

Figure 2. Investigation on application frequency of CAD method

3.3. Avoid the operation of solid mold test
In the field of industrial design, the 3D model design software of computer can replace the solid design of mold design[5]. We know that the manufacturing of solid model will waste a lot of cost. In the process of artificial mold design, the factory must test, adjust and repair the mold. Fortunately, the emergence of today's computer-aided technology will be able to use the advanced means of dynamic trial of 3D model.

3.4. Emergence of ultra precision design technology
In the process of traditional mold design, the control of precision needs many years of design
experience of engineers. However, the accuracy of human eye recognition can only be maintained in the millimeter range. Millimeter precision products are difficult to be recognized in our life. Nowadays, the mold design supported by computer aided technology can realize the dream of manufacturing ultra precision. Its accuracy of recognition can be guaranteed at the nanometer level.

4. Application method of mechanical mold design based on computer aided technology

4.1. Modular design
In life, we may find that many products have many similar characteristics. Some products even have similar functions[6]. Some products with similar functions can replace each other. Through the specific similarity of modular analysis skills, we can effectively reduce the cycle of mold design. This design method is called computer modular design method (see Table 1 and Figure 2).

4.2. Complete parametric design
Using the computer drawing software, we can constrain the different sizes of parts. We can also adjust its external shape and some special parameter variables. Complete parametric design can be called personalized design. After understanding the specific application functions of products, engineers can design products of different sizes or shapes according to the needs of customers. This can change the fixed characteristics of the product.

4.3. Standardized scheme design
Standardized design is the most common in the process of mold design. In our computer, many drawing software will save the standardized mold design[7]. If an engineer wants to design a standardized mold, he doesn't need to adjust the dynamic parameters himself. The computer can directly call the standardized mold design plan in the database. This greatly shortens the cycle of mold design.

5. Software application of mechanical mold design based on computer aided technology

5.1. Application of 2D mapping software
Generally speaking, the process of mechanical design is more complex. Engineers must learn to design plane drawings. The final engineering manufacturing instructions must be accompanied by drawings. In this process, the computer's two-dimensional mapping software plays an important role. Generally speaking, many engineers usually use Auto CAD software and CATIA software. The operation of these two kinds of software is relatively smooth.

5.2. Application of 3D mapping software
Traditional mold design must ensure the shape of solid model and some fixed parameters[8]. With the help of computer aided technology, 3D drawing software can make solid model in virtual space. According to the virtual model of different perspective transformation, engineers can more easily modify the mold parameters. Generally speaking, the software that people like to use includes UG NX10 software and SolidWorks software.

5.3. Application of mold flow analysis software
Die flow analysis is a very important step in manufacturing high precision die. We have to make sure that the flow of the material is balanced. This requires the computer to determine the most suitable position of the die runner port. It is worth noting that the mold flow analysis can also greatly determine the final production quality of products. Generally speaking, people often use Creo software and Moldflow software for mold flow analysis.

6. The specific requirements of mechanical mold design and application based on computer aided technology
6.1. Guarantee of mold parameters
In the preparation stage of mold design, engineers must have a complete communication with customers[9]. Engineers need to understand the fixed parameters and fixed shape characteristics of industrial products. After that, the engineer has to determine the general mold parameters. Through different three-dimensional model testing stage, determine the final mold design dynamic parameters. This is an important means to ensure the processing quality of industrial products.

6.2. Minimize manufacturing cost
The choice of every mold design scheme is not random. We have to make sure that the cost of all processes in this scheme can be borne by customers. Therefore, in the process of mold design, designers must learn to predict the cost. A plan that wastes a lot of cost can not be called the best one. To minimize the cost is the second consideration of mold design.

6.3. Prediction of manufacturing cycle and guarantee of mold application life
The implementation of each mechanical design project should have a certain period. Designers should ensure that they can hand over the work in a specific time. Try to ensure that the mold manufacturing is completed in a medium time[10]. In addition, designers also need to determine the years of mold application. This needs to take into account the years of application of mold materials. It also needs to consider the problem of moment balance in some stress concentration areas of the die.

7. Conclusion
Mold design is an important stage of industrial manufacturing. With the development of computer technology, many advanced manufacturing technologies are proposed by experts. Computer aided technology is just the beginning of an era of mold design. I believe the mold design industry will show more efficient technology in the future.

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