Research on The Application of Computer Technology in Dynamic Sculpture Design

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Abstract—Computer aided design has become a way for designers to express design schemes, which is easier to be accepted by designers than traditional design methods. The future sculpture design will be a multi-dimensional combination of shape, color, video and audio. Computer aided modeling and design can help designers carry out modeling design with their own ideas and better realize their creative ideas. On the basis of computer-aided design, this paper analyzes the design methods of traditional sculpture, puts forward the sculpture design idea based on computer reverse engineering, and puts forward the modeling idea of rapid modeling through the three-coordinate GPS positioning accuracy calibration machine. Through the example of rhinoceros modeling software, it is proved that computer-aided modeling technology plays a great role in the field of sculpture, especially in the field of modern sculpture.

Key words: Computer, 3D modeling technology, dynamic sculpture

1 Introduction

With the development of the computer application field, all majors have introduced computer technology as an auxiliary means of design and calculation, so that the computer specialized software has been continuously developed. Even in the relatively traditional sculpture art field, a new sculpture style has been born because of the emergence of computer technology. The artistic style is constantly changing with the progress of science and technology, and with the development of materials, Skilled use of technology and tools, from ancient medieval rock murals to Renaissance realistic art, to Baroque, Rococo to modern sculpture design style. Even if the times are different and the ways of expression are different, its essence is the innovation of science and technology and the expression of contemporary spirit. In sculpture design, designers pay more attention to the design sense and artistry of sculpture modeling, and computer-aided design will help designers better understand the structure of sculpture in the design stage, which has an important impact on designers in the conceptual creativity stage of sculpture design.

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2 Current situation of traditional sculpture

The creation of Chinese traditional sculpture is very extensive. It has made outstanding achievements in various fields of sculpture in different historical periods. According to different sculpture materials, it can be divided into many categories, such as ceramic sculpture, ceramic sculpture, clay sculpture, porcelain sculpture, wood carving, bamboo carving, jade carving, brick carving, stone carving, bone and tooth carving, metal casting and so on. According to the use purpose, it can be divided into architectural sculpture, religious statue, memorial sculpture, tomb sculpture, craft decoration sculpture, garden sculpture, Mingqi sculpture, desk sculpture and other different types.[1] Compared with the realistic sculptures of Western classical sculptures such as David and the Venus of Milo, Chinese traditional sculpture lies in expressing artistic conception and similarity through techniques. With the development of modern science and technology, a variety of new arts such as plane color composition and three-dimensional image art have emerged, which has broadened the form of art. In today's era of rapid development of computer, computer modeling assisted sculpture design will bring new ideas and creativity to the traditional sculpture industry, and combine traditional and contemporary art to burst out new vitality.

3 Computer technology and modern sculpture design

With the development of computer technology, relevant design software has been deeply involved in the design work in various fields. Computer aided design has been widely used in music, film, industrial design, visual communication and other related fields. Among them, the three-dimensional modeling design is carried out through the computer modeling software, the design works are observed more intuitively in the design stage, the details of the works are fully understood, and further optimization is carried out on this basis, which greatly improves the designer's design efficiency and design effect. This also brings new opportunities for sculpture art. Through computer, we can not only design sculpture, but also simulate the complex conditions in the use scene of sculpture, so as to better express the concept and connotation of work design. In addition, the creation method is extended to the computer three-dimensional space through the three-dimensional virtual modeling design. Taking the 3D printing technology as an example, the 3D modeling of the virtual space can be presented in the form of solid materials from virtual mode to reality through the 3D printing technology.

4 Current situation and principles of dynamic sculpture design

Dynamic design was first presented as an art form of dynamic sculpture, which can be traced back to the era of art masters such as Duchamp, Garbo and Calder. Some studies have pointed out that the first creative attempt of dynamic design is moholinarchi's work "regulator of space and light" created in Bauhaus from 1922 to 1930. This work is characterized by an obvious structuralist style, which combines sports and plastic art to produce dynamic images, with the development of computer, dynamic art is closely combined with computer, and its form of expression develops from static to dynamic to interactive. There are three important characteristics.[2]

4.1 Change

Visual language elements are the characteristics of dynamic design. According to different visual language elements, visual language elements can be changed according to different materials, colors and shapes. The motion state includes the direction of motion, speed and staggered space. The combination of the two changes makes dynamic sculpture give the viewer a new experience. The computer can simulate the possibility of various changes in the design of dynamic sculpture, and import the modeling, structure and graphics into the computer. The designer can have a more intuitive feeling of dynamic sculpture according to the material, color and lighting effect, and optimize the scheme of dynamic sculpture on this basis.

4.2 Time

Time is the scale that reflects the movement. Through time, the change of movement can be highlighted and the sequence and replacement of movement can be realized. In the traditional static sculpture, the work display makes it static without time change. In the sculpture of computer dynamic design, the analysis of dynamic sculpture can be more hierarchical and related, and the changing space can be created through different ways.

4.3 Space

Time and space in dynamic sculpture are interrelated. Spatial structure is the basis of time structure. Time is invisible and needs to be displayed through space as the carrier. Space can be divided into two-dimensional space and three-dimensional space, static space and dynamic space, objective space and subjective space, real space and virtual space. Dynamic sculpture works can express the infinite possibility of space. Due to a series of data corresponding to computer graphics, the change of data can cause the change of image. Through these instructions, computer design can be constructed and optimized in space, so as to seek the inspiration of dynamic sculpture design from a three-dimensional perspective.[3]

5 Sculpture design system based on computer reverse engineering

With the development of computer, there are many forms of modern sculpture. In order to reduce the design cycle and ensure the accuracy of parts and overall dimensions, reverse engineering came into being. Reverse engineering, also known as reverse engineering, originates from precision measurement technology. [3] It establishes point cloud model data by scanning existing products, makes feedback derivation from the downstream of the design to the upstream of the design, and reoptimizes it to form a new downstream of the design, constitutes the design idea of the whole design closed loop, and plays a positive role in the design of modern sculpture.[4]As shown in Figure 1.

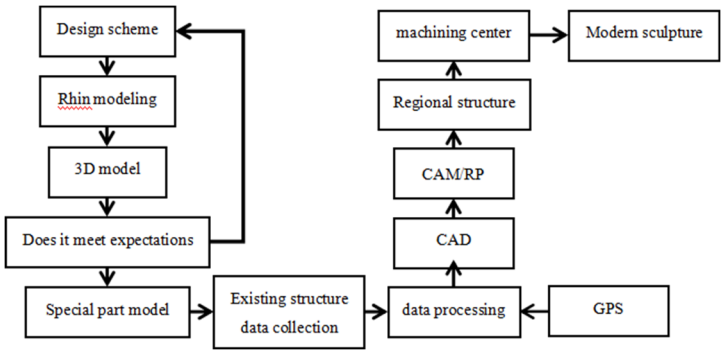

Figure 1 sculpture design system of computer reverse engineering

The traditional sculpture art is produced and processed through the designer's design draft, but it is difficult to grasp the overall structure in the design stage, and it is difficult to consider the overall understanding of the structure. [5] However, the computer-aided modeling technology makes the sculpture or sculpture parts meet the service conditions by scanning the existing sculpture size or part size, Especially for the dynamic sculpture in modern sculpture, which has many components and complex structure, it is difficult to understand the overall structure through the design draft, but the overall modeling design of the dynamic sculpture is carried out through computer-aided design, and the sculpture size and important part size are aided by computer reverse engineering, It enables designers to have a deeper understanding of the overall structure of dynamic sculpture, optimize the use process of dynamic sculpture, reduce the design cycle and improve the feasibility of the scheme. The measurement technology is the key to the realization of reverse engineering. The traditional measurement technology can not meet the accuracy of reverse engineering. The new generation of three-dimensional GPS positioning accuracy calibrator is a geometric measurement instrument integrating optics, machinery, computer science, test and measurement technology and instruments.[6] It can be fast, accurate and reliable Effectively measure and obtain complex workpiece size data. The physical measurement is mainly realized by using the principle of coordinate measurement. On the one hand, in life, we look for the objects that need to be measured, extract the geometric elements involved in the objects, then clarify the specific measurement coordinates in the geometric elements, and implement centralized measurement in combination with the found coordinates. In the specific measurement process, it is necessary to measure the shape, size and size of geometric elements according to the measurement standards.[7]

6 Application of computer technology in dynamic sculpture design

The emergence of dynamic sculpture breaks the static state of traditional sculpture and introduces the concepts of time and space. Its complex internal structure and operation process make it necessary to make rational use of interdisciplinary knowledge: such as dynamics, architecture, mechanical design principle, mechanical analysis and other related fields to meet the needs of dynamic sculpture changes. The London winding bridge, designed by the famous artist Thomas Heatherwick in Paddington, London, UK, is 12m long. Its particularity is that it is

usually an ordinary steel structure pedestrian bridge. When ships pass by, the bridge body will automatically roll up the bridge deck in a circular ring through the stretchable winding eight section structure controlled by the air pressure axis for ships to pass through. The whole design not only has ingenious conception and beautiful form, but also adds practical and interactive functions to realize the combination of practicality and beauty in artistic creation.[8]As shown in Figure 2.

Figure 2 London winding bridge designed by Thomas Heatherwick

Through computer modeling technology to simplify the design process and make the design structure more clear. In this paper, the rhinoceros modeling software is used to model the London winding bridge, so that the London winding bridge can be visualized in the design stage and optimize the modeling design and structural design of the scheme. By modifying the model, the London winding bridge shows the use process, and gives the model texture through rendering technology to achieve the effect picture display. As shown in Figure 3.

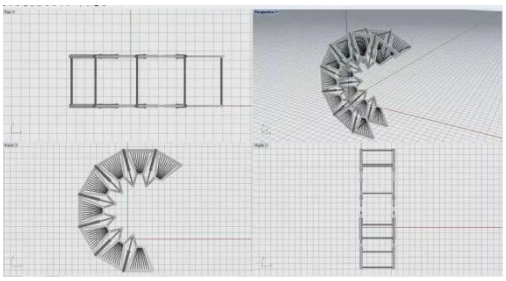

Figure 3 London curved bridge model

Through the adjustment and modification of the model, the state of London curved bridge under free stretching is shown, as shown in Figure 4, which is convenient to help realize the working process through computer-aided design and make the use function of the bridge go smoothly. The design of the joint and the internal support are optimized to make its stress meet the mechanical characteristics and ensure the stability of the bridge deck. Design and optimize the bridge deck in the process of folding or stretching, and strengthen the relevant key components.

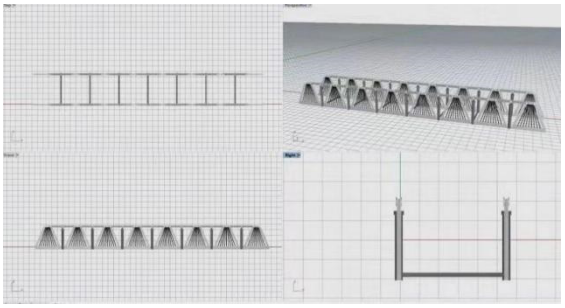

Figure 4 Free stretching working model of London curved bridge

Part is an important part of realizing dynamic sculpture. It is necessary to detect the part to control the part quality. Through computer-aided design, dynamic sculpture must analyze the part processing error with the help of computer. To analyze the error, we need to understand the relationship between part design and manufacturing related to quality control.[9]CAD gives the part measurement requirements, geometric features and element topological relationship, and inputs the data into cam to ensure that the part manufacturing accuracy meets the use requirements, so as to realize the integration of design and processing, so as to shorten the design cycle, improve work efficiency and form a closed loop of design processing design.

7 Conclusion

Compared with the hand-painted small manuscript design in the traditional sculpture design, the production process is complex, completely made manually, not easy to modify, and the design cycle is long. A reverse engineering aided dynamic sculpture design system model is proposed. Based on the existing structure, the sculpture model is digitized by CMM, and the dynamic sculpture is adjusted on the basis of the digital model to realize the spatial simulation of large-scale sculpture and form a design closed loop integrating design and processing feedback, The design of London winding bridge is reversed by using computer modeling technology to support innovation. Through reverse engineering aided dynamic sculpture design, designers and constructors can communicate more effectively to achieve the completion of sculpture, which helps to reduce the risk of irreversible effect caused by the combination of ideas and practice. It can be seen that the application of reverse technology can provide new schemes for traditional sculpture design and stimulate people's creativity, which is of great significance to the design of modern sculpture.

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