



Design of Three-Dimensional Model of Trans-regional Water Transport Device for Water Conservancy Projects Based on Cloud

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Abstract. In order to understand the application of hydraulic engineering in three-dimensional model design, a cloud-based three-dimensional model design of cross-regional water transport device for hydraulic engineering is proposed. In this paper, firstly, the application of three-dimensional model design method in water conservancy engineering industry is explained, and then the application of three-dimensional design method in water conservancy engineering design is analyzed and studied, thus proving the application superiority of three-dimensional design technology more effectively. Finally, it is concluded that the three-dimensional model design has a wide application prospect in water conservancy projects.

Keywords: water conservancy project · Three-dimensional model · place high in the sky

1 Introduction

Today's three-dimensional technology has a very broad application prospect and is widely used in many fields. It has great advantages in the design of water conservancy projects. In the construction of water conservancy projects, the scientific use of three-dimensional design methods can reduce the investment of construction funds, improve the success rate of design and effectively enhance the competitiveness of enterprises. Therefore, the application of three-dimensional design presents a wide range of characteristics. There are many contents in the design of water conservancy and hydropower projects, mainly including construction, water supply and drainage, machinery, architecture, civil engineering, geology, surveying and mapping, and so on. There are not only mutual influences in design, but also frequent interactions in data, that is, there is a close relationship between the professions, which requires a high degree of sharing of design results. The above characteristics and requirements of water conservancy and hydropower engineering require that the designed platform must have the following properties: easy popularization, technical specification, wide professional coverage, collaborative design ability and strong data compatibility [1, 2].

2 Current Situation of Water Transport Device in Three-Dimensional Model Design of Water Conservancy Projects

In the current water conservancy and hydropower industry, the application of three-dimensional design method is still in a relatively backward state, and its application development is far worse than that of power, petrochemical and other industries. The main reason for this phenomenon is that the hydraulic engineering design itself has extremely prominent complexity characteristics, and at this stage, a set of software has not yet appeared to solve the existing problems comprehensively and properly. In other industries, such as electric power, petrochemical, etc., the application of three-dimensional design is mainly factory design, and the problems to be solved in design are the reasonable setting of space pipelines and the design coordination of specialized space, and there are mature design software. Factory design has a strong standardization, which promotes the application and development of three-dimensional design and improves the design efficiency. However, in the engineering design of water conservancy and hydropower industry, the topography and geological conditions involved are different, so it is impossible to achieve standardization [3, 4]. Therefore, the three-dimensional design is difficult, and the application scope cannot be expanded. As shown in Fig. 1:

2.1 Application Status of 3D Design

Three-dimensional software has been around for a long time. It was first used in the mechanical industry, and now it has been widely used in the field of construction engineering. As shown in Table 1:

1. Survey and Mapping

After digitizing the contour data, a three-dimensional landform map can be established, including various buildings, excavated slopes and original landforms, which can be continuously updated according to the progress of the project. On the other hand, because the three-dimensional landform is built with three-dimensional numbers, the volume, area and other properties of any part of the building and the amount of earthwork can be accurately calculated. Parametric design of hydraulic design can make efficient use of existing templates and facilitate the change of design scheme. The three-dimensional design results of the image also facilitate the proofreading work, and at

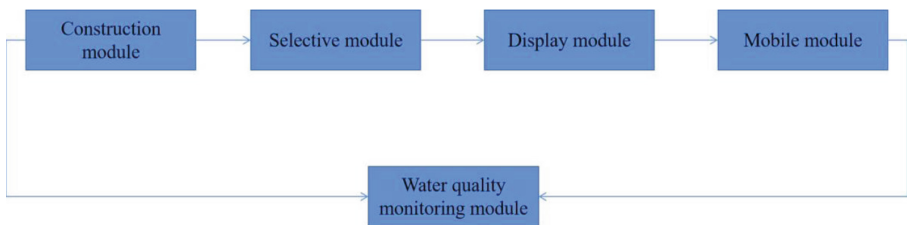


Fig. 1. Water quality detection module

Table 1. Parameter information of 3D model of water conservancy project

Parameter information of three-dimensional model of hydraulic engineering		
Parameter information of feasibility study stage	Parameter information in design stage	General information of parameters in bidding stage
Parameter information in construction stage	Parameter information of completion stage	Operation stage parameter information

the same time, it is beneficial to the communication between various professions and reduces some obvious mistakes in the design. In addition, the three-dimensional model can also well show the relationship between buildings and surrounding environment, geological and topographic conditions [5, 6].

2. Construction organization

Under the condition that the constraint conditions between the construction site and the terrain are clear, the required results can be obtained quickly and the corresponding plan and section drawings can be generated by using the three-dimensional dynamic layout construction platform. Using three-dimensional modeling technology can intuitively understand the feasibility of various schemes, which is conducive to the rapid and convenient comparison and selection of various schemes.

3. Calculation of engineering quantity

With an accurate three-dimensional model, the engineering quantity can be accurately calculated. If you have the data of building materials and geological classification, you can also calculate the amount of different materials, and then provide reliable data for the budget and material supply plan during construction.

3 The Importance of 3D Model Design Method in the Application of Water Conservancy Projects

1. Three-dimensional design method is widely accepted and applied in the construction and application of water conservancy projects. The main reason is that the three-dimensional design method can improve the construction quality, reduce the construction cost and improve the construction efficiency. Compared with the traditional two-dimensional design method, the design process of three-dimensional design is simpler, the template selection is more accurate, and the drawing display is more stereoscopic. Combining the three-dimensional design method with China's water conservancy projects effectively plays an important role in rational allocation of water resources, improving construction efficiency, improving construction quality and reducing construction cost of China's water conservancy projects.
2. To improve the advancement and effectiveness of China's water conservancy projects, three-dimensional engineering is more human's construction mode and thinking habits. Therefore, both the related technicians of water conservancy projects and the broad masses of the people can directly understand the design details and design

effects of the project through three-dimensional design methods. Three-dimensional design technology can help technicians to connect and divide abstract geometric figures, formulate efficient and reasonable construction schemes, and greatly promote the development of water conservancy projects in China.

3. The good application and development of water conservancy projects can improve people's living standards and effectively promote social stability and harmony. The construction of water conservancy projects is related to people's water quality guarantee and reasonable discharge of water quality and quantity, which are closely related to people's production and life. Good three-dimensional design method can improve the overall quality of water conservancy projects and promote the stability and harmony of social relations in China.
4. Three-dimensional design method can constantly improve and innovate the construction of water conservancy projects in China, improve the modernization level of water conservancy projects in China, and effectively promote the improvement of China's scientific and technological level and comprehensive national strength [7].

4 Application of Design in 3D Model in Hydraulic Engineering

4.1 The Use of CATIA

CATIA (CG Aided Three-Dimensional Interactive Application) contains four main contents: knowledge engineering, construction engineering design, internal structure design and surface design.

- (1) knowledge engineering package. This project package is a comprehensive and scientific solution to the problem of template design, and can apply the function of feature design. Adding some design experience and rules and regulations to CATIA can provide effective help for future three-dimensional design. It can avoid unnecessary mistakes in engineering design, further improve the scientific standardization of water conservancy engineering design, and at the same time, improve the efficiency of the whole water conservancy engineering design.
- (2) Construction engineering package. This project package is mainly aimed at the overall layout problem in construction, providing geological design and Boolean operation of surfaces. Design the buildings of water conservancy projects in an all-round way, and fully consider the mutual influence between water conservancy projects by using scientific technology.
- (3) Internal structure design package. This project package is mainly for the rational design of dam components, which can complete complex surface design work, realize templating and parameter design, create a very intuitive environment for dam modeling, capture and reuse the whole process and method of water conservancy project design, greatly improve the design efficiency of water conservancy project and improve the overall quality of the project.
- (4) Surface design package. The application scope of surface design package is mainly to solve the modeling problems of different geology and topography involved in water conservancy projects. The design contents mainly include: surface deformation, reverse engineering and complex surfaces. At the same time, it can also import

Table 2. Use of 2CATIA

CATIA	knowledge engineering	
	Construction engineering design	parts design
	Internal structure design	Assembly design
	Surface design	

and process related data information such as modeling, so as to predict and generate related data of geological modeling. Through scientific calculation of relevant geological model data, the data information of hydraulics, geology, construction and other aspects in the whole hydraulic engineering design can be effectively combined, and the application value of curved surface design package is very high. As shown in Table 2.

4.2 ANSYS-Based 3D Finite Element Application

The application of ANSYS in hydraulic design is of great significance, and its application value is excellent. Moreover, the application and development of ANSYS keeps pace with the times, which can change and develop with the gradual development of science and technology in the times, further improve the overall efficiency and quality of the whole hydraulic design, and help engineering enterprises obtain the maximum reasonable economic income. Its application and development potential is great. The application steps of this design method are: remove the key points of the surface and line on the small feature layer one by one, and then find out the relevant boundary line with this characteristic, so as to make it become a whole line and form a larger surface. Use related tools and their own interrupt function to make lines connected with surfaces. Use drawing tools to combine all the lines, and then form a smaller surface. This type of graphic production can promote the existence of the required common lines and points between various faces. After the model import operation is completed, the graphic influence displayed is vague. After the entity command is input in the related production tools, the detailed engineering design model can be seen. By introducing the part design model into ANSYS, making reasonable adjustment and modification and grid part, the general three-dimensional modeling design is completed [8].

4.3 Application Example of 3D Design Method in Hydraulic Design

The water intake of a hydropower station is divided into intake diversion canal and tower. The water intake tower adopts double-layer water intake, with the length and width values of 226 m and 31.48 m respectively. The height of the tower top is 821.8 m, and the height of the foundation surface is 735.2 m. The foundation rock mass in the area where this hydraulic project is located is mainly weathered granite and sedimentary breccia, which has good integrity.

Relevant designers used CATIA three-dimensional technology to assemble parts for this project. At the same time, it also uses its internal modules to help designers add and

constrain loads. In this way, it can help designers to make a preliminary finite element analysis and verify the whole engineering design. In addition, engineering designers use the three-dimensional design technology ANSYS to adjust and correct the data of the design model. Finally, a very scientific and reasonable hydraulic engineering design modeling is obtained, which provides reference for its actual design [9, 10].

5 Conclusion

In the design of water conservancy projects, in order to obtain better design results, three-dimensional modeling appears in the minds of relevant designers. A large number of practical experiences have proved that the use of three-dimensional design can help to straighten out the design ideas of hydraulic designers and show the design image on the design drawings in a more detailed way. This can not only improve the overall design efficiency, but also show the specific design shape in a concrete and comprehensive way, which is helpful for the calculation of engineering data. The application of three-dimensional technology in actual hydraulic design can scientifically improve the construction quality of the whole project, minimize the capital investment as much as possible, and make full use of the design results. It can be predicted that the three-dimensional design method will be more widely used in the design of water conservancy projects in its future development, providing assistance for the construction and development of the whole society.

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