Application of 3D Design Technology in Substation Design

Yang Gao
State Grid Jibei Electric Economic Research Institute
472256603@qq.com

Abstract. In recent years, with the development and progress of computer technology, its application has become more and more widely. Among them, the application of 3D technology in the design industry is very common, which effectively improves the design efficiency and design quality. In the process of substation construction design, the application of 3D design technology to the design of substations can effectively improve the scientificity and effectiveness of the design scheme and avoid cross-design. In this paper, the relevant applications of 3D design technology in the design of substations are analyzed in detail in order to promote the further improvement of the design level of substations.

1. Introduction
At present, China's computer network technology is constantly developing and improving. In the process of substation design, the level of design has also been significantly improved. However, if compared with other industries, two-dimensional design is still used in the process of substation design. In the process of 2D design, there may be cross design and construction. At the same time, it takes a long time to review the design plan. If 3D design technology is applied in the design process, these problems can be solved easily. The technology must be continuously developed and improved.

2. Development background and foundation of 3D design technology
With the advancement of efficient and intelligent computer software worldwide, the informatization of the power survey and the design industry is also continuously developing. The operation mode based on the information-based intelligent three-dimensional design platform has greatly optimized the operation process of the design, making a change from the design of the layout to that of the system solution, and the tedious data modeling work has been completed before the design of the system solution. This will bring changes to the review system and human resource structure of electric power design of tradition and production also. What’s more, it will lead the second revolution of the design industry with a digital three-dimensional design platform to achieve standardization of the knowledge management system and digital transfer as a means to establish a comprehensive project of engineering. Life-cycle service profit model, also expand service chain and scope, as well as promote transformation and upgrading of design enterprises.

3. Characteristics of 3D software design
3D software has the characteristics of strong visibility and operability. The application of 3D software in the design can effectively improve the quality and efficiency of the design. In specific design applications, 3D software design has the following characteristics.
3.1. Direct measurement of distance
In the three-dimensional substation model space, we can verify the correctness of the point's safety distance in the diagram without switching back and forth between the plan and section drawing. Therefore, manual calculation steps of the traditional method are saved to avoid man-made measurement errors.

3.2. Avoiding possible design errors
The three-dimensional model is reasonably sectioned, and a two-dimensional view at any angles in the station can be automatically generated to truly show the relative relationship between the equipment and the wire and the building.

3.3. The practicality of the design solution has been improved.
By using the standard model of equipment, the information and attributes of the equipment will not only facilitate the management of the ledger after the equipment is transferred, but also facilitate the sharing of engineering information to technical personnel in various aspects such as design, construction, construction management, operation and maintenance, and maintenance.

4. Analysis of the main platform for 3D substation 3D design
The following is an example of Bentley platform solution to introduce the application of three-dimensional digital design of substation.

| Table 1. Software for Digital Solution of Bentley Substation |
|-------------------------------------------------------------|
| **Series software for digital solution of Bentley substation** | |
| No | Name of the Software | Application Fields |
| 1 | Context capture | Real modeling |
| 2 | ProjectWise | Collaborative design |
| 3 | SubstationSS8 | Electrical design |
| 4 | BentleyRaceway & Cable Management | Cable laying |
| 5 | GeoPak | General layout design |
| 6 | AECOsim, Prosteel, Prostructures | Architectural and structural design |
| 7 | Staadpro | Structural design |
| 8 | Navigator | Drawings examination |
| 9 | eB | Engineering Data Center |

4.1. 3Dmax software
3Dmax software is a 3D modeling, rendering and animation production software developed by Autodesk. Not only the operational interface is simple and convenient, but also the view is powerful, and the rendering effect is strong, then the compatibility is good, as well as the design efficiency is easy to get started. And the use of 3Dmax software for the design of the completed three-dimensional drawings of the substation production renderings and animation roaming display effect will be better. Therefore, 3Dmax software is not used as a substation 3D software for actual engineering design, but also has important value as a post product tool.

4.2. PDMS software
PDMS software is a factory three-dimensional design management system, which is usually mainly used in the chemical industry also the power field. In actual applications, PDMS software can create a solid model through a collaborative design model. At the same time, PDMS software can also automatically update and mark the floor plan especially in the design of substations. Among them, PDMS software plays a powerful role and is also the most widely used. The application of PDMS software to design substations requires the creation of a rich database. However,
the application of PDMS software in this field consumes a lot of time, which is determined by its own nature of application. And the application of PDMS software in the field of plant design will not only save a lot of time, but also reflect its application value, and will achieve significant results of application.

4.3.  Substation software
Substation software is mainly developed by the United States Bentley company. Substation software is a three-dimensional software specifically used for substation integrated electrical and structural design. Substation software can provide important functional blocks for actual design work. Examples include 3D structural models, control diagrams, switchboard layouts, and other reports. Designing a substation through Substation software can provide important grounding grids, cable sags and other tools for this design process. Applying the Substation software to electrical design, the overall performance of its tool is strong, it can realize automatic numbering, and it can be applied at different levels according to the type. The Substation software is also capable of error checking for short circuits, short circuits, and equipment.

5. Application of 3D Design Technology in Substation Design

5.1.  3D modeling depth requirements
If you want to realize 3D design, you need to study the depth of modeling in advance. Modeling depth affects not only the progress and workload of 3D design, but also the overall quality and efficiency of 3D design. As the core equipment of substation, electrical equipment needs to specify the depth and modeling accuracy of its model, so as to provide relevant work and guarantee for 3D designers.

5.2.  Create 3D Model Library
The creation of 3D model library is mainly aimed at the support model and the equipment model, and these two models constitute the component model. Therefore, in the process of 3D design, component modeling is the initial step in the development of 3D design work, and the overall quality of 3D design schemes largely determines the level of component modeling. On the premise of ensuring the effectiveness of the three-dimensional layout check, Designers need to continually simplify component information based on actual conditions. Whether the component model is reasonable or not seriously affects the smoothness of the 3D design, and at the same time has a direct impact on the subsequent work. Based on the support model and the equipment model, the difficulty of the modeling is relatively high. In general, to achieve the expected reason To achieve the effect, the equipment supplier needs to provide the specified file format, or provide a more complete 3D model. At the same time, make sure that the drawing scale of the model is up to standard. In addition, equipment suppliers are responsible for the quality of their models.

In the process of creating the model, the naming of the device model should strictly comply with relevant standards and should not be more arbitrary. Compared with the naming of 3D digital models, its naming has the characteristics of uniqueness, accuracy and rationality. However, the current method is mainly for the convenience of identification and the management of some columns. First of all, the name of the three-dimensional digital model can also use numbers, letters, underline, and so on. In addition, during the process of creating the model library, the designer needs to simplify the geometric content of the model to save the storage space of the model library. The following principles should be followed to simplify the geometric content of the model. Secondly, fully ensure that the functional expression of the model itself will not be affected, and the basic structure will not be adversely affected. Thirdly, the assembly of the model shall not be affected. Fourthly, in the process of model geometric details simplification, the key dimensions shall not be simplified, nor the professional interface part shall be simplified.
6. Conclusion
The prospects of application of 3D design technology are very wide, and it has excellent practicability in the field of electric power construction. At present, there are still some shortcomings in the practical application of China's three-dimensional technology in the power design, which cannot be comprehensive in the application process.

It exerts the advantages of 3D technology, which has affected the development and application of 3D design technology to a certain extent. Relevant designers should strengthen the research on the application of 3D technology to further promote the development and progress of China's power design technology.

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