Application of Automatic Auxiliary Software in Cable Laying Design for Substation

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ABSTRACT

Nowadays, as the computer technology has been developing rapidly, the tools for substation design also witness earth-shaking changes. In order to improve the design efficiency and guarantee design quality, this paper introduces the design methodology of the combination between multiple design methods for optimizing cable laying and statistics. The feasibility and practicability of this methodology have been proved through several actual project practices.

Keywords: ELEC2.0 software, AUTOLAY software, Substation design, Cable laying

INTRODUCTION

In order to adapt to the development of electric design industry for domestic and overseas, as well as improving the design standard, revolution of design tools is imperative. Before the development of CAD, manual design with pencils and rulers always leads very low efficiency. CAD, which is Computer Aided Design, utilizes computer and its graph facility to aid designers. The appearance of CAD is one main revolution for design tools of design industry. The relating software also includes ELEC which aims at electric secondary design, BCSOFT, aiming at the calculation for anti-thunder, Auto Lay and so on.

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SNPDRI began to use software ELECT2 in 2010 for substation auxiliary design, and first gave the actual application of this software in secondary design in Wulan 750kV substation, subsequent application for this software also lead to favorable results. For meeting current challenges, we need to keep our mind broaden and optimize our design tools, more importantly, increase design efficiency. So, for this article, a methodology which aims at cable laying and cable statistics to optimize and innovate design method is presented to increase design efficiency and ensure the quality of cable length statistics and cable laying.

FLOW PATH FOR ELEC2.0 DESIGNING SOFTWARE

SOFTWARE STRUCTURE FOR ELEC2.0

In the end of 2005, the united developed platform for ELECT software between Shanghai XD Information Tech. Co., LTD and domestic designing institute have begun to take its shape, the electric automatic auxiliary designing system ELEC2.0 is updated upon ELEC software platform and became the software used for secondary design in power transformation design specialized[1,2]. The soft frame which is established upon professional design idea and technology is presented in Fig. 1.

In order to satisfy the stability and reliability of design platform, ELEC is the auxiliary design software defined upon the basis of public networking design platform, where all of the designers will be working on the same network and platform in terms of same project.

Figure 1. Structure illustration of the software design.
DATABASE SYSTEM FOR ELEC2.0

ELEC2.0 applies SQL Server \[3\] as the background database, and it will abstract the objects which appear through automatic design into data entity, physical models of database will be generated according to these abstract models. The design of database is carried out through normative standards and requires the third normal form for database.

DATABASE CONNECTION FOR ELEC2.0

Due to the fact that ELEC is the project managing and auxiliary design software, many parts of ELEC are involved with the problems of data exchanging with AutoCAD. Extracting data from the drawing, and redrawing the graph based on the design both require the stable and highly effective connection and this will ensure the communication of the database between AutoCAD and ELEC. ObjectARX and AutoCAD are applied by ELEC and this accomplishes reading and writing functions for DWG image database. All of these characteristics are largely distinguished from the AutoCAD expansion and development (VBA, LISP and so on), the execution efficiency and stability are highly improved \[4\]. Through the development for ObjectARX program from C++ and the ADO technology of Microsoft could be used directly, as we visit the image information by ObjectARX technology, the ELD database is visited, in such way, C++ becomes the binder between the two technologies and leads to one ideal connection between CAD and ELD database \[5,6\].

CABLE LIST of ELEC2.0

After finishing the schematic diagram of one volume, the data information of the relating volume is finished at the same time. Cable list of the project could be exported quite easily (only several minutes for cable list exportation of one volume). Based on the designing custom and uniting with software companies, the State Nuclear Electric Power Planning Design & Research Institute (SNPDRI) has been studying and correcting constantly and came out the model shown below in Fig. 2:

![Figure 2. Cable list model generated by SNPDRI.](image-url)
AUTOLAY DESIGNING SOFTWARE

Autolay designing software receives the cable code and information of starting and finishing point of cable. Location of equipment which could be analyzed through the Autolay platform, or through the three-dimensional digital arrangement platform. By combing the arrangement of cable channel itself, cable wiring is generated automatically and the demanded designing results will be output.

AUXILIARY DESIGN FOR COMBINATION OF CABLE STATISTICS AND CABLE LAYING

Aiming at secondary design for power transformation projects, as the schematic diagram is finished by using ELEC, the SQL database is generated correspondingly as well as the cable list. However, the length of the cable is still immeasurable, using the origin method would need manual measurement, which is time-consuming and inaccurate, more importantly, the quality cannot be guaranteed; as a result, such method is out of the current developing trend.

AUTOLAY solves the problem of cable laying and measuring properly. Based on the electric layout and the location for panels, arranging the cable channel in AUTOLAY platform; according to the designing principles of code and design handbook, for the output of ELEC2.0 platform, the cable list with cable and equipment code as input of the cable list, all of the locations for equipments and panels (which is labeled with code), the length and laying path of the cable could be calculated, the arrangement of cable and summarizing could be generated according to the arrangement of cable crane, which all gives detailed description for cable path. By using this method, advice could be applied for cable laying during construction period, which gives the favorable laying path. Fig.3 is the flow illustration based on the method put forward of this article.
At present, design task for substations of power grid department in SNPDRI is rather full, design periods for different projects have been shortened over and over again, and resources of design personnel are very tense. The secondary part is always at the very end during various design work and always affects the final design period. As a result, the owners and within the enterprise require higher standard for secondary design level. The vital target for the moment is to keep the design period shortens and satisfies the requirements for design schedule of owners.

According to the heavy mission for SNPDRI, the main problem of finishing the secondary design in electric part with limited human resource has becomes more realistic. We have studied and carried the in-depth discussions from different links of design and also collected new skills and mind from oversea and domestic of this field, trying to finish the time-consuming and arduous and repeated work by the software in every possible way. So using newer design method to shorten designing time, improve the design efficiency have become the problem needs to be solved. The application for combining ELEC2.0 and AUTOLAY, has improved secondary design efficiency, the error rate has been almost reduced to zero.

CONCLUSIONS

For higher and higher level of office automation, it is very essential to have the design platform excellent enough among the drastic competition. For this reason, based on extensive usage and the actual situation of ELEC and AUTOLAY as well
as the new characteristics and requirements for the complex project design in domestic and overseas, we have the wide-range discussion in terms of the problems occurred during software application, where we put forward the new function for exportation of project cable list by using ELEC; also the cable laying and statistics by using AUTOLAY. Further development and integration will be carried out from all of the functions. The actual application of power transforming secondary design for Weifang ultra-high voltage power transforming project and Jinbei Converter project, the methodologies mentioned in this article results in both shorter working period and higher design efficiency, which could be considered as preferable value for application.

REFERENCES