Research on Design Scheme Optimization of Transmission Line Based on Internet Technology

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Abstract. As an important part of the power grid, the rationality and scientificity of the design scheme of transmission line not only relates to the stability and reliability of the whole power grid system, but also plays an important function in the energy loss and efficiency amelioration of the power grid system. Based on this, this paper first analyses the function and characteristics of the transmission line, then studies the meteorological conditions of the transmission line design under the Internet tech, and finally gives the design optimization principles and strategies of the transmission line.

Keywords: Design Scheme, Transmission Line, Internet Tech

1. Introduction

With the iterative maturity and progress of computer tech, it has been widely and deeply studied and popularized in many fields, especially the application of computer tech represented by Internet tech in the design of power transmission lines, which greatly accelerates the optimization and amelioration of the design scheme of power transmission lines. As an important part of the power grid, the rationality and scientificity of the design scheme of transmission line not only relates to the stability and reliability of the whole power grid system, but also plays an important function in the energy loss and efficiency amelioration of the power grid system. The research and application of Internet tech in the field of transmission line design, on the one hand, ameliorates the intelligence and info level of the whole power grid system; on the other hand, it also makes the design of the whole transmission line fully integrate the function and influence of environmental factors, and ameliorates the safety of the electrical line design scheme [1].

Under the condition of network and info, the traditional design of transmission electric lines is difficult to meet the development needs of the industry. It is urgent to optimize the design of transmission electric lines, and solve the problems and shortcomings by using Internet tech. The application of Internet tech can design intelligently the environment of the electric line and the overall state of the transmission system, especially the parameters and collocation of electrical equipment, so as to ameliorate the stability and specialty of the system operation process and eliminate the potential power conflict in the transmission electric line [2].

In addition, in the design process of electric transmission lines, not only the space consumption, leakage probability, repairability and maintainability of electric lines need to be comprehensively considered, but also the stability and reliability of electric transmission lines, as well as the operation
efficiency of power grid need to be considered. These factors and requirements put forward higher requirements and challenges to the design of transmission lines. With the growing demand for electricity from all walks of life, transmission lines are undertaking higher and higher power load and operation technical requirements. The utilization of Internet tech can effectively analyze the safety bearing capacity and safety of transmission lines, as well as the problems and hidden dangers that should be focused on in the technical level of transmission line construction, and effectively solve them. Therefore, it is of great practical value to study the design optimization of transmission lines based on Internet tech [3].

2. Functions and characteristics of electric transmission lines

2.1. Function and classification of transmission line

Electric transmission lines can be divided into transmission lines and distribution lines according to their voltage levels, overhead lines and cable lines according to their structures, and AC transmission lines and DC transmission lines according to their power properties, as shown in Table 1 below. Secondly, transmission lines can be divided into ordinary transmission lines and EHV transmission lines according to their voltage levels. Compared with overhead transmission lines, transmission lines have the advantages of simple structure, less investment, high economic efficiency, large transmission capacity, strong maintainability and maintainability [4].

| Classification of transmission lines | Types | Typical composition |
|--------------------------------------|-------|---------------------|
| Voltage level                         |       | Transmission line   |
| Transmission structure               |       | Distribution line   |
| Electrical energy properties         |       | Overhead lines      |
|                                      |       | Power line          |
|                                      |       | DC transmission line |
|                                      |       | AC transmission line |

2.2. Structure and function of electric transmission line

The important components of transmission line include conductor, lightning rod, insulator, stay wire and foundation. Among them, the conductor is mainly used to transmit current and power, and needs to consider its own anti-corrosion, damping, splitting and span performance. Secondly, the main purpose of the lightning conductor is to prevent lightning strike, realize the shunt of lightning current, reduce the lightning current into the pole, and realize the coupling and shielding of the conductor. In addition, the line fittings include clamp, connection fittings, continuous fittings, protection fittings and stay wire fittings. The insulator can support and guarantee the reliable electrical insulation strength of the line, and the tower can be divided into several types as shown in Figure 1.

![Figure 1. Several types of tower forces](image)

The stay wire can balance the transverse load and conductor tension acting on the tower, so as to reduce the consumption of tower materials and reduce the cost of the line.
3. Consideration of meteorological conditions for transmission line design under internet tech

3.1. Meteorological influence factors of transmission line design
The meteorological factors that affect the design of transmission lines mainly include wind, ice and air temperature. In the aspect of wind speed, wind speed will lead to excessive load of conductor and tower, and change the distance between live conductors and cross arm, tower and other grounding parts. And the wire will also cause vibration under the influence of wind speed, threatening the safety of transmission lines. Secondly, the thickness of icing will also threaten the safety of transmission lines, such as causing flashover accidents between wires and objects to be crossed. In addition, it is difficult to remove icing and rime due to their strong adhesion. The change of air temperature will also lead to thermal expansion and cold contraction of wires, which will affect the stress of transmission lines. Too high temperature will lead to the conductor crossing objects and the distance to the ground does not meet the requirements, while too low temperature will lead to the increase of transmission line stress and decrease of mechanical strength [5].

3.2. The function of Internet tech in the analysis of meteorological influencing factors
The utilization of Internet tech can analyze the maximum temperature, minimum temperature, annual average temperature, maximum wind speed, icing thickness, lightning day and other regional meteorological info of the transmission line area, so as to obtain the maximum sag, maximum stress and other data info, so as to better carry out tower positioning, foundation verification and insulator string upside down verification. The analysis of maximum wind speed is helpful to the verification of safety clearance and safety distance. Secondly, the data analysis of icing thickness and lightning days can provide data analysis for safety distance, tower foundation strength verification and lightning protection design [6].

3.3. Basic process of transmission line design
First of all, in the construction drawing stage, according to the section map provided by the technical design, the indoor arrangement work is carried out. After the indoor arrangement is completed, the pile is handed over on site, and the indoor arrangement of tower position is measured and placed on the ground. If necessary, geological and hydrological personnel will carry out certain exploration work on the tower location. Secondly, after the completion of on-site pile delivery, the arrangement is revised, and the tower location list and section diagram are formally put forward. At the same time, the tower, foundation construction drawings and mechanical and electrical construction drawings are also completed at this stage. The design process of electric transmission line is shown in Figure 2 below [7].

![Transmit line design process](image)

**Figure 2.** The design process of electric transmission line
In addition, in the construction stage, it is necessary to review the path agreement, and the key route is the field work, including site alignment, cross-section survey, hydrological and geological exploration, positioning and pile delivery, etc. On this basis, interior design work can be carried out, and the design of tower pile and some mechanical and electrical construction drawings can be carried out in parallel [8].
4. Optimization of design scheme for electric transmission line

4.1. Optimization principle of design scheme for electric transmission line
First of all, the Internet tech is used to solve the feasibility problem of electric transmission line path to avoid subversive factors, and multiple line paths are designed, and the recommended path scheme is obtained by using Internet data analysis. Secondly, the conditions of electric transmission line in several aspects as shown in Figure 3 are clarified, and the detailed feasibility analysis of electric transmission line is formulated. In addition, in the process of preliminary design of transmission electric lines, it is necessary to clarify the construction scale, basic situation of power system, and define the end point direction of transmission electric lines, terrain along the line, construction and operation conditions of transmission electric lines and the transition scheme in the construction drawing design stage [9].

![Figure 3. Current situation and contents of electric transmission lines](image)

4.2. Meteorological condition design of transmission line
First of all, in the aspect of meteorological condition design, it is necessary to focus on the detailed investigation and demonstration of basic wind speed design, icing design and special meteorological areas. At the level of construction drawing design, it is necessary to explain the design values of temperature, wind speed and ice thickness of the combination of maximum temperature, minimum temperature, basic wind speed, icing, installation, average temperature, lightning overvoltage, operating overvoltage and checking ice wind. In addition, the Internet tech is used to sort out the hydro meteorological reports of scientific research and preliminary design, supplement the investigation conclusions of the micro meteorological areas along the line in the construction drawing stage, clarify the design requirements of meteorological sections and special sections, and the hydrological design along the line in the construction drawing stage [10].

4.3. Structural element design of transmission line
First of all, in the design level of the conductor and ground wire of the transmission line, it mainly includes the selection of the conductor and the bottom line. Among them, the wire selection uses Internet tech to determine the wire model and specification after comprehensive technical and economic comparison. The selection of ground wire is determined according to the system communication, the coordination of conductor and ground wire and the thermal stability of ground wire. Secondly, at the level of insulation coordination, it is mainly to determine the pollution and development situation near the transmission line, and confirm the environmental change factors, altitude correction, operation experience and other factors near the transmission line, so as to carry out insulator selection. In addition, at the level of lightning protection and grounding design, it is necessary to investigate the lightning activity along the line and the lightning trip out rate of the existing lines nearby, and design the lightning withstand level and lightning trip out rate of the basic tower type.

5. Conclusion
In summary, the utilization of Internet tech can effectively analyze the safety bearing capacity and safety of transmission lines, as well as the problems and hidden dangers that should be focused on in the technical level of transmission line construction, and effectively solve them. This paper analyzes
the structure and classification of electric transmission lines by studying the functions and characteristics of electric transmission lines. Based on the analysis of meteorological conditions of transmission line design under Internet tech, the function of Internet tech in the analysis of meteorological factors is studied. Through the research on the optimization of the design scheme of the electric transmission line, this paper analyzes the optimization principles and specific strategies of the design scheme of the electric transmission line.

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