The Application Discussion on Intelligent Technology in Electric Engineering Automation Control

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Abstract. Electric engineering automation control is kept in the important status of electric system. The construction of electric engineering automation control is directly related to stability of electric system operation. With the scientific development and improvement of automation level, the electrical engineering automation control gradually develops towards the intelligent direction. The intelligent application can effectively improve the overall level of electric automation control and promote overall development of electric engineering. Based on the theoretical foundation of intelligent technology, the author discusses the application of intelligent technology in electric engineering automation control.

1 Introduction

With the constant development of electric industry, the automation level is increasingly high. the intelligent technology is gradually presented in the electric engineering automation control. The intelligent technology can effectively overcome some difficulties in electric engineering automation and promote the rapid development of electric engineering. At present, intelligent technology has the great development potential in the electrical engineering field. The author will further analyze the application of intelligent technology in electric engineering automation control.

2. Features of Intelligent Technology in Electric Automation Control

The principle of applying intelligent technology in electric automation control application aims to realize control intelligence and humanization, reduce fault in control and save manpower and material resources. At present, the intelligent control has the following advantages in electric automation control by comparing with the traditional control:

A. Intelligent technology provides more convenience for electric system adjustment. The intelligent controller can use robustness and response time to realize the adjustment and control for the entire system, also effectively improve working efficiency, and enhance precision of automation control.

B. Intelligent technology enhances control precision. The traditional control mode can't accurately master dynamics of control objects for complexity of control objects, so as to take place unpredictable object factors in the control project. As a result, the model can't be well controlled for insufficient accuracy. The intelligent controller has no need to establish the object model, thus uncertain factors are reduced and precision of automation control can be enhanced.

C. The intelligent technology has the strong consistency. As dealing with different data issues, results by inputting different data are relatively ideal and meet automation control requirements. In addition, different control objects will result in diverse control effects. The controller doesn't have the control requirements for each control object, but the control effects are relatively ideal. At the same time, changes of some control objects will make control effects fail to reach the relevant requirements. As a result, in the automation control setting, it must begin with the actual situations. As evaluating the control, we can't blindly deny the automation control. It is necessary to find out specific causes for problems and solve it.

3. Specific Application of the Intelligent Technology in Electric Engineering Automation Control

A. Application of the Intelligent Controller

Compared with the traditional controller, the application of the intelligent controller leaves out the modeling design process of the controlled objects, thus it can avoid from numerous uncontrolled factors in the initial stage, so as to improve the control precision of intelligent automation technology in electric engineering automation control. In addition, by virtue of constantly changeable robustness and controlling fall time and response time to automatically adjust control schedules of the system, the automation control of electric equipment can provide the favorable safeguard. Furthermore, the intelligent controller application is reflected in the adjustment control process of electric equipment. In terms of the intelligent controller, changes of relevant parameter data can realize self-adjustment, thus the field exploration of professionals has the lower requirements. According to the electric power principles, electric parameter voltage U, current/power P and energy W can be directly calculated as follows:

$$U=\sqrt{\frac{1}{T}\int_0^T u^2(t)dt};I=\sqrt{\frac{1}{T}\int_0^T i^2(t)dt};P=\frac{1}{T}\int_0^T u(t)i(t)dt;W(\tau)=\int_0^T u(t)i(t)dt \quad (1)$$

As detecting the current and voltage signal, electric quantity mutual inductor can't collect without time discontinuousness. Most of mutual inductors collect N voltage and current data in a fundamental wave period, thus the formula 1 can be converted into:

$$U=\sqrt{\frac{1}{N}\sum_{k=1}^{N}u_k^2};U=\sqrt{\frac{1}{N}\sum_{k=1}^{N}i_k^2};P=\frac{1}{N}\sum_{k=1}^{N}u_k i_k \quad (2)$$

The calculation of electric quantity applies the recursion formula in mathematics:

$W_j=W_{j-1}+u_j i_j \Delta t$ (Formula 3)

In the formula, Wj and Wj-1 can calculate the energy accumulation from the beginning of energy counting to j^{th} and $j-1^{th}$ of sampling. uj and ij are the instant voltage and current value of j^{th} sampling. Δt is the sampling interval. The calculation of power S and power factor cosφ is shown as follows:

$S=UI$; $\cos\Phi=P/S$ (Formula 4)

In terms of dealing with different data, the intelligent controller's control effects are different and this is determined by the controlled objects. In the actual operation process, when the controller controls some objects, it can be found that no action is taken, but the controlled objects still can reach the favorable control effects. However, it is worth noting that the controlled objects are still changed, which make control effects hard to reach the predicted target. As a result, in the process of designing the electric automation system, it must be based on the specific systematic design principles to comprehensively analyze different controlled objects. Rational selection or design intelligent controller can enhance control precision for all kinds of electric equipment.

B. Application of the Intelligent Technology in Fault Diagnosis and Electric Engineering Design

By analyzing the electric engineering automation control system, it actually is a machine system, thus it inevitably will break down in operation process. The application of intelligent technology can timely diagnose and debug fault for automation control system, so as to minimize relevant loss. By taking the transformer fault as an example, when transformer in the electric system breaks down, the application of the intelligent automation control system can regard the leakage oil decomposition gas of the transformer as the media to powder the leakage oil and troubleshoot and confirm the fault position, so as to help workers to propose scientific overhauling scheme and maintain normal operation of relevant electric equipment.

The purpose of over voltage protection is to prevent too high busbar voltage from damaging the capacitor bank. As disconnecting the capacitor tank, reactive trend can't be changed at the same time, so as to reduce busbar voltage.

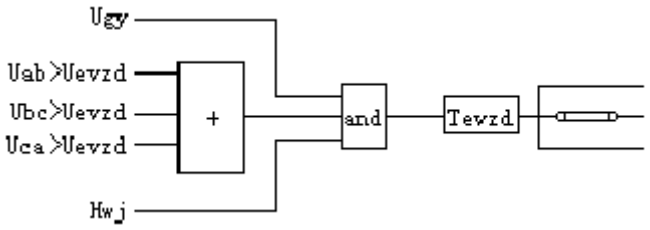

Fig.1 Schematic Diagram of Over Voltage Protection

The zero sequence voltage mainly judges the difference voltage of unbalanced voltage or open delta form. The schematic is shown in the figure:

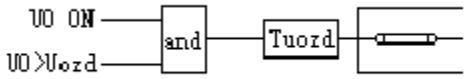

Fig.2 Schematic Diagram of Zero Sequence Voltage Protection

There is the internal fault protection in the capacitor tank, which is composed of multiple capacitors in series and parallel. When the insulation in the single capacitor breaks down, the respective configured fuse should be protected in a single one. The rated current of the fuse should 1.5-2 times of the single fuse's rated current.

The application of the intelligent technology in electric engineering automation control design mainly conducts the trial test for the main transformer, capacitor, mutual inductor and outlet line of their control, protection, status monitoring and system operation. The specific situation is shown as follows:

The main transformer, capacitor and mutual inductor relay protection are shown as follows:

Tab.1 Insulation Testing

	AC voltage	AC current	DC power	Tripping and closing	On-off input	Signal loop	Automatic dispatching interface	Over the ground
AC voltage(Group A)	——	150MΩ	100MΩ	160MΩ	50MΩ	100MΩ	120MΩ	90MΩ
AC current(Group B)	——	——	100MΩ	200MΩ	50MΩ	120MΩ	125MΩ	80MΩ
DC power(Group C)	——	——	——	200MΩ	50MΩ	120MΩ	130MΩ	70MΩ
Tripping and closing(Group D)	120MΩ	125MΩ	——	120MΩ	126MΩ	128MΩ	90MΩ	120MΩ
On-off input group D	135MΩ	250MΩ	230MΩ	180MΩ	——	120MΩ	140MΩ	50MΩ
Signal loop(group E)	200MΩ	270MΩ	255MΩ	200MΩ	125MΩ	——	150MΩ	60MΩ
Automatic dispatching interface	170MΩ	180MΩ	250MΩ	160MΩ	180MΩ	160MΩ	——	75MΩ

On-off quantity input loop detection:

Tab.2 Functional Pressing Plate Inspection

No.	On-off quantity name	Terminal number	Protection plate status	Management plate status	Results
1	Differential protection input	2B29-2B7	1	1	√
2	Zero sequence differential protection input	2B29-2B26	1	1	√
3	I side alternating backup protection input	2B29-2B17	1	1	√
4	I side ground zero sequence protection input	2B29-2B22	1	1	√
5	I side unground zero sequence protection input	2B29-2B13	1	1	√
6	II side alternating backup protection input	2B29-2B9	1	1	√
7	II side ground zero sequence protection input	2B29-2B10	1	1	√
8	I side unground zero sequence protection input	2B29-2B14	1	1	√
9	III side backup protection input	2B29-2B8	1	1	√
10	IV side backup protection input	2B29-2B12	1	1	√
11	Public winding backup protection input	2B29-2B11	1	1	√
12	Withdraw I side votlage input	2B29-2B16	1	1	√
13	Withdraw II side votlage input	2B29-2B18	1	1	√
14	Withdraw III side votlage input	2B29-2B19	1	1	√
15	Withdraw IV side votlage input	2B29-2B15	1	1	√

Tab.3 Output Connection Inspection of Tripping and Closing

No.	Tripping and closing output name	Equipment terminal number	Cabient terminal number	Results
1	Tripping I side switch	1A3-1A5 , 1A7-1A9 , 1A11-1A13 , 1A15-1A17	1CD1, 1CD23	√
2	Tripping II side switch	1A19-1A21, 1A23-1A25, 1A27-1A29, 1B1-1B3	1CD3, 1CD25	√
3	Tripping III side switch	1B17-1B19	1CD17, 1CD39	√
4	Tripping I side buscouple	1B5-1B7, 1B9-1B11, 1B13-1B15	1CD13, 1CD35	√
5	Tripping III and IV side section	1B25-1B27	1CD21, 1CD43	√

The application of the intelligent technology in electric engineering design is mainly reflected in CAD technical development. To be specific, it is the application of genetic algorithm and expert system in electric product design. The genetic algorithm has the higher calculation precision, thus it is extensively applied in electric product design. It enhances product stability and also enhances product innovation degree. In expert system, the electric equipment fault has the significant non-linearity and uncertainty, but there is a close relation with various omens before breaking down. Expert system uses the artificial intelligent method and technology to troubleshoot the electric system fault by using the neural network and fuzzy logic. This effectively lengthens the lifetime of electric equipment and enhances production efficiency of equipment.

C. Application of PLC

PLC is the programming logic controller. The application in electric automation control is mainly reflected in electric system automation. In the thermal power plant, various technical processes of the auxiliary system give priority to switch control and sequent control. The constant improvement of productive index in electric industry enables relay in large-scale electric enterprise auxiliary system to be replaced by PLC. By virtue of PLC control system, it not only can realize the control for certain technical process, but also can coordinate the production work of the entire electric production department and enhance production efficiency. On the other hand, by analyzing cola handling system of the electric enterprises, it can be observed that in addition to auxiliary system, it also includes coal uploading, coal storage, coal downloading and coal matching system. The master station layer and remote IO station, as well as sensor on the spot are composed of the coal control system. The master station composed of PLC and man-machine system plays a crucial role on system control precision. The central control room gives priority to automatic control of PLC. Workers can realize the real-time monitoring for the system in line with the system display screen. In addition, after applying PLC, the object components in the power station control system are replaced by soft replay. This not only enhances system reliability, but also helps the power supply system to realize automatic switch and enhances precision for power supply system.

4. Conclusions

In the paper, the electric engineering automation control was used as the research background. The intelligent technology was considered as the research object. By simply analyzing the application of the intelligent technology in electric engineering automation control, the author conducted the systemic discussion and analysis for application of the intelligent technology in electric engineering automation control from intelligent controller, fault diagnosis, electric engineering design and programming logic controller. Research results indicate that the intelligent technology can effectively enhance working efficiency of different electric equipment, reduce fault occurrence, enhance fault maintenance efficiency, and finally promote sound and stable development of the electric engineering industry.

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