Functions and General Structure of Fault Diagnosis System Software

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Abstract. Referred to in the fault diagnosis of power grid mainly refers to the transmission network and transmission network bears an important task of power transmission, power plant and terminal user ties, is one of the most important parts of the power system. Long term exposure to natural environment in the transmission network, and wide coverage, complex structure, due to natural disasters or operational failures and other factors, the failure is inevitable. The dependence of modern society on the electric energy is increasing, and the short time of transmission network fault can cause great loss. When the power grid is in a fault, the fault recorder can be transmitted to the dispatching center through the public telephone network or other channels. The rich recording information provides the basis for the further diagnosis.

Introduction

As an important part of the whole “regional power grid dispatching decision support system”, the purpose of the power grid failure diagnosis and recovery system software is to serve for the dispatch operator. In the situation of the failure, it can assist the dispatch operator to judge and deal with the fault with the fastest speed. According to the status of the fault processing software in the whole decision system and the specialty of fault treatment, when the fault occurs in the system, decision system should be preferentially transferred to perform fault processing functions and cannot be shielded by the other computing programs.

The diagnostic software make meet the field requirements and conform to the actual situation as a starting point. On the basis of analyzing all kinds of characteristics about the faults in the power system and according to the experience and the process of dealing with accidents by the general scheduling personnel, we construct the whole structure of the fault diagnosis system.

Power System Fault and Scheduling Process

The Classification of Power System Fault. The Failure of the Main Parts. It includes the short-circuit fault and disconnection fault of the line, the bus and the transformer and internal abnormality and failure of the main transformer. The Abnormality and Failure of the Main Equipment. It includes the abnormality and failure of the high voltage circuit breaker, isolating switch, current transformer and voltage transformer, capacitor and reactor and other equipments. The Failure of the Secondary Equipment. It includes the failure of DC system, the failure of secondary wiring and relay protection and safety automatic device.

(4) The Abnormality of the System Frequency

(5) The Abnormality of the System Voltage

(6) The System Oscillation

(7) The System Separation

The Diagnosis Process of Dispatcher with Power Grid Fault. When a fault occurs in power system, and the circuit breaker trips, the diagnosis process of dispatcher for the system fault can be generally described as follows. First of all, according to the tripping condition of the circuit breaker, we open CRT of the related station in the SCADA system and contrast the deflection of the simulation plate so as to determine whether the system has had a failure. After we confirm the system has had an accident, we use the relevant information on the SCADA to search for the related equipment about the power failure in the process of the accident and make the preliminary

judgment of the failure according to these equipment. If there is only one equipment with the failure in the process of the failure, the equipment is the fault equipment. If multiple equipments have the power failure, the dispatcher will analyze the possible reasons for the power failure of each equipment according to the principle analysis of the cooperation within the protection(for example, weather it conforms to the characteristics of the switch trip field personnel to check the protection action signal after the operation of the main protection, the characteristics of tripping about the operation of the backup protection and the characteristics of the switch trip after the operation of fault protection). With the above analysis, we give a preliminary judgment on the fault equipment.

After the field personnel check the signal of the protective operation and make a report, we finally confirm the location of the failure point according to the signal of the protective operation. If there is a failure within the substation, we should be able to check the relevant equipments to find whether they have flashover marks.

The Basic Requirements of the Power Grid Fault Diagnosis System Software

It has the same requirement with other advanced application software in the decision system. It it operated on the unified support software platform. It adopts the same graph structure, real-time library and a part of history library so that it can share network topology model, parameters and data, and maintain data consistency. Graphical hints. It uses different colors to show the fault components or equipments and the possible recovery path. It establishes the faulty diagnosis and restoration and provides the maintenance and modification methods for the rule base and friendly user interface. The maintenance process of the database does not affect the operation of software applications. It realizes the two kinds of operation modes, namely the real tense and research tense. In the state of the real tense, it fetches the data from the fault information system and SCADA system. In the state of the research tense, it fetches the data from DTS or uses manual placement alarm.

(1) It uses the fault information system or the dispatcher to trigger the operation of power grid fault diagnosis system software. The dispatcher can also be activated by a button, and then it can run the system recovery processing software.

(2) In the situation of incomplete information, it hints the dispatcher to input those more detailed information so as to determine the fault components further.

The Interface with Other Application Software

It establishes the data interface with SCADA system, and according to the requirement it obtains the real-time data and historical data. The data got from the SCADA system mainly includes the real-time and historical value of the switch, the breaker switch, and remote electricity quantity, SOE and PDR information. It establishes the data interface with the fault information system, and according to the requirement it obtains the real-time data and historical data. The data got from the fault information system mainly include the status of the relaying plate, protection action and disturbance information, the report of trip protection and the fault data recorder information. It establishes the data interface with DTS data to realize the data sharing and the mutual transfer. The information got from DTS is the same with the data got from SCADA system and fault information system (DTS may not provide for the protective disturbance and fault recorder information). It recovers the software interface with power grid failure.

The Basic Function of the Power Grid Fault Diagnosis System Software

The Starting Detection of the Power Grid Fault Diagnosis System Software. We make the fault information collected in the fault information system and the SCADA system be consolidated into the format which is easy to be diagnosed and judge whether we start the core fault diagnosis process with simple logic. If we judge that it is not the starting core fault diagnosis process but the network structure changes, we should only operate the initialization program, and show to revise and update the network knowledge of the diagnostic procedure.

The Diagnosis of the Related Information about the Point of Failure. The Location of Fault Point. According to the information provided by the complete degree, we can make the fault point be positioned to the area, components or equipment.

If fault information system can only provide the action information of switch.

—For simple faulty, we can position to the components;

—For complex faulty (the switch, or the protective action resistance, error action), we can only be positioned to blackout area, and the system can calculate the failure probability of each component in the blackout area and line up from big to small according to failure probability.

If fault information system can provide the action information of the switch and the protector.

—For the situation of the switch action resistance and error action, we can position to the components;

—For some situations of the protector action resistance and error action, we can position to the components,

If fault information system can not only provide the action information of the switch and the protector, but also provide the fault recorder information. For the complex failure, we can position to the components precisely.

If fault information system also can provide the abnormality and failure information; we can make a further diagnosis till the equipment with the basis of positioning to the components precisely.

Judging the Types of fault (the breakdown, ground fault ground fault or phase fault)

If fault information system can only provide the action information of the switch and the protector; we can confirm the possible types of fault.

If fault information system can provide the report about the trip protection and the fault recorder information; we can confirm the types of fault precisely.

Judging the Failure Property(instantaneous fault or permanent fault)

If fault information system can only provide the action information of the switch and the protector, we can confirm the possible property of fault.

If fault information system can provide the fault recorder information, we can confirm the types of fault precisely.(We can provide the information of automatic circuit recloser and we can also affirm the possible fault property.

The Overall Structure of the Fault Diagnosis Expert System

The fault diagnosis system is a part of the whole “Regional power grid intelligent dispatching decision support system”, so its whole structure should comply with the functional requirements of whole decision system to construct. The advanced application software of scheduling decision system is constructed based on the data platform. We use the intelligent dispatching decision machine to coordinate each software to operate with what kind of time order and combination mode so that we make it be intelligent and automated when we analyze operation state of power system. It can provide reasonable analysis results for the dispatchers so as to make the system be able to realize the safe and economic operation in the true sense. Because the fault diagnosis system belongs to the transient analysis, only the power grid has an accident, it can be operated and analyzed. What’s more, at the same time, the fault information volume is very large. In order to shorten the time of fault diagnosis, we need more efficient information processing means and effective storage way, and these jobs are dealt with by the data platform located in the upper layer. We can combine with the whole structural design of intelligent decision system to deal with.

Conclusion

We first analyze the types of the various faults and abnormalities, and the basis and process of analyzing the failures by the dispatcher in the actual power system in This paper. Then, according to the field requirements of Lanzhou local dispatching and starting from the whole situation of regional power grid online intelligent decision support system we analyze the relationship between

the diagnostic software and the advanced application software of other various parts to complete the overall functional design and structural design of fault diagnosis system. The design has been smoothly passed the acceptance at the end of 2003. After we have analyzed the information demand of the fault diagnosis system and the function requirement of diagnostic software in details, we can realize our online intelligent fault diagnosis expert system specifically.

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