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Development of Power System Relay Protection Experiment in E-Learning

Gangjun Zhai^{*}, Ying Wang, Longzhi Li, Huawei Miao

Dalian University of Technology, Dalian, 116023, China

Abstract

The learning of power system relay protection requires some practical drills. Laboratories have therefore been built in campus and the experiment teaching has been carried out. However, in distance education, the actual presence of the students in the laboratories is practically impossible. To overcome this problem, power system relay protection experiment in E-learning has been developed. An experiment system of relay protection was developed and the E-learning links were designed. It enables autonomous, interactive and collaborative learning of relay protection experiment through the Internet. In fact, students can learn at any time any place. This system will therefore enhance students' experimental skills and improve experimental teaching quality.

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1. Introduction

With the development of information and network technology, E-learning, as a learning mode based on resources, changes people's mode of thinking and learning greatly, and makes education developed towards networked, virtual and individualized. Information construction of teaching resources using modern information technology has become an important teaching means in modern education [1]. With the global sharing of digital learning resources, the emergence of virtual classrooms and virtual schools, as well as the development of modern distance education, learning has broken the restriction of time and space, and lifelong learning has become possible.

^{*} * Corresponding author. Tel.: +86-0311-8799-4277.

E-mail address: course2@dlut.edu.cn.

Power system relay protection is a major subject in a power system course. Within the power industry, relay protection is an important measure to guarantee safe, stable and reliable operation of power system. In order to cultivate students' ability of analyzing and solving practical problems, power-system relay protection laboratories have been built in campus and the experiment teaching has been carried out. However, in distance education, the cost and difficulties of providing field experience to the students have limited the teaching of power system relay protection. Thus, making full use of advantages of multimedia and network technology, developing power system relay protection experiment in E-learning has become an imperative.

2. Development of Relay Protection Experiment System

2.1. Development of Relay Protection Experiment

(1) The teaching mode

Due to the advancements in Internet and Web technologies, virtual experiment has been widely adopted in distance education. The realization of virtual experiment can effectively solve the difficulties of experiment funding, space, equipment, etc. A virtual demonstrate experiment is well-designed by the teacher, according to the experiment phenomenon. By using modern multimedia technology, the whole experiment process in a real environment is shot, and then made into a demonstrate video.

Demonstrate experiment has the characteristics of vividness, truth and objectiveness [2]. In the demonstrate video, the experiment process is vividly presented with the real equipment and continuous images. Following the video, students are able to observe, operate and complete various scheduled experiment projects as in the real environment. The demonstrate experiment will therefore allow students to understand the theory better, enhance their basic skills and practice ability.

(2) The contents arrangement

In experiment contents arrangement, basic concepts, basic principles, basic analysis and design methods have been emphasized. Traditional relay protection experiment mainly covered the characteristic testing of relays and the experiments of unit protection. With the development of new technology of relay protection, microcomputer relay protection has been widely applied and occupied a leading position in power system [3]. Thus, the comparison and application of electromagnetic protection and microcomputer protection should also be emphasized.

As shown in Table 1, characteristic experiments of current relay, voltage relay, time relay, auxiliary relay, as well as power direction relay and differential relay are opened. Besides, experiments of automatic reclosing devices and three-section current protection in both electromagnetic protection and microcomputer protection ways are arranged.

Table 1. Experiment Item of Relay Protection

Experiment Item	Property
Electromagnetic Current Relay and Voltage Relay Experiment	Validation
Electromagnetic Time Relay and Auxiliary Relay Experiment	Validation
Power Direction Relay Experiment	Validation
Differential Relay Experiment	Validation
Automatic Reclosing Devices Experiment	Comprehensive
Three-section Current Protection Experiment	Comprehensive

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