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Application of Virtual simulation in Expermient Teaching of Optical Fiber Communication

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Abstract: Optical fiber communication is an important professional course. Experimental teaching is an important part of the course. In view of the problems in the experiment teaching, the construction of experimental teaching content based on simulation software is put forward in this paper. It is shown that the method is effective and applicable.

Keywords: Simulation; optisystem; Optical Fiber Communication.

1. Introduction

Optical fiber[1] is a kind of wired transmission medium, which has the advantages of fast transmission speed, large capacity and good confidentiality.In the network, most of the data is transmitted by optical fiber.Therefore, it is very necessary for communication engineering students to learn the principle of optical fiber.The knowledge of electromagnetic fields and electromagnetic waves, circuits and communication principles is covered by the course of Fiber-optic communication.So, it is difficult for students to learn the course. In order to learn it better, it is necessary to set up an experimental session.

2. Problems in Experimental Teaching of Optical Fiber Communication

Expensive experimental equipment

The price of optical devices is high. It is prohibitively expensive to design experimental fiber-optic communication systems. It is not suitable for undergraduate teaching. During the experiment, operational errors can result in large losses. There are higher requirements for students in the experimental operation. Therefore, a cheaper experimental solution is needed.

Insufficient experimental skills

In order to avoid damage to the optical equipment, the built fiber communication system is packaged in a box. The experimental solution is a good demonstration of the

fiber-optic communication system. However, it is difficult for students to carry out secondary development. It is hard to get exercise for students' hands-on ability. The original intention of setting experimental is violated. It takes The students takes a small amount of time for completing the experiment . Worse, students still don't understand the principle of experimentation.

3. Measures to solve the problem

According to the theoretical teaching content, the experimental project should be reconstructed. The experiment schedule arranged reasonably according to the teaching content. In the course of theoretical teaching, the principles of optical transmission, optical devices and optical fiber communication system are taught in turn. Similarly, the experimental items should correspond to it.

It is important to choose the right fiber communication lab solution. Using software simulation is a good way, such as literature [2][3]. Software simulation not only avoids the loss of experiment, but also helps students understand the theoretical knowledge. Optisystem is a widely used simulation software for optical fiber communication.

4. Application of OptiSystem Simulation Software in Optical Fiber Communication Course

Optisystem is an optical communication system design software from Optiwave, Canada. optical communication and photonics design suite is provided by optisystem. It enbales students to test the optical communication system constructed by the suite[4].

This article takes an example to introduce the application of this software in optical fiber communication experiments. After learning the principles of optical system , it is suitable for students to do it. In the SMF System, the rate is 10 Gbps, the encoding method is NRZ, as the picture 3.1shows[5]. The length of the optical fiber is 30Km. In order to amplify the optical signal, EDFA is adopted. The wavelength and power of the optical signal are 1310nm and 15mw. The role of Mach-Zehnder modulator is to convert electrical signals into optical signals. The role of PIN is the opposite. In order to observe the waveforms of optical signals and electrical signals,Oscilloscope and spectrum analyzer are set in the experiment. The time domain waveform and the spectrogram are shown in Figure 3.2, 3.3, respectively.

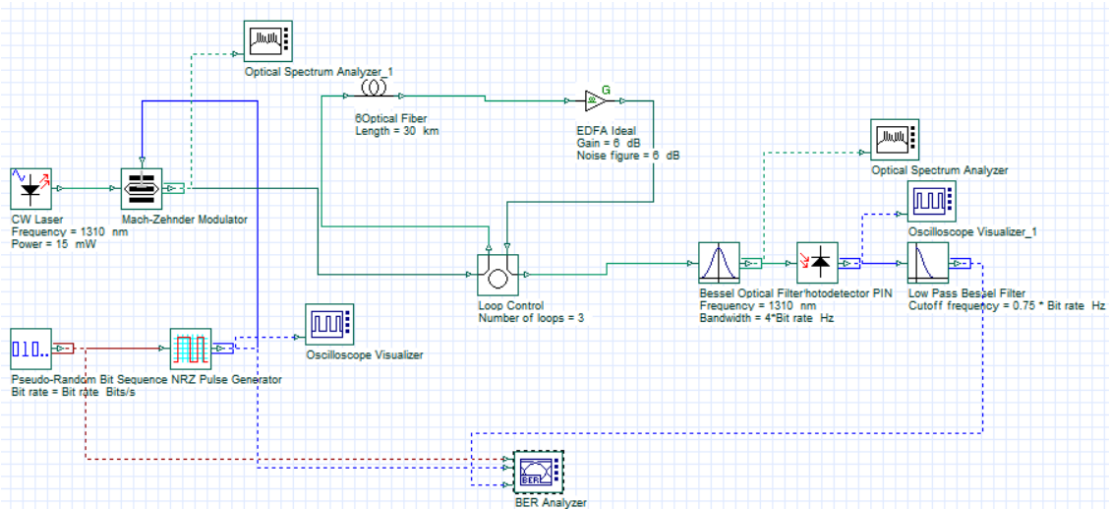
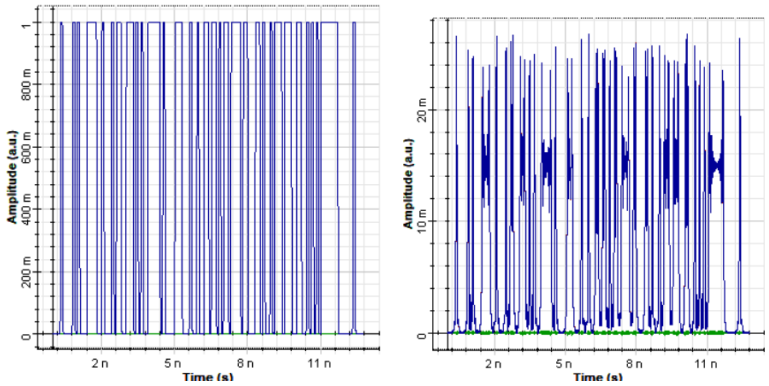
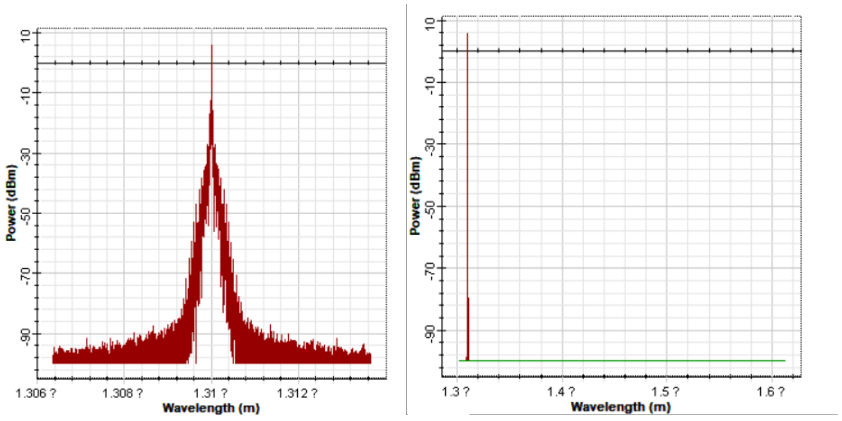


Fig 3.1 Optical fiber communication system diagram



A.send signal B.receive signal

Fig 3.2 electric signal time domain waveform



A.send signal B.receive signal

Fig 3.3 optical signal time domain spectrogram

Through this experiment, students can fully understand the fiber-optic communication system. By changing parameters, such as fiber length, EDFA gain, signal wavelength, the students can learn the effects of attenuation on optical signal transmission based on changes in the signal.

5. Conclusion

Using the simulation software, the purpose of learning and analyzing the optical fiber communication system is achieved. Not only exercise the students' hands-on ability, but also deepen the theoretical knowledge. It has been proved that this teaching method can reduce the cost of experimental teaching and improve the teaching effect

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