THE RESEARCH ON TEMPERATURE PRECISION INFLUENCED BY FIBER LOSS BASED ON DISTRIBUTED TEMPERATURE SYSTEM IN CABLE MONITORING

LIU Qianqian, **WANG** Wei, (China), liuqianqian@sgepri.sgcc.com.cn, Wangwei3@sgepri.sgcc.com.cn

ABSTRACT

The Distributed Temperature System based on Raman scattering is introduced in this article, and the precision of temperature measuring is analyzed. In connection with the unavoidable fused fiber splice in actual cable operation monitoring project, related analysis is given. The impact on accuracy by splice loss is analyzed in connection with some device, and is taken into account in project design and implementation in practice. The monitoring proved that the precision of temperature measurement is not affected within designed splice loss and the current system has been successfully applied to running cables and achieved good results.

KEYWORDS

Distributed; fiber optical temperature measurement; precision; splice

AUTHOR NAMES & AFFILIATIONS

LIU Qianqian,

Wuhan WHVRI Electrical Power Science and Technology Co., Ltd. China. liuqianqian@sgepri.sgcc.com.cn

WANG Wei,

Wuhan WHVRI Electrical Power Science and Technology Co., Ltd. China. Wangwei@sgepri.sgcc.com.cn

INTRODUCTION

Distributed optical fiber temperature measurement system is a recently developed real-time measurement with the Stokes light in the room temperature distribution sensing system. It is a distributed, continuous, functional fiber optic temperature sensor. In the system, optical fiber is both the transmission medium and sensing media, using the temperature effect of fiber back Raman scattering (the Anti-Stokes light), real-time temperature measurement can be made where the fiber locates, using optical time domain reflectometry (OTDR) , precise positioning of measurement points can be confirmed. The system has advantages such as explosion-proof, anti-corrosion, anti-electromagnetic interference and high pressure, and it can achieve fast real time multi-point temperature and position, etc., so it is widely applied in many fields.

Longer distance performance is what the instrument pursues. In actual application, especially in the cable monitoring, the laying of optical cable as long as several kilometers would probably cause unavoidable fused fiber splice because of the producing length or actual construction difficulties, which can bring splice loss and reduce the precision. Although the instrument has already considered some loss budget, overmuch loss would still cause the drop of monitoring precision. Therefore, how much the splice loss influence the system precision is what we should consider in actual projects.

1 DISTRIBUTED OPTICAL FIBER TEMPERATURE MEASUREMENT SYSTEM AND ITS WORKING PRINCIPLE

1.1 Principles of Optical Fiber Temperature

The mechanism is based on fiber optic temperature effect of back Raman scattering: when the laser pulse interacts with optical fibers during the spread, scattering occurs in various forms, such as Rayleigh scattering, Brillouin scattering and Raman scattering. Raman scattering is composed of two different wavelengths light, which is a longer wavelength than the light source of light, known as the Stokes light, and a short wavelength light than the light source, called Anti-Stokes light. The wavelength offset is decided by the optical fiber materials property, and Anti-Stokes light is temperature-sensitive, and its intensity changes with temperature.

1.2 System Components

Distributed optical fiber temperature measurement system block diagram in Figure 1 shows the basic functions.

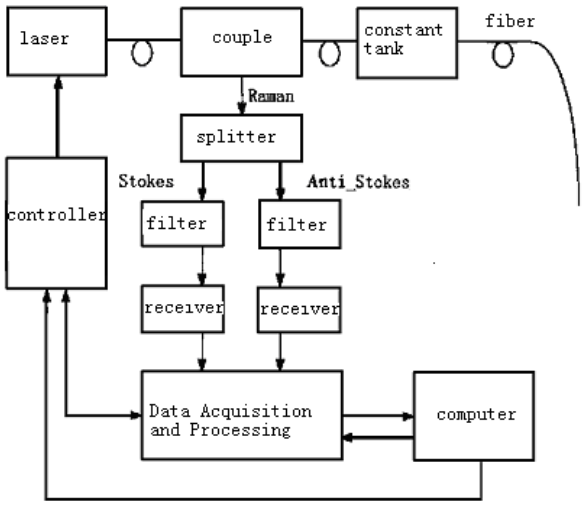

Figure 1 Basic block diagram of temperature measurement system

The laser light pulse output from pigtail will be through the optical coupler to enter a period of optical fiber placed in a constant temperature bath (for system calibration), and then into the sensing fiber. When the laser scattering occurs in optical fiber, the temperature information carried by the Raman backscattering light returns to the optical coupler. Splitter consists of two optical filters with different