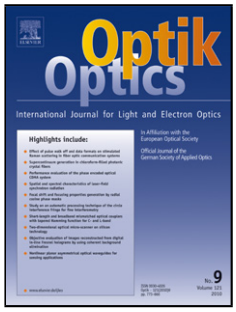

Title: A New Detection and Recognition Method for Optical Fiber Pre-warning System

Author: Qu Hongquan Zheng Tong Pang Liping Li Xuelian

PII: S0030-4026(17)30242-5
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2017.02.093
Reference: IJLEO 58909

To appear in:

Received date: 6-12-2016
Accepted date: 25-2-2017

Please cite this article as: Q. Hongquan, Z. Tong, P. Liping, L. Xuelian, A New Detection and Recognition Method for Optical Fiber Pre-warning System, *Optik - International Journal for Light and Electron Optics* (2017), http://dx.doi.org/10.1016/j.ijleo.2017.02.093

A New Detection and Recognition Method for Optical Fiber Pre-warning System

Qu Hongquan[1], Zheng Tong[1], Pang Liping[2,*], Li Xuelian[1]

[1]College of Electrical & Information Engineering, North China University of Technology, Beijing 100144, China

[2]School of Aeronautic Science and Engineering, Beijing University of Aeronautics and Astronautics, Beijing 100191, China

*Correspondence should be addressed to Pang Liping, plp_ncut@163.com.

Abstract

Optical Fiber Pre-warning System (OFPS) is widely used in several fields. But there are massive vibration data which is varied in complicated surroundings of OFPS. This will be a challenge to locate and identify the vibrations accurately. A new detection and recognition method is established in this paper. The method consists of two parts, detection and recognition. First, the presented detection method is based on the theory of Constant False Alarm Rate (CFAR) and Dilation and Erosion (DE). The former can detect the harmful intrusion signals and the latter can eliminated some isolated interferences. Harmful intrusions can be located and the data quantity for further recognition is reduced by using the detection method. Second, a multi-feature recognition method is established in this paper to determine the type of the intrusions. Typical signal features, such as Average Magnitude Difference Function (AMDF), Pitch Period (PP) and Duty Cycle (DC), are used to identify the vibrations generated by vehicles, machine and artificial intrusions. In order to check out the feasibility and validity of the proposed method, several tests were carried out in Rushan of Shan Dong, China. The results show that the proposed detection and recognition method can locate the harmful intrusions and identify the type of vibrations effectively.

Keywords: OFPS, Detection and recognition method, CFAR, DE, Feature extraction.

Introduction

The OFPS is mainly used to pre-warning damage events in pipeline transportation. These damage events may cause large loss of life and property [1-2]. The environment of pipeline is varied, which includes river, swamp, road, desert and so on. Hence, the accurate location and recognition of harmful intrusion signal becomes a difficulty for OFPS.

There are some studies for OFPS both here and abroad. For example, there are some scholars extract vibration signal by reflection and interference [3-8]. The Dr. Zengguang Qin in Ottawa