Fiber Optics in Sensing and Measurement

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Abstract:- Optical techniques to measure, interference, geometry, spectral and polarization, has long been used in material measurements and environmental assessment. Implementation of fiber lend these basic concepts also more flexible. Fiber-optic technology, and 30 years, has made scientific measurements made important contributions. This article describes these contributions while, in fact, far more than these highlights the important conceptual advances in fiber optic technology and appliaton breadth there have been early to do a perspective. There's even more imaginative research, application guided wave optics and the apparent opportunity arises and challenging measurement requirements, recovery from the micro characterization of cellular biochemistry art. Index Terms acoustic measurements, chemical analysis, de placement measure, gyroscopes, mechanical measurement, optical fiber measurement applications, optical sensors, the measurement of the power system, temperature measurement.

1.INTRODUCTION

Fibre undoubtedly have a profound impact on the communications industry [1]. This can be traced back to Kao and Hockham, and Simon and Spitz's seminal paper [2],

[3], who basically appreciates the early to mid-60s along the optical signal can be glass or quartz fiber may be lower than experienced a loss coaxial copper cable transmission. Further, unlike copper, the skin effect which increases the loss of the baseband modulation frequency can be maintained for all the possible modulation frequencies, the loss of the fiber. After a child, Dyott [4] noted that the transmission characteristics for silicone zero dispersion area. The rest is well-documented history of brilliant package at Hecht's book [1]. But fiber is not new in 1965 fiberglass has appeared in ornamental lamps and DIELEC-TRIC waveguide basic idea is perfect. Use fiber to guide light, and from a place where it is carried out measurements have emerged from the concept to the PRAC- Atlantis. The first patent application has been made of fiber-optic sensing over and has become a temporary product [5] described in the literature. Around the same time, innovative intelligence to facilitate Snitzer, with the phase-modulated optical fiber to transmit the proposal

Another important class -The base signal [6] of the optical fiber sensor. So this brief article will introduce per spective mainly for research, development history, and the optical fiber sensing technology APPLICA, of evolution. From the early beginning, almost 35 years ago, fiber optic sensors (OFS) Community infected happiness communication, and by the mid-1970s to the early 1980s that OFS technology is the solution to all problems. Exudation realism, though perhaps a bit slow, and now we know there areas of practical application, but there are still interesting and relevant issues left before lifting the research community.

2. Sensor Technology

Sensing and measurement is a specialized art. Sensor tech nologies is a specific application. It controls your central heating thermometer switch is totally inappropriate for the cooling system to control the car. All sensors work in niche markets. Sensing mechanism is based on literally dozens of interfaces to electronic

signal conditioning physical and chemical phenomena, through dozens of custom-designed protocol. Insiders thus greatly chaos mented-A while setbacks, challenges and satisfaction of those in their origin. Therefore, the optical fiber sensor, which is conceptually related to the optical fiber is orthogonal to the communication system of a very large number of substantially identical configuration and components. In practice, there is very little spin-off from the communications industry to sensor technology. The fiber itself, a number of wave guide elements, some, but not all, of the connector, and some, but not all, of the source and detector are common elements. Envisaged to achieve the main part of the wave guide elements around the necessary mechanical and electronic angle -tronic infrastructure optical fiber sensing technology. Specifically, the package is a huge challenge, indeed the case for all sensing technology.

Sensing technology there is an important common feature. This is actually the use of all physical and chemical phenomena in the transduction process is temperature-sensitive. Most MEA-surements do not care temperatures. Therefore, most of the sensor and measuring system must correct temperature. It is already certain marks fiber sensing technology giants in the process, generating solutions, and close to the perennial problem of different de-grees with grace and wisdom.

3. Fiber optic sensor technology: The Basics

In the optical fiber sensor is shown schematically in Fig. The basic element 1 is simple. Optical fiber modulator is taken to re-use, and by the modulation of Gion physical, chemical or biological phenomenon in which light is modulated and transmitted back to the receiver, the detection and demodulation. At this time, if there is between the signal of interest and PHE-nomenon of the demodulated one relationship. Have achieved a viable optical fiber sensing technology two major problems:

1) to ensure that the one to one relation to the measurement signal and the PA-rameter between demodulated;

2) match in the application of technology cost and performance phase.

The first of these is a simple one, and despite the impact of the fiber from the modulation area, debris tions with temperature and time and temperature effects on the modulation processing characteristics of the source and the detector are very important.

4. THE FOTONIC SENSOR: INTENSITY MODULATED SYSTEMS

The Fotonic sensor is described exhaustively in [5] and was patented somewhat earlier. It is based (Fig. 2) on bifurcated fiber bundles.

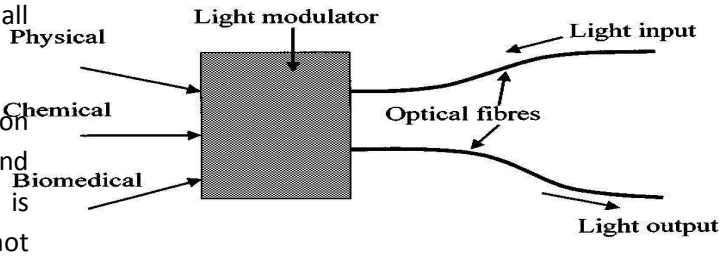

Fig. 1. Basic functions of the optical sensor.

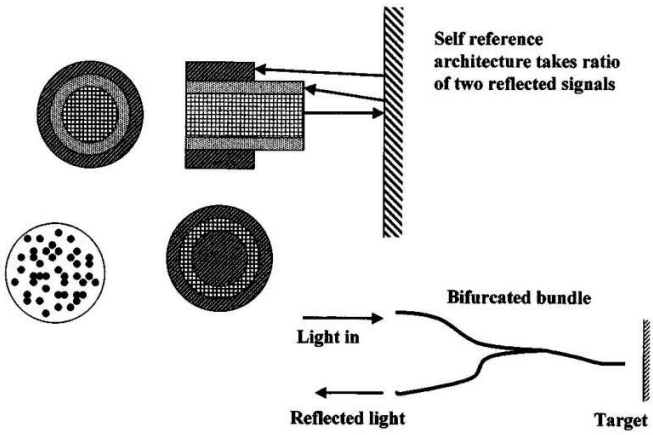

Fig. 2. “Fotonic” sensor measuring the position of a reflector relative to a fiber (bundle) end.

The basic idea is simple. Receiving the light beam and a fractional emitting element EL- packets sent between the statements of this reflector and the beam separator depends among themselves, and at a small angle of rotation of the first approximation, independent of the object, from an incandescent bulb the amount originally envisaged sensor par ticularly high numerical aperture fiber evenly ILLUMI- light through NAT.

Fifth, the use phase: hydrophone and gyroscopes

5. USING PHASE: HYDROPHONES AND GYROSCOPES

Interference is one of the favored tool for optical, many versions have been incorporated into most interference optical fiber sensing technology. The Fotonic sensor, which is based on a very simple concept, never really entered the OP- Tikal literature. This is ten years later became the subject of the optical fiber sensor system, the single-mode optical fiber by the temperature, the phase delay of the pressure dependence, and the strain will become apparent [8] [9] - although this presence of people are in some ways simpler, but has now been almost completely abandoned.

6. What kind of future

Guided wave optics, especially fiber optic systems, and to provide unique possibilities within the measuring range. If this can cause dependence, especially in studies of social initiatives. Many are still one of the major activities in the interests of considerable chemical sensing and distributed measurement. Tapered fiber has become a means to monitor chemical cells with significant sub-micron resolution. The same is also

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a phase dependence has been pointed out in various contexts Snitzer [6]. At about the same time [10], [11], where the fiber can give a new dimension to the Sagnac effect becomes apparent and fiber optic gyroscope ideas and confirmed.

The concept show is simple but exciting stage. Sensor structure, the most significant fiber Mach - Zehnder, Michelson fiber, and fiber Sagnac interferometer multiplicity evaluated, calibration and testing. Very basic sensitivity were evaluated. Changing the phase delay of the optical fiber from each longitudinal microscopic about 1ppm, each environment hydrostatic pressure change lever 1 ppm, and in accordance with the temperature change C of 10ppm. The impact of noise on each laser source interferometric coherence soon became apparent, and the Mach - Zehnder or

Michelson configuration is designed to be as close as possible between the zero path length difference between the arms in order to avoid the conversion of phase noise to amplitude noise. Some of the difference between each interferometer detection systems were evaluated, although these

applicable to the resolution of the material properties of the micro-engineering structure determination, although these have not been confirmed. There is also the prospect of a very large and gravitational telescope on the basis of a huge Sagnac interferometer has been proposed although they may be less likely to achieve.

So most of the fiber optic sensor work is now focused on the emerging very productive period, from the mid 1970s to the mid-1980s development opportunities. But more specu-lative research will continue, at least some will lead into harsh, full of exotic, innovative measurement exotic.

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