A LOW COST PORTABLE OPTICAL FIBRE SENSOR MEASURING INSTRUMENT (HARDWARE DEVELOPMENT)

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ABSTRACT

Fibre optic sensor technology is an outgrowth of today's rapidly growing telecommunications and opto-electronic industries. A low-cost portable measuring instrument by using optical fibre sensor in conjunction with the personal computer is developed. This measuring instrument has been designed for the measurement of micrometer displacements and colour variations. The scope of my work is to further develop the hardware such as putting in a variable voltage reference, a signal conditioner for the display panel meter, changing the fibre bifurcation, fabricating a new optical fibre sensor cable, using a blue light emitting diode (LED) instead of red light emitting diode (LED) and finally putting the whole components into a metal box casing. This is done to enhance the reliability and efficiency of the measuring instrument.

The measuring instrument employed LED as a light source and semiconductor photodiode as a photodetector where it converts the light signals to an electrical signal. The optical fibre cable is used as a media of transmission between light source, sensors and photodetector. All components connection are developed on a breadboard before PCB fabrication. The signal output is in the form of voltage level representing the colour variations or micrometer displacements detected through the same optical fibre sensor. The instrument can measure displacement with an accuracy of $\pm$ 5.0 μm.

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CHAPTER 1

1.0 INTRODUCTION

The potential of optical fibres in applications other than communications has been recognized only relatively recently. Consequently, this is a subject area which is expanding rapidly and which includes an ever-increasing range of technology. This tends the designer to combine a product based on fibre optic telecommunications with optoelectronic devices to produce measuring instrumentation using optical fibre sensors. From an industrial point of view, fibre optics is attractive because they offer excellent sensitivity and dynamic range, compact and rugged packages and potential for low cost and high reliability[1].

Optical fibre is used to sense environmental effects in two distinct ways. There are intrinsic sensors in which the phenomenon of interest acts on light while it is propagating within an optical fibre and extrinsic sensors in which the light is removed from the optical fibre for transmission to a signal processing location.

Many fibre sensors have been demonstrated to measure essentially all the common parameters needed for industrial process control: temperature, colour, displacement, pressure, fluid level, flow, position, vibration, pH, dissolved oxygen, electrical voltage and current. These fibre optic sensors are differentiated according to the method whereby optical radiation is modulated by the parameters of interest[1].