PREFACE

With the technological advancement in the area of fiber optic communication, there has also been a growing interest among researchers across the world to exploit optical fiber for sensing purpose. Today, fiber optic sensor technology has evolved to the point that one can measure nearly all parameters of interest. In the present research work, an attempt has been made to design and fabricate low cost enhanced sensitive fiber-optic sensors for various laboratory applications and also industrial applications, particularly in the industries of North-Eastern region of India.

To start with, Chapter I deals with introduction on the topic- fiber optic sensor. This chapter describes the advantages of fiber optic sensors over the conventional electronic or other optical based sensors. It also includes the various classes of fiber optic sensors and the current global investment in this area of research. The motivation of the present work and selection of parameters for the present research work have also been discussed.

Chapter II narrates the principle behind fiber optic sensor. As the present research work mainly focuses on the intensity modulated fiber optic sensor where evanescent wave absorption from an optical fiber is exploited for sensing investigation, this chapter describes the detail theory behind evanescent field absorption in optical fiber. Also, to enhance the sensitivity of the sensor, evanescent wave absorption in different shaped sensing region such as U-shaped and tapered-shaped optical fiber have been discussed.
Chapter III deals with the detection unit required for the sensing system. For intensity modulation technique, generally a photodiode (in photoconductive mode of operation) or an optical power meter is used. An 8-channel multiplexing data acquisition system is developed for the present work using ADC0808 and the modulated signal from the photodiode is monitored on a computer. The software is developed for such purpose using C-programming language. This chapter describes the operation of DAS for the present work.

Chapter IV contains the present research work done on fiber optic refractometer sensor. This chapter explains how a curve-shaped fiber tip can be exploited for measurement of refractive index of liquid solutions. The chapter also deals with another type of fiber optic refractometer: non-intrusive fiber optic refractometer.

Chapter V is devoted to fiber optic liquid level sensor. Here also, the same curve-shaped fiber tip is used for the measurement of point contact liquid level. Better resolution can be achieved with curve-shaped fiber tip than with an angle-shaped fiber tip as reported in the literature by other researchers.

In chapter VI, discussion, conclusion and future scope of the present work are described. The chapter also includes other possibilities of the present work in different areas of research such as in bio-medical instrumentations. The scope of the present work for different industrial and laboratory applications in the North-Eastern region of India is also highlighted.

Appendix I describes an extrinsic fiber optic relative humidity sensor. The sensor response and the overall cost of fabrication of the sensor indicates its merit over the intrinsic fiber optic sensor.

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In appendix II, a fiber optic temperature sensor based on evanescent field absorption in a medium surrounding an U-shaped fiber is described. The designed sensor is suitable to monitor temperature in any environmental situation. Performance of the sensors described in Appendix I and II are yet to be optimized. However, it is confirmed that the designed sensors offer a number of advantages over the other fiber optic sensors reported in the literature.

Appendix III contains the C-program that has been written for the development of Data acquisition System (DAS) in the present work.

Photographs of the complete experimental set-up for the present investigation is given in Appendix IV.

References and the authors’ list of publications are included at the end of the report.