Self-Calibrated Interferometric/Intensity-Based Fiber Optic Temperature Sensors

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Abstract

To fulfill the objective of providing robust and reliable fiber optic temperature sensors capable of operating in harsh environments, a novel type of fiber optic sensor system titled self-calibrated interferometric/intensity-based (SCIIB) fiber optic temperature sensor system is presented in this thesis including the detailed research work on the principle analysis, design, modeling, implementation and performance evaluation of the system.

The SCIIB fiber optic temperature sensor system shows us an innovative fiber optic sensor system compared with traditional fiber optic sensors. In addition to the general benefits of the traditional fiber optic sensors, the SCIIB fiber optic sensor system possesses several unique advantages. By taking advantage of the Split-Spectrum technique developed in Photonics Lab at Virginia Tech, the SCIIB sensor technology possesses the capability of Self-Calibration that can fully compensate for the fluctuation of optical source power and the variations of fiber losses. It combines the advantages of both the interferometric-based and the intensity-based fiber optic sensors in a single system. A multimode fiber-based SCIIB temperature sensor system is designed and successfully implemented. Comprehensive experiments are performed to evaluate the principle of SCIIB technology and the performance of the multimode fiber-based SCIIB temperature sensor system. The experiment results illustrate that the development of the SCIIB fiber optic temperature sensor system provides a reliable tool for the temperature measurement capable of operation in high temperature harsh environments.