

RSoft Application: Fiber Bragg Grating Temperature Sensor

Large Dynamic Range, High-Resolution Sensor for Biomedical Applications

Overview

A fiber-optic sensor researcher needed to design a temperature sensor with high sensitivity and low cost.

The Challenge

- ▶ Existing sensor systems have good sensitivity but expensive interrogation schemes
- ▶ Biological and medical industries seek highly sensitive yet low-cost interrogation systems
- ▶ Typical setups require expensive interferometers and spectrum analyzers

The Solution

RSoft™ OptSim™ provides an excellent platform for prototyping various “what-if” scenarios. OptSim includes models required for sensing designs, including broadband sources and fiber Bragg grating (FBG) models. Widening FBG bandwidth and using long-period grating (LPG) as edge filter to interrogate the FBG can help improve sensitivity¹.

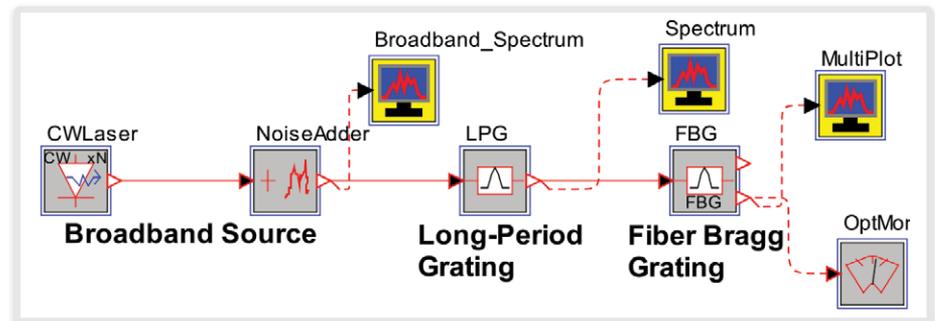


Figure 1. Schematic for simulating the FBG-based temperature sensor

The Result

Interrogating LPG's spectra is nearly linear over sufficiently wide range (Figure 2). Light from the broadband source is modulated by LPG and illuminates FBG. The shift in Bragg wavelength depends on the change in temperature affecting reflected power. The sensor achieves a large dynamic range of 110 0C and low resolution (Figure 3) with a low-cost interrogation technique, making it suitable for biomedical applications.

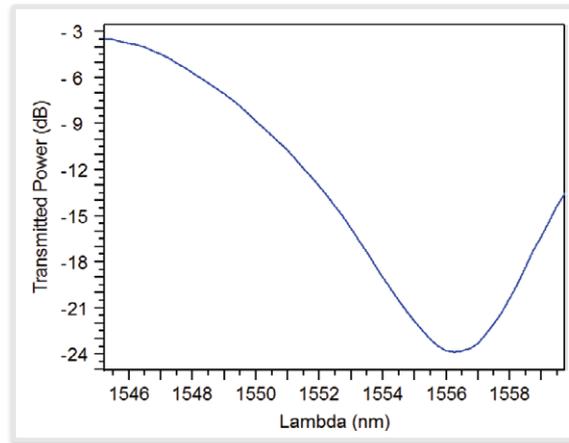


Figure 2. LPG Transmission spectrum

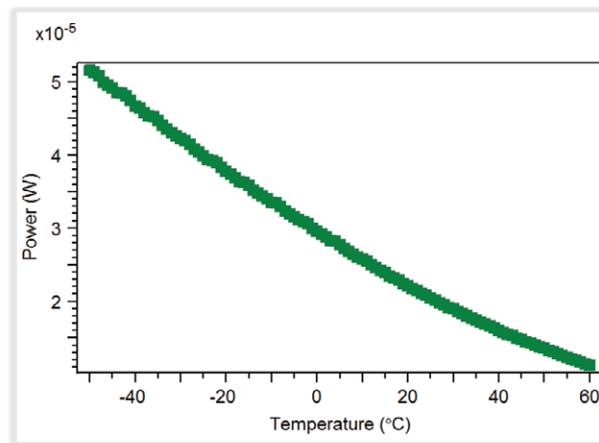


Figure 3. Measured power as a function of temperature

¹Y. Zhan, H. Cai, R. Qu, S. Xiang, Z. Fang, and X. Wang, "Fiber Bragg grating temperature sensor for multiplexed measurement with high resolution," *Optical Engineering*, vol. 43, no. 10, pp. 2358-2361, October 2004.

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