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论文

基于PCF-LPG的差分算法实现对光纤传感器的噪音消除

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摘要:

为了有效消除光源抖动及系统不稳定因素给光纤传感器带来的噪音干扰,提高光纤传感器的准确度,本文提出了一种基于光子晶体光纤长周期光栅的差分算法.利用光子晶体光纤长周期光栅良好的温度稳定性及宽光谱滤波特性,同时监测位于光子晶体光纤长周期光栅透射谱正负斜率线性区域内的两个信号功率变化.这两个信号是经同一路径到监测设备的,包含光源抖动以及系统其它不稳定因素带来的噪音干扰,对这两个信号进行差分处理即可有效消除噪音干扰,并将其应用于光纤环镜温度传感器.结果表明:通过基于光子晶体光纤长周期光栅的差分处理,在光源功率变化±10%的情况下,差分值基本保持不变,由此获得的温度测量值与真实值相对误差分别为0.04和0.03|与未引入差分算法相比,传感器准确度从约76%提高到约97%.本文提出的基于光子晶体光纤长周期光栅的差分算法可以有效消除光纤传感器内功率抖动所带来的噪音干扰,大大提高系统的准确度.

关键词: 光子晶体光纤 长周期光栅 差分算法 光纤传感器 噪音

A Differential Algorithm Based on PCF-LPG to Eliminate Noise of the Fiber Sensor

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Abstract:

A differential algorithm based on a long-period grating in a photonic crystal fiber was proposed to eliminate the noise of fiber sensors and raise the accuracy of fiber sensors.Utilizing the property temperature insensitive and wide transmission spectrum of the long-period grating,the intensities of two signals located respectively within the positive and negative linear region of the long-period grating′s transmission spectrum could be monitored simultaneously and accurately.The noise of fiber sensors was eliminated effectively by the algorithm of two signals,since the two signals (also including the noise of fiber sensors) transmit through the same way to the monitor.When the differential algorithm based on the long-period grating in photonic crystal fiber was applied in a high-birefringence fiber loop mirror temperature sensor,experimental results show that the differential algorithm eliminates the broadband source fluctuations and all of power fluctuations in the system,and raises the accuracy of the sensor by the differential algorithm based on the long-period grating in a photonic crystal fiber.The value of the algorithm remains constant when the power of light source varies ±10% and the relative error between the measured temperature change and the true change is only 0.04 and 0.03.Compared with the sensing without the algorithm,the accuracy increases from ~76% to ~97%.

Keywords: Photonic crystal fibers Long-period gratings Differential algorithm Fiber sensor Noise

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