

高电压技术

架空输电线路覆冰监测用光纤光栅风速传感器的研制

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摘要:

风荷载测量是输电线路覆冰监测的重要组成部分,为解决现有输电线路覆冰在线监测系统中风速测量传感器需要现场电源,易受电磁干扰,不能实时测量风速,需要无线传输模块等缺点,开发了基于光纤布喇格光栅(fiber Bragg grating, FBG)传感技术的风速传感器,此传感器利用粘贴有FBG的等强度梁对风速产生的压力进行测量。鉴于温度对光纤光栅应变测量有较大影响,采用在等强度梁上下2侧对称粘贴光纤光栅的方法解决了温度与应变交叉敏感的问题。对所研制的传感器进行了温度影响试验和风洞试验,试验结果表明,温度造成的传感器测量误差小于±5 pm,传感器线性度良好,测量误差小于±0.5 m/s,经计算由风速测量误差引起的冰荷载测量相对误差小于2.14%,这些参数满足现场监测的要求。

关键词: 架空输电线路 覆冰监测 风速传感器 光纤布喇格光栅 实时测量

Development of Fiber Bragg Grating Wind Sensor for Icing-monitoring of Overhead Transmission Lines

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Abstract:

Measurement of wind load is an essential part of icing monitoring on overhead transmission lines. To overcome the drawbacks of the existing wind sensors, such as the requirement for field power, the sensitivity to electromagnetic interference (EMI) and the unavailability of real-time measurement, a novel wind sensor was developed on the basis of the fiber Bragg grating (FBG) sensing technique. In the sensor, a beam with uniform strength was used to measure the pressure caused by wind speed; two naked FBGs were symmetrical glued on the upper and lower surface of the beam to solve the problem of cross-sensitivity between strain and temperature of FBG sensing. The temperature effect on zero output was investigated by putting the FBG sensor into a oven, and the experiment results indicated the temperature effect on the wind speed zero output was less than ±5pm. The results of wind tunnel experiment indicated that the sensor has the advantages of lower non-linear error with the measurement error of less than ±0.5m/s. The ice load error caused by the wind measurement error was calculated with the relative error of less than 2.14%. These parameters of the proposed FBG wind sensor are suitable for ice monitoring on overhead transmission lines.

Keywords: overhead transmission line icing-monitoring wind sensor fiber Bragg grating real-time monitoring

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