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分布式光纤布里渊散射应变传感器参数计算

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PARAMETER CALCULATION OF DISTRIBUTED OPTICAL FIBER STRAIN SENSOR BASED ON BRILLOUIN SCATTERING

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摘要 介绍了由布里渊散射机理构成的分布式光纤应变传感器, 首次推导出了布里渊散射光相对于入射光的频移与光纤应变的关系及有关参数的理论计算公式。计算结果表明: 光纤中由应变引起的布里渊频移变化主要是通过调制杨氏模量实现的; 其布里渊频移为几十GHz, 由应变引起的布里渊频移变化量为几十MHz。其理论与实验数据基本吻合。

关键词: 布里渊散射 光纤传感器 应变传感器 参数计算

Abstract: Brillouin scattering in optical fiber is a nonlinear effect, i.e. scattering and frequency shift equal to the natural frequency of medium will occur when the pump light interplays with acoustic wave. Optical fiber strain can be exactly measured by Brillouin spectrum, and the longitudinal strain distribution along fiber length can also be got when pulse pump light is launched into optical fiber. In this paper, distributed optical fiber strain sensor based on Brillouin is introduced. The relationship between optical fiber strain and frequency shift of Stokes light to pump light and parameter calculation formula are published. The results show that Brillouin frequency shift caused by strain in fiber is mainly created by changing Young's modulus, Brillouin frequency shift is about several GHz, and variation of Brillouin frequency shift caused by strain is about several MHz. The theory is coincident with experiments.

Keywords: Brillouin scattering fiber sensor strain sensor parameter calculation

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