传感技术学报
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反射式500kV全光纤电压传感器设计及电场分析

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摘　要：

设计了一种基于两线偏振模(和)干涉和石英晶体逆压电效应的反射式500 kV全光纤高电压传感器系统，分析了传感器的测量原理，给出相应的信号解调方法，重点讨论了不同结构的光纤电压传感头的内外电场分布情况，结果表明，光纤电压传感头内部结构的不同会导致内外电场分布差别较大，通过优化系统得到，较长的弧形电极结构能使传感头的内外部电场强度分别降到1.19 kV/mm和2.79 kV/mm，均低于空气和石英晶体的击穿电场强度(3.5 kV/mm和>100 kV/mm)，保证了系统的绝缘性和安全性，满足设计要求。

关键词：电压传感器；保偏光纤; 击穿电场

Design and electric-field analysis of reflective 500 kV all-fiber voltage sensor

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Abstract:

A reflective 500 kV all-fiber high-voltage sensors based on the interference of two linearly polarized modes (and) and the inverse piezoelectric effect of quartz crystal is designed. The measuring principle of high voltage transformer is firstly analyzed, and the signal demodulation method is given. The field distribution inside and outside the optical fiber voltage sensor heads with the different structures is discussed in detail. The results show that, the different fiber-optic voltage sensor head structures can cause large differences between the internal and external electric fields of the sensor. Moreover，the longer arc electrode structure can make the internal and external electric field strength of the sensor head reduced to 1.19 kV/mm and 2.79 kV/mm respectively，which are lower than the breakdown field strength of air (3.5 kV/mm) and quartz crystal (>100 kV/mm). Thus the system's insulation and security is ensured, and the design requirements are meet.

Keywords: Voltage sensor; Polarization-maintaining fiber; Breakdown electric field

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