激光偏振干涉纳米定位系统的设计与实验研究

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摘　要：

为适应工业发展和计量界对精密定位提出的越来越高的要求，本文提出了基于偏振激光干涉技术的纳米定位方法。在该干涉测长系统中，用偏振计取代传统单频激光干涉仪的光电传感器并配置偏振分光元件、起偏镜等，可将干涉仪出射光的干涉条纹相位细分为36000份，使用波长为633nm的激光源,可将理论测量分辨率提高到 10pm。将完成的偏振干涉测长系统与商用SIOS干涉仪的实验测量结果做了比对。本文还就完成的实验系统的各误差源做了实验研究，得到量化值。经不确定度评估计算，在标准实验室环境条件下，对于微米级行程的位移，其位置测量不确定度小于1.4nm。该方法可应用于纳米定位的各个领域。

关键词：偏振干涉定位；实验研究；误差分析

Design and experimental study of polarimetric interferometric nanopositioing system

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Abstract:

Aiming at the requirement of higher accuracy of positioning in industry and metrology, we propose a positionning method based on polarimetric interferometer. In this interferometric system, a polarimeter combined with polarization beamsplitter and polarizer has replaced photo-detector.The fringe interpolation of output laser beam can be reached at 36000, for a 633nm laser source, the potential theoretical resolution is 10pm. The measurement have both carried out by own-developed polarimetric interferometer and commercial SIOS interferometer . The comparison results between this two interferometer show us our polarimetric interferometer is feasible. The experiments have also been done to get the quantified value for each source of errors. Under standard experimental environment, according to uncertainty evaluation, the total uncertainty of measurement is less than 1.4nm over micrometric displacement range. This method can de dedicated to various fields of nano-positioning.

Keywords: polarimetric interferometric positioning; experimental study; error analysis

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