

光学计量与测试

频率扫描干涉中基于DFT的相位测量

王林春¹;江月松¹;郭泾平²

1.北京航空航天大学电子信息工程学院,北京100191;
2.中国空间技术研究院,北京100094

摘要:

频率扫描干涉可以实现绝对距离测量,其中相位测量至关重要,其精度直接影响干涉测量的最终精度。从信号频域角度出发,提出了一种利用参考信号和测量信号离散傅里叶变换的相位测量方法。在对参考信号和测量信号采样前,分别对它们进行负向过零检测,当信号负向过零时才开始采样。对信号离散傅里叶变换后进行频谱分析,指出在信号采样前进行负向过零检测,可以消除信号频率值的相对偏差。根据理论分析,在LabVIEW中进行了建模仿真。结果表明:该方法具有精度高和抗噪声能力强等优点,在测量距离为10m时,相位测量平均值与理论值相差 2π ,相对不确定度仅为0.105%。

关键词: 绝对距离测量 相位测量 频率扫描 离散傅里叶变换

Phase measurement in frequency-sweeping interferometry based on DFT

WANG Lin-chun¹; JIANG Yue-song¹; GUO Jing-ping²

1. School of Electronic Information Engineering, Beihang University, Beijing 100191, China;
2. China Academy of Space Technology, Beijing 100094, China

Abstract:

Frequency-sweeping interferometry can be used to measure absolute distance and phase measurement plays an important part in it, because the precision of phase directly influences the precision of distance. The paper puts forward a new phase measurement method making use of Discrete Fourier Transform of reference signal and measurement signal. It does not start to sample until each signal crosses zero negatively. After the spectrum analysis, relative errors can be eliminated if zero-crossings can be tested before sampling signals. According to the theory, the paper has made simulations in LabVIEW, and the results show that the method has the advantages of high precision and good ability to overcome the noise. When the distance is 10m, the difference between the average of the measured phase and ideal value is 0.2π , and relative uncertainty is 0.105%.

Keywords: absolute distance measurement phase measurement frequency-sweeping Discrete Fourier Transform

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通讯作者: 王林春(1985-), 男, 山西晋中人, 北京航空航天大学在读硕士研究生, 主要从事光电技术、空间激光信息技术方面的研究工作。

作者简介:

作者Email: wanglinchunbuaa@163.com

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