传感技术学报
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灰色理论的位移传感器标定不确定度评定

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摘　要：

硅晶元等高精度平面度测量时，为提高测量可信性，对所用位移传感器标定已成为业界常规。本研究针对用于基于逐次两点法(STPM)测量硅平面的两电容式位移传感器2804/3890J设计了一种压电陶瓷标定系统，实现其标定间隔达到8nm/1mv，提高了标定的精确度。建立基于灰色理论的GM（0，2）系统数学模型，确立待标定传感器测量结果的回归模型，以得到传感器特性的最佳估计，并确定其联合不确定度，得到被标传感器的测量不确定度的最佳评估。与传统回归模型比较，得出GM（0,2）模型具有很好的精度，满足要求。通过STPM测量过程的模拟，得到用此传感器实施的STPM测量的测量精度约为56nm（λ为20nm）。

关键词：标定；高精度；灰色系统理论；测量不确定度；逐次两点法

Evaluate Displacement Sensors' Calibration Uncertainty Using Gray Theory

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Abstract:

When using displacement sensors to measure the Silicon wafer with high accuracy flatness, it is in general to calibrate the sensors to improve the calibration accuracy. This research is aimed at designing a piezoelectric ceramic calibration system to calibrate two capacitive displacement sensors 2804/3890J which use for the Si plate measurement by STPM can calibrate the sensor as the calibration interval is 8nm/1mv in order to improve the calibration accuracy. Building a GM (0, 2) model, it can establish the system error regression model. Using it can get the best estimate of the calibrated results and determine its combined standard uncertainty. Compared with traditional model, the GM（0,2）is very precision and meets the requirements. Through simulating plate measurement simulation by STPM, It shows that the measure accuracy by STPM using these two sensors is about 56nm（λ=20nm）.

Keywords: calibration; high accuracy; gray theory; uncertainty; STPM

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