

Determination of probe non-linearity and error due to measurement position for direct measurement type of gauge block comparator and its measurement uncertainty

The non-linearity of probes is an important component in gauge block calibration by mechanical comparative method of two gauges blocks at the same nominal length. However, an advance method for gauge block calibration is a mechanical direct measurement method of two gauges block showing the greatest difference in nominal length 25 mm. This method used special probe base on the interferential scanning principle to produce the signals to measure the displacement. In this paper, non-linearity and error due to measurement position were investigated as it related to the accuracy of measurement result. The difference in central length of a pair standard gauge block made of steel was measured by optical interferometry with the measurement uncertainty ($k=2$) 23 nm. Length in the range of 5 μm to 25 mm was used in the experiment. Non-linearity of probe was evaluated by simple linear regression model. Various factors such as origin setting point, temperature and vibration have been analyzed. In the preliminary experiment, the non-linearity at 10 μm , position error at 25 mm, repeatability and retrace error are less than 15 nm, 10 nm, 5 nm and 15 nm respectively. The measurement uncertainty of non-linearity is close to 15 nm.

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