Self-Calibration Rotary Encoder System

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ABSTRACT

Self-calibration rotary encoder system has been developed in collaboration with National Metrology Institute of Japan (NMIJ) to establish national primary angle standard. The measurement principle is based on the equal division averaged method (EDA-method). The measurement result contains the calibration curve representing the deviations of all graduation lines. The uncertainty of measurement is ± 0.05° approximately.

INTRODUCTION

Rotary encoders have been widely used in laboratories and industry. In Thailand, there is no calibration service for the instruments. To overcome this problem, National Institute of Metrology (Thailand), NIMT have developed the standard for that in collaboration with NMIJ. Since a rotary encoder provides high precision for angle measurement, the developing standard uses a combination of rotary encoders with self-calibration technique in order to establish a national primary angle standard in Thailand.

In this poster, the self-calibration technique is briefly described. The self-calibration rotary encoder system is presented as well as the measurement results. The measurement uncertainty is evaluated according to “Guide to the expression of the uncertainty in measurement” (GUM).

MEASUREMENT SETUP

The self-calibration rotary encoder system is set up based on the EDA-method, which is the same principle as the multi-orientation techniques (the multi-step method) used for roundness measurement. The reading heads are arranged at equal angle interval around a scale disk as illustrated in figure 1. The scale disks of rotary encoder A and B are attached in the same axis. The developing self-calibration rotary system is shown in figure 2.

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The calibration data of the rotary encoder A can be expressed as

$$\delta_{ij} - \mu_{ij} = a_{ij} - b_i$$

Before averaging the calibration data of each position, all data must be shifted to zero position (index position). Figure 4 shows the calibration curve of the rotary encoder A.

CONCLUSION

The self-calibration rotary encoder system at NIMT has been developed using the EDA-method. The scale disks of rotary encoder A and B are attached in the same axis. The calibration curve (figure 3) represents the deviations of all graduation lines. The uncertainty of measurement is ± 0.05° approximately.

REFERENCES


TRACEABILITY CHART

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