

Grating Scale Thermal Expansion Error Compensation for Large Machine Tools Based on Multiple Temperature Detection

Authors : Wenlong Feng, Zhenchun Du, Jianguo Yang

Abstract : To decrease the grating scale thermal expansion error, a novel method which based on multiple temperature detections is proposed. Several temperature sensors are installed on the grating scale and the temperatures of these sensors are recorded. The temperatures of every point on the grating scale are calculated by interpolating between adjacent sensors. According to the thermal expansion principle, the grating scale thermal expansion error model can be established by doing the integral for the variations of position and temperature. A novel compensation method is proposed in this paper. By applying the established error model, the grating scale thermal expansion error is decreased by 90% compared with no compensation. The residual positioning error of the grating scale is less than 15um/10m and the accuracy of the machine tool is significant improved.

Keywords : thermal expansion error of grating scale, error compensation, machine tools, integral method

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