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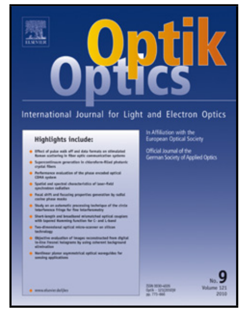

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Research on the temperature characteristic of magnetic sensor in the magnetic drift compensation fiber-optic gyroscope

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Abstract
Software compensation is an effective method for enhancing the magnetic field environment adaptability of light-small fiber-optic gyroscope (FOG). In order to decrease the magnetic drift of FOG, an accurate magnetic sensor is typically required to measure the intensity of magnetic field in this software compensation method. The magnetic sensor generally suffers from the measurement error due to the variety of temperature. In order to compensate the magnetic drift of FOG preferably in full temperature range (-40°C~+60°C), the temperature sensitivity of the Hall sensor manufactured by Allegro is studied in this paper. Temperature compensation models of quescent voltage output and magnetic sensitivity are established, and the variation is compensated respectively. The measurement precision of Hall sensor is 0.02G over the temperature from -40°C to 60°C after compensation, which meets the requirement of magnetic drift compensation of FOG in full temperature.

Key words: Fiber-optic gyroscope (FOG), Magnetic drift compensation, Hall sensor, Temperature compensation, Quiescent voltage output, Magnetic sensitivity

1 Introduction

Drift of fiber-optic gyroscope (FOG) induced by magnetic field is one of the principal factors which influence the measurement precision of angular velocity.[1-3]Magnetic shielding is generally used to decrease the magnetic drift.[4,5]While it leads to an increase in weight and volume which will limit the FOG's applications such as inertial measurement units.[6-8]For a light-small FOG, magnetic drift can be compensated with magnetic sensor.[9]It has been proved to be a feasible method to improve the magnetic field environment adaptability .[10,11]Both the axial and radial magnetic drift in the FOG are about 0.5°/h/G. In order to greatly reduce the magnetic drifts (e.g., 0.05°/h/G) and improve the measurement accuracy of the FOG, the precision for measuring the magnetic field should be 0.1G at least. With the software compensation method mentioned in reference [10], magnetic drift has been compensated obviously and decreased at least two orders of magnitude at room temperature. However, a magnetic drift compensation in full temperature is still desired, and most of the magnetic sensors are sensitive to temperature and the output varies obviously when the temperature change from -40°C to 60°C.[12,13]So it is highly necessary to study the temperature characteristic of the magnetic sensor, and compensate the variety with the temperature.
As the typical magnetic sensors, Hall sensors and Anisotropic Magnetoresistives (AMR) are sensitive to temperature (e.g., the quiescent voltage output and the magnetic sensitivity of Hall sensor, the bridge offset and magnetic sensitivity of AMR). The temperature variation will affect the precision for measuring the magnetic field, and make influence on the results of the magnetic drift compensation in further. Compared with AMR, Hall sensor feature with a relatively large measuring range (generally