Research and development of inclinometer based on magnetoresistive and tilt sensors

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Abstract: The growing requirement on a high precision, small volume and low cost inclinometer in the field of coal-bed logging needs further research on the inclinometer. This paper introduces the inclinometer based on the theory of gravitational field measurement and geomagnetic field measurement, and then brings forward a new scheme based on tilt sensor and magnetoresistive sensor. In this paper, the formulas for vertex angle and azimuth angle are deduced; an inclinometer prototype based on the two sensors is designed. Furthermore, the sensor calibration is completed; the characteristic equations of the sensors are built; and the real time measurement for the vertex angle and azimuth angle is implemented. In order to compensate for the rotation error of the probe, a compensation method which using the average value of the positive order and negative order sampled data is described; in order to eliminate the dithering problem of the measure data, a limit range filtering algorithm is applied. The specifications of the prototype described in the article are: an external diameter of 40mm, a vertex angle precision of up to 0.1 degree and an azimuth angle precision of up to 2.5 degree. The performance of the prototype is guaranteed in practical engineering application.
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