Measurement Technology | Technology Offer

Correction of angular errors in optical encoder readings prior to sensor signal generation

Application area

Rotary angle sensors or encoders are used to detect angular positions. They are applied in many industrial sectors, such as the automobile industry, engineering, driverless transportation systems, industrial trucks, and medical technology.
Optical encoders provide a high-resolution output for angular positions. The accuracy of their reading, however, depends on the correction of manufacturing tolerances and assembly errors.
The encoder according to the invention compensates errors optically, prior to sensor signal generation, and can be manufactured inexpensively.

State of the art

The basic principle of optical encoders is based on a revolving shaft to which an encoder disc with a measuring track is mounted. The measuring track segments are scanned optically and either deliver an angle change or absolute angular values. In both cases, the accuracy of the sensor values depends on whether the center of the shaft corresponds to the center of the encoder disc and/or measuring track. This requires great technical effort during assembly and is thus costly. Despite high effort exercised during assembly, mechanical errors cannot be entirely avoided (mechanical backlash).
Previous solutions have mainly focused on correcting errors in encoder readings during data evaluation, generally through the use of multiple read-out units and/or additional measuring tracks.

Innovation

At the Institute of Applied Optics of the University of Stuttgart a procedure has been developed that allows for optical correction of errors in optical encoder readings before the sensor signal is actually generated.
Optical compensation is achieved by means of adding a compensating track to the diffractive measuring track on the encoder disc. Both tracks are produced in a single step, which ensures in a simple way that they both have the same rotation center.
The compensation track, which is also diffractive, makes sure that the light beam producing the spot responsible for illuminating the scanning area of the measuring track does not remain static, but is redirected upon misalignment of the shaft and encoder disc. Redirection of the lighting can be arranged so that is always aimed at the same position of the measuring track (tangential height of its rotation axis) even if the encoder disc moves towards the tangential direction of the light source due to mechanical backlash.

Your benefits at a glance

- ✓ Low-cost optical compensation of eccentricity of encoder disc
- ✓ Suited for incremental and absolute encoders
- ✓ Optical compensation of errors in encoder reading prior to signal generation
- ✓ No additional electronics required
- ✓ Alignment-free assembly of encoder disc

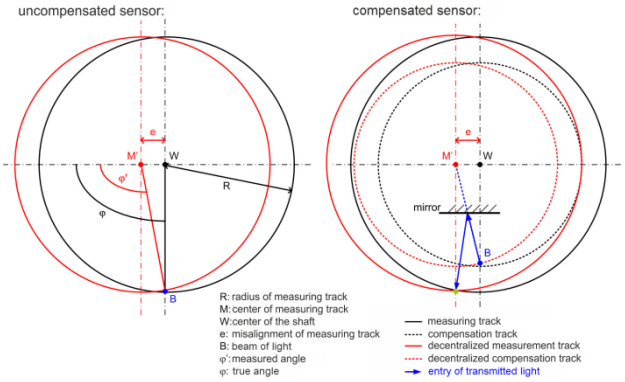

Figure 1: Encoder reading without compensation (left) and with compensation track (image: ITO, University of Stuttgart)

Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licences.

Patent portfolio

EP 10 754 691.3 granted, validated in Germany, France, Great Britain and Switzerland.

Contact

Dr.-Ing. Florian Schwabe
schwabe@tlb.de
Technologie-Lizenz-Büro (TLB)
der Baden-Württembergischen Hochschulen GmbH
Ettlinger Straße 25, D-76137 Karlsruhe, Germany
Phone 0721 79004-0, fax 0721 79004-79
www.tlb.de

Reference number: 09/036TLB