Precise, dynamic torque measurment

Growing demand for high speed miniature and micro machines has prompted Sensor Technology to develop a torque monitor that can accurately measure down to 10mNm, combined with a 50kHz bandwidth allowing the most fleeting of transient torques to be recorded with accuracy.

Sensor Technology has combined increasing electronic data processing speeds and the latest in display systems with new sensing techniques developed in-house to produce a new generation of optical rotary torque sensors that are designed for applications requiring precise, dynamic measurement of rotary and static torque in the range of 10mNm (milliNewton-metres) to 100Nm, with a high resolution so that even ultra-short torque peaks and troughs can be recorded.

Typical applications include profiling the acceleration and deceleration of high speed motors, controlling micro systems and miniature machinery, collecting data from repetitive scientific experiments, and testing industrial machinery to destruction.

Operating principle

The technology behind Sensor Technology's ORT230/240 optical torque sensor is based on an extensively proven and developed measurement principle whereby two discs with segmented gratings are positioned on a rotating drive shaft a short distance apart so that the opaque sectors on one disc partially obscure the clear sectors on the other. Light passes through the sectors and is detected by photovoltaic detectors.

As torque is applied to the shaft, a slight twist changes the alignment of the gratings and thus varies the light transmitted through to a detector. The use of this technique results in a transducer that can detect torque bi-directionally and which has a fast mechanical and electrical response, low inertia and complete freedom from brushes or complex electronics.

The intensity of light beams, which is constantly monitored, is modulated by the applied torque and produces an electrical output that is used to provide a precise indication of the torque transmitted by the shaft. The light intensity is automatically controlled within the transducer body by a monitor cell.

Very high full-scale sensitivity can be achieved with fast electrical responses up to 50kHz and low inertia. As the measurement is non-contact, it also has complete freedom from brushes and complex electronics on the shaft, which are often found in traditional torque measurement systems.

The absence of brush gear and fixed electronics allows high-speed operation with a continuous rating up to 30,000rpm standard. Further increases in speed are available depending upon shaft size. The torque shaft is of low compliance 0.5° maximum torsion deflection on the smaller transducers and 0.25° maximum on the larger transducers at full-scale deflection. Any full-scale torque can be specified within the range 10mNm to 100Nm. The non-contact operation ensures a long and reliable life of accurate operation. The optical operating principle also means there is total immunity to noise corruption.

TorqSense ORT 230 series sensors provide fixed voltage or current analogue outputs – one for torque and one for either speed or power. The TorqSense ORT 240 provides two user-selectable voltage or current analogue outputs – one for torque and the other for either speed, power or peak torque – plus digital outputs including RS232, CANbus and USB for interfacing with modern instrumentation and laptops. The ORT 240 enables users to connect up to ten transducers via USB, with transducer configuration software for making changes to transducer variables.

Features of both devices include self-diagnostics to report if the transducer's torque, speed ratings or calibration date have been exceeded, while inbuilt sensors monitor shaft temperature for better compensation and accuracy. The device also offers a simple 'sensor status' output.

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