NON-CONTACT MONITORING

One of the best ways of assessing the performance of plant and machinery is by monitoring torque in a drive shaft but, because drive shafts rotate, hard wiring a sensor into place usually requires the use of a delicate slip ring. There is, however, an alternative: to use a non-contact radio frequency detector to monitor 'Surface Acoustic Waves' (SAWs).

Torque imparts a small degree of twist into a driven shaft, which will distort SAW devices (small quartz combs) affixed to the shaft, causing a change in the resonant frequency of the combs, which can be measured via a non-contact radio frequency (RF) pick-up mounted close to the shaft. The pick-up emits an RF signal towards the shaft which is reflected back by the combs with its frequency changed in proportion to the distortion of the combs. Electronic processing and calibration of the returned signal generates a precise, real time indication of the torque being transmitted by the shaft.

A SAW transducer is able to sense torque in both directions, and provides fast mechanical and electrical responses. Not only does this solution offer complete freedom from slip rings, brushes and/or complex electronics, but SAW devices have a high immunity to magnetic forces, allowing their use in motors where other analogue technologies are very susceptible to electronic interference, for instance.

In its simplest form, a SAW transducer consists of two interdigital arrays of thin metal electrodes deposited on a highly polished piezoelectric substrate such as quartz. The electrodes that comprise these arrays alternate polarities so that an RF signal of the proper frequency applied across them causes the surface of the crystal to expand and contract and this generates the surface wave.

These interdigital electrodes are generally spaced at half- or quarter-wavelength of the operating centre frequency. Since the surface wave or acoustic velocity is 10-5 of the speed of light, an acoustic wavelength is much smaller than its electromagnetic counterpart.

As an example, a signal at 100Mhz with a free space wavelength of three metres would have a corresponding acoustic wavelength of about 30 microns, resulting in SAW's ability to incorporate an incredible amount of signal processing or delay in a very small volume. As a result, physical limitations exist at higher frequencies when the electrodes become too narrow to fabricate with standard photolithographic techniques and at lower frequencies when the devices become impractically large. Hence, at this time, SAW devices are most typically used from 10Mhz to about 3Ghz.

APPLICATIONS

SAW-based torque sensors have been used around the world in many fields – from test rigs to wind turbines and generators based on tidal or river flows, in the development of engines and gearboxes for Formula 1, and by pharmaceutical companies to monitor the pumps micro-dosing active ingredients into medicines and tablets. Torque feedback systems can also be used by security firms to determine the direction their movable CCTV cameras are facing.

Sensor Technology **www.sensors.co.uk**

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COST EFFICIENT, HIGH QUALITY, RFID READ/WRITE HEADS

Pepperl+Fuchs' new RFID read/write heads with integrated IO-Link interface are available in three different housing designs and work in the HF range in accordance with ISO 15693. Suitable for harsh environments, these compact and high performance products support the quick, open and future-proof IO-Link standard V1.1 while still connecting to the tried-and-tested fieldbus modules in the IDENTControl family. Easy mode allows for simple commissioning with plug-and-play connectivity, and requires no programming. Use of a function block is not required, simplifying implementation.

Via the IO-Link interface, the read/write heads can be integrated into automation systems quickly and easily through point-to-point connection to any IO-Link master. In the fieldbus module product range, Pepperl+Fuchs offers the corresponding Ethernet IO modules with integrated IO-Link master for an optimised connection and end-to-end parameterisation. In addition to the multi-protocol capability that supports the traditional hierarchical fieldbus connection – meaning the communication between the central control panel and the field level – the integrated 8-way IO-Link master also provides the new Ethernet IO modules with the appropriate cross-hierarchy connectivity for communication structures. These structures can also be found in the implementation of Industry 4.0 and in sensor technology 4.0 applications in the smart factory. A total of up to eight IO-Link-enabled RFID read/write heads can be connected.

According to the company, by connecting up to eight read/write heads, channel costs are very low, providing a cost-effective total solution from a single source.

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