Driving innovations in wireless torque measuring technologies19 May 2016

Sensor Technology, developer of the innovative TorqSense range of wireless torque transducers, has continued to develop its product range, offering users new options for measuring power in drive shafts and other rotating machine elements.

A technological breakthrough has occurred in the world of sensors that will almost certainly grab the attention of machine designers who are looking to measure power in drive shafts and other rotating machine elements.

Measurement of torque in rotating shafts is a fundamental requirement in a vast number of applications. In production machinery and processes measurement of torque can help to reduce downtime and improve product quality, and is a key measurement in the battle to optimise energy efficiency. In applications such as belt conveyors, measurement of shaft torque provides an efficient means to monitor the power being used to drive the conveyor, which in turn can help to optimise speed.

Accurate torque measurement is also vital in many R&D applications to test system characteristics or evaluate system performance. Direct torque measurement is preferred in such critical applications over remote or indirect methods of calculating torque as it is inherently more accurate and reliable.

Regardless of type, the job of the torque transducer is to convert torque into an electrical signal. On a rotating shaft, this equates to monitoring the minute differences in twisting from one end of the shaft to the other, and turning this into a usable output.

Conventional torque measuring solutions for rotating shafts introduce as many problems as they solve. Strain gauges require connection to the outside world via slip rings, inductive couplings or rotary transformers which can all represent a compromise in terms of factors such as electrical noise, long term reliability, speed range, accuracy, etc. Phase measurement or magnetic measurement techniques are also available, but introduce compromises of their own.

Sensor Technology's solution in the core of its TorqSense products is to use the properties of surface acoustic waves, by measuring the resonant frequency change of surface acoustic wave (SAW) devices in a non-contacting manner when strain is applied to a shaft to which SAWs are fixed. The applied torque causes a deformation of the quartz substrate of the SAW device, which in turn causes a change in its resonant frequency.

Practical torque sensors use two tiny SAWs made of ceramic piezoelectric material containing frequency resonating combs. These are glued onto the drive shaft at 90 degrees to one another. As the torque increases the combs expand or contract proportionally to the torque being applied. In effect the combs act similarly to strain gauges but measure changes in resonant frequency.

The adjacent RF pickup emits radio waves towards the SAWs, which are then reflected back. The change in frequency of the reflected waves identifies the current torque. This arrangement means there is no need to supply power to the SAWs, so the sensor is non-contact and wireless.

Sensor Technology's SAW-based torque sensors produced using this technique are bi-directional, with fast mechanical and electrical responses. There is complete freedom from brushes or complex electronics, and none of the drawbacks of phase measurement or magnetic measurement technologies.

One of Sensor Technology's breakthroughs as it developed the TorqSense range was the ability to deliver a highly compact device yet which had all the complex electronics placed within the transducer itself. The high level of integration was key in allowing the company to radically reduce the overall size of the sensor. This innovation formed the basis of the RWT310/320, a significant development over the previous 300 series.

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