The non-contact approach to rotary torque measurement

Engineers face a constant dilemma when trying to measure rotary torque. One solution, however, is the digital non-contact sensor, TorqSense, from Sensor Technology. Director, **Nick Hopkins**, explains how the concept has evolved from a theory to a technology and on to a full range of products and solutions.

This Spring sees the launch of the RWT 330/340 series TorqSense non-contact torque sensors, which builds on the RWT 310/320 series and will expand the considerable range of options now available from Sensor Technology. With this, the sensing head is separate from the control electronics, so instead of one integrated unit there are two separates, making the RWT330/340 ideal for applications where space or access is restricted.

TorqSense, however, has been around for a number of years. The company developed this digital non-contact measurement technology in response to the need for a simple, cost effective, easy to use solution that would do away with the previous technologies of slip rings or induction coils that are often mechanically complex. We knew that what we developed for design engineers would have applications potential in many other technical fields, such as machine building, plant and process monitoring. In fact, any machine with a rotating shaft is a candidate for TorqSense.

Rotary torque measurement is often considered difficult and expensive to measure because sensors have to be mechanically coupled using either slip rings, inducing drag, or induction coils that can have high inertia to obtain the signal. TorqSense overcomes these problems by using a radio frequency (RF) transmission link to distort a quartz resonator, in proportion to the applied torque. Inside the quartz resonator, which is fixed to the shaft, are tiny piezo-ceramic combs. The change in resonant frequency is then transmitted via a non-contact RF coupling to a receiver/controller. Power required to activate the combs is so small that this can also be supplied via the RF coupling, removing the need for a hard-wired power connection.

The components used in a TorqSense system are mechanically simple and few in number, making it very cost effective, drag free and providing a system with low inertia.

Data can be presented on an alpha-numeric display or more commonly on a PC which can be used for storage and analysis using the TorqView software programme and show torque and speed in a dials or bars format or as a chart.

Torque about applications

TorqSense is finding more and more applications across the whole gamut of industries, from process control to discrete manufacturing, instrumentation to research, automotive engineering to medical science.

For instance, a test rig built at Centa Transmissions in Shipley is ensuring that the precision gearboxes supplied to the nuclear industry do not fail in use. It tests each gearbox for three hours at the full load, and then at 300% load for another hour. At the heart of the test, a TorqSense sensor generates a performance profile for each gearbox that can be compared with the ideal standard.

The TorqSense reading is a true refection of the gearbox performance, Centa doesn't even have to allow for drag. This means calculations, which are submitted by Centa to the Nuclear Inspectorate are easily understood even by non-technical people.

The gearboxes have to be 100% reliable. They are used in completely automated scoops that collect 'high-activity liquor' from the reactor cooling systems. This is sealed into thick-walled ceramic flasks for long term storage until the radioactivity has decayed to safe levels.

At the other end of the scale, a medical researcher has used TorqSense to analyse the performance of implanted replacement knee joints, hoping to increase the understanding of their long term post-surgery performance.

Judith Lane at Queen Margaret University College in Edinburgh realised that a few patients don't achieve full function with their replacement joint so explored the relationship between function and stiffness.

She aligned the axis of the Torqsense with the patient's knee and attached the ankle to the end of a crank, while another crank moves the knee without the patient having to put in any muscular effort. This isolates the joint so that Lane can calculate the resistance to movement created by soft tissues around the knee.

Meanwhile, in Wolverhampton, Comar Engineering is helping to develop electric, rather than hydraulic, flap actuators for the new Falcon 7X business jet.

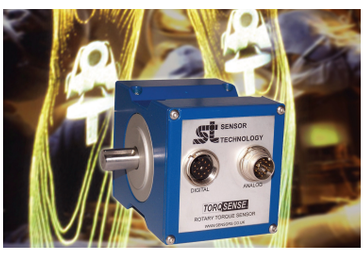
Each flap system consists of a power drive unit and four actuators linked via transmission shafts and gearboxes. In flight conditions, the aerodynamic load on the flap increases as the actuators extend, which translates into increased torque in the shafts and gearboxes.

Comar's test rig is designed to apply computer-simulated aerodynamic load profiles, and each actuator is tested with a servo hydraulic motor and monitored using a 22Nm TorqSense. Typical tests performed include: no load input torque, compressive loads, tensile loads, running in, backlash, efficiency, performance and endurance (one endurance life being 20,000 operating cycles).

The beauty of TorqSense is that it can be applied to anything that rotates; including an endless assortment of plant, machines, engines, gearboxes; from tiny to enormous, and in just about every industry going that can benefit.

Sensor Technology
T: 01869 238400 **Enter 686**

The Falcon Business Jet relies on torque monitoring by Sensor Technology



TorqSense is being used to assess replacement knee joints