PUTTING SENSORS to the test

Non-contact transducers from **Sensor Technology** are being specified for test rigs used in a range of industries. Here we look at two examples

Torque sensors from Sensor Technology have been used in a variety of test rig applications over the years. In one of the most recent, Bifold Group has selected the company's radio frequency based torque transducers for two of its test rigs which are being used to analyse the performance and reliability of valves and pumps.

Many of the company's products are custom-designed to very short lead times, and sample products and components are comprehensively tested to ensure their reliability. So when it came to assessing the effects of wear on its long-life valves, Bifold set about designing a special test rig. The company wanted to measure the power required to operate the valve to see how it changed over time. As the best way to do this was to measure the torque input over an extended period, the company selected Sensor Technology's TorqSense transducers.

TorqSense sensors have been selected for a test rig that will be used by a university automotive research facility

Being non-contact measuring devices, the sensors are a benefit for test rigs. Attached to the surface of the transducer shaft are two Surface Acoustic Wave (SAW) devices. When torque is applied to the shaft the SAWs react to the applied strain and change their output. The SAW devices are interrogated wirelessly using an RF couple, which passes the SAW data to and from the electronics inside the body of the transducer.

Sensor Technology's Mark Ingham explains: "All you have to do is set up a TorqSense transducer in the test rig and fire it up. The SAW frequencies reflected back are distorted in proportion to the twist in the test piece, which in turn is proportional to the level of torque. We have some clever electronics to analyse the returning wave and feed out torque values to a computer screen."

Commenting on the benefits, Bifold engineer, Andrew Laverick, said: "As a test engineer you are almost resigned to long set up procedures and software that falls over at the drop of a hat. But Sensor Technology has designed these problems out of their TorqSense equipment, with the result that we were able to complete our long term test procedures with the minimum amount of fuss and heartache, and well within the allotted time schedule."

Following the success of this project, a second TorqSense transducer has been fitted to a new test rig used to assess the performance of mission critical chemical injection pumps, as used at oil and gas wellheads and on process pipelines.

RESEARCH

In another project, a test rig has been supplied by Tirius, an electric vehicle design and development company, to a world renowned UK university's automotive research facility.

The company is helping the university's research team develop electric drive train technology typically found in 'A-Class' cars. Specifically, it is currently looking at permanent magnet traction motors in a number of sizes and configurations, with a view to optimising electronic control for each motor type.

The research involves running each motor on a test rig through its full output range and mapping its torque output at many points to build up a performance profile. The design of the controller can then be matched to the motor characteristics. This should be able to ensure that the motor runs in its optimum operating zone as much as possible, maximises motor life and regenerative braking, minimising wear, and is as energy efficient as possible.

Again, the TorqSense torque sensor has been selected for the test rig. According to the company, the sensor is beneficial for this work because its non-contact operation allows rapid set-up during the profile building test runs. It also means extra drag forces are not added to the system, so measurements represent true values and calculations are therefore straightforward.

Head of Tirius, Dr Tim Allen, commented: "With our type of research work there are some potential errors that we have to look out for, including time-based zero-drift, bending moments on the shaft, bearing losses, temperature fluctuations, etc. These are easily accounted for with TorqSense-based test rigs. Normally you have to account for the drag caused by the slip rings, but the wireless TorqSense does not use them, so that is one less calculation."

Sensor Technology
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OPTICAL SENSOR SUITS TYRE MODELLING

As a five times winner of the UK Formula Student competition, Oxford Brookes University's team decided that better tyre modelling was essential for their 2018 campaign. To meet demands, a Correvit S-Motion two axis optical sensor (on loan from Kistler Instruments) was selected to obtain tyre slip angle, the key data needed for accurate tyre modelling.

The S-Motion unit, which offers plug & play capability, was mounted on the 2017 Oxford Brookes Formula Student car, along with load cells, infrared tyre temperature and laser ride height sensors, to collect as much tyre data as possible. The S-Motion sensor accurately measures vehicle longitudinal and transverse speed and slip angle with a high logging rate which is essential for the relatively low-speed Formula Student driving events.

The Correvit system has the ability to automatically transform speed and slip angle measurements to any point of interest on the vehicle. These were transformed to the centre of gravity where yaw rate was measured, simplifying tyre slip angle calculation during steady-state tests.

Testing consisted of increasing velocity runs on a constant radius skid pad for a minimum of three cold inflation pressures and three static camber settings to capture the quadratic relationships in the lateral force model. Quantities derived from measurements were calculated in MATLAB before being passed to the tyre model tool. Roll angle measurements from the S-Motion and damper displacement data were used for lateral weight transfer models to determine inclination angle and total vertical load. Steered angle of each front wheel was used to calculate front tyre slip angles using vehicle slip angle from the S-Motion.

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