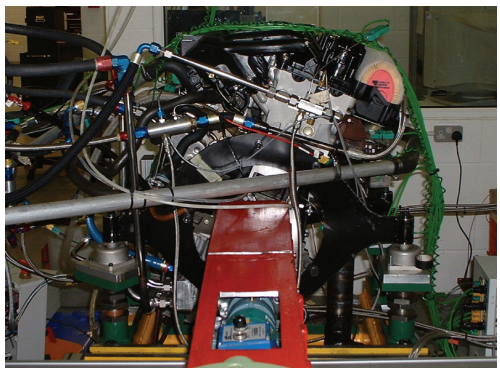
Torque sensor helps reduce engine emissions

Energy efficiency is becoming an important topic. So to help meet demands, a major UK supplier asked Powertrain Technologies to design an intelligent lubrication system and analyse its effects on engine friction and parasitic losses. For this, a highly specialised test rig was built for the project and, as measuring the small changes in drive torque reliably and repeatably was a critical requirement, the TorqSense transducer from Sensor Technology has been used.

The engine being tested was a current production diesel and the test bed was configured for motored friction tests with a 6000rpm 32kW electric motor driving the engine.

"We completely redesigned the engine lubrication system and installed a bank of five computer controlled oil pumps," explains Andrew Barnes, a Powertrain director. "Each is capable of supplying individual parts of the engine with oil under conditions unique to that part of the engine and sensitive to its operating conditions – for example, we can supply the head with oil at pressures different to the block and supply the bearings with more oil when the engine is under high load."

The intention is to completely profile the performance of the engine under various



lubrication conditions and derive optimum configurations of the intelligent systems for best performance. The torque sensor is critical to the project as the object of the exercise is to measure the effect on friction of a range of different oil supply strategies and oil types. Thus the changes in friction are represented by a change in the motored drive torque of the engine.

TorqSense sensors are particularly suitable for development work because they are wireless. These fit-and-forget, non-contact, digital sensors don't require the wiring up of slip rings for each new measurement and, together with digital outputs, good accuracies can be obtained. The adjacent RF pickup emits radio waves towards the SAWs as well as collecting the reflected resonant changes, and it is this change in frequency of the reflected waves that identifies the applied torque.

TorqSense effectively senses and measures the radio frequency (RF) waves generated by two Surface Acoustic Wave (SAW) devices fixed onto a rotating shaft and converts them to a torque measurement using two tiny SAWs made of ceramic piezoelectric material with frequency resonating combs laid down on their surface. The SAWs are fixed onto the drive shaft at 90° to one another. As the torque increases, the combs expand or contract proportionally to the torque being applied, acting similarly to strain gauges but instead measuring changes in resonant frequency.

The next step in the project is to install the engine in a car and drive it under a range of conditions, including a mixture of test tracks and rolling roads, to build up profiles of fuel consumption, explains Barnes.

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