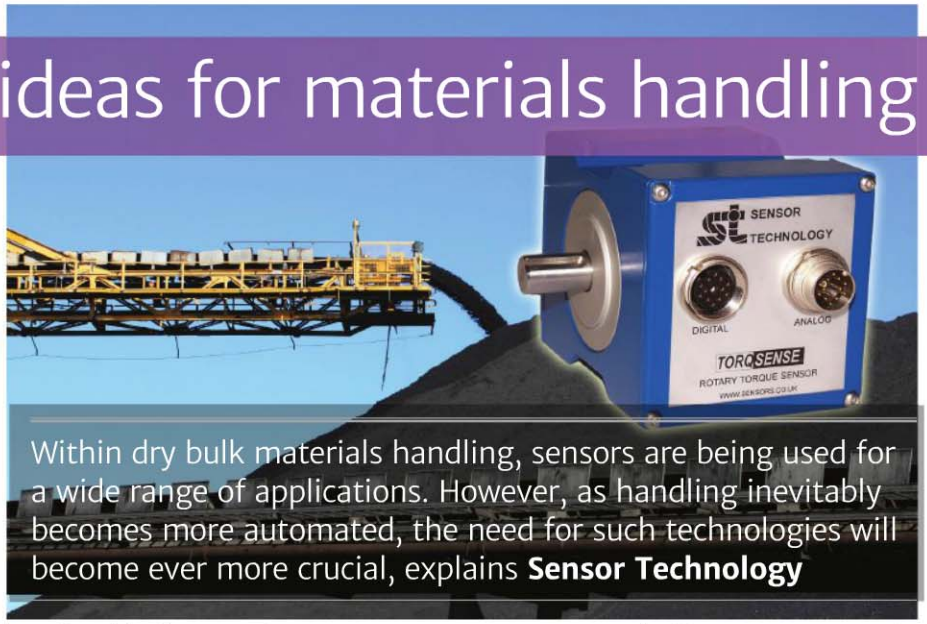
Conveying ideas for materials handling



Within dry bulk materials handling, sensors are being used for a wide range of applications. However, as handling inevitably becomes more automated, the need for such technologies will become ever more crucial, explains Sensor Technology

Within every process today, speed, accuracy and efficiency are essential. One example is in the handling of dry bulk materials – such as grain, coal, aggregates, minerals and chemicals – from producer to end-user. Here, major handling facilities feature banks of computers collecting information from many sources, collating it, and then calculating the optimum procedures for every stage.

The data processing abilities of these are based on relatively simple logic algorithms. The technology developments that are driving the advancement of bulk handling, however, are at the sensing end of the system, where the prevailing conditions of the moment are detected and converted into data signals for the computer to use.

"Sensors are the eyes and ears of the computerised system," explains Mark Ingham of Sensor Technology. "They constantly monitor what is going on and feed real-time data to the computer."

The company has recently, in fact, introduced a load sensor with a difference. Being wireless, LoadSense is easy to deploy in situations like docks and grain banks. Online permanently, this constantly sends real-time load value signals to either the central computer or its own local computer or receiver for preliminary analysis. It can be used in all types of materials handling operations, but is particularly useful for measuring loads in augers and on conveyors, where materials are 'in flight', so the load varies constantly with time.

LoadSense can be thought of as a two-part system, the company explains. First is a strain gauge-based stainless steel tension type sensor, with a twin antenna transmitter built into it for transferring the load data the instance it is generated. Second is the receiver, which can be either fixed in place or handheld. This reads, displays and records the data and can pass it onto the central control system.

The receiver includes an in-built 32MBit memory, which can hold up to 280 hours of data. Each receiver can also collect data from several nearby load sensors simultaneously, in a range of up to 100m.

LoadSense transmits using the worldwide licence-free frequency of 2.4GHz. In operation, data is transmitted at up to 10 times a second, so it is constantly updating and providing real-time information that enables operations to be optimised. The system is also easy to reconfigure and has a long battery life.

LoadSense was originally developed for use with helicopters to enable the pilot to know the weight of cargo nets slung underneath, and has since been adopted by many other industries.

Sensor Technology has also transferred another of its technologies, TorqSense, into the world of dry bulk materials handling. Like LoadSense, TorqSense uses a radio frequency signal transfer technique, but its sensing head measures the rotary torque in a turning shaft.

"Consider a screw conveyor or auger, both of which are driven by a rotating motor shaft," says Ingham. "If this is rotating empty, it requires little power from its drive shaft. If it is half full, it requires rather more, and if it is completely full it needs a lot more.

"The same goes for speed – the faster, the more power consumed. Also, the denser the material being conveyed, the more power required. By constantly measuring the torque in the driveshaft, we can determine the volume and weight of material being conveyed."

Non-contact digital torque monitoring is proving useful for applications including coal conveying

CONVEYING SOLUTIONS

Torque sensing technology is also proving useful for materials handling in the coal industry. Conveyors have a major role to play during the coal mining, transporting, processing and burning industries. However, due to the nature of the product being handled, and the fact that these are heavy duty electro-mechanical systems operating in highly challenging environmental conditions, mechanical failure is a regular occurrence.

But, non-contact digital torque monitoring technology is opening up the potential to transform these conveying processes into highly accurate and controlled procedures.

In coal conveying systems, when the conveyor is empty it requires very little power from the drive shaft to keep it moving smoothly. As coal is added and the conveyor load increases, so more power is needed. Similarly, if the conveyor is run at a higher speed, more power is needed. Controlling the speed helps minimise shock loads, and leads to both increased reliability and increased efficiency.

Sensor Technology's TorqSense transducers

Accurate control of the conveyor comes from the ability to monitor the power being used to drive the conveyor. This information can then be fed into computerised control systems to ensure the belt conveyor is always moving at optimum speed. Real-time data from the conveyor is collected by having sensors monitoring the critical variables – in this case the torque on the drive shaft, the speed of the motor, and the drive power – and fed back to the control system.

Sensor Technology's TorqSense transducers use two tiny SAW devices or SAWs made of ceramic piezoelectric material containing frequency resonating combs. These are glued onto the drive shaft at 90° 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.

This method of measuring torque brings advantages to coal conveying, whether in extracting coal from the mine, or transporting it for processing, or as part of subsequent shipping operations.

Sensor Technology
T: 01869 238400
www.sensors.co.uk
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