Sensors have changed a lot in recent years and the pace of change is accelerating. Ivor Matanle reviews some recent advances

Pacing sensor technology

A Sensor-Technik temperature sensor, showing the thin-film structures

The sensors for automation and control that industry relies upon - proximity, motion, temperature, pressure, level, infrared etc - are all still there, but most are smaller, more precise and, surprisingly, cheaper in real terms than they were a few years ago. Networking of production systems has advanced rapidly, with wireless networking becoming the favoured approach. As sensor costs have reduced, the cost of networking has tended to increase, thus balancing any savings.

Condition monitoring of machinery has become more important as equipment contains more sealed units, and working parts become less accessible. One of the recent innovations in this area has been wear debris sensor technology, invented by researchers at the University of Edinburgh some eight years ago and developed by MACOM Technologies. This technology makes possible the detection and counting of metallic wear particles in the lubrication oil of engines, gearboxes and complex assemblies. A sudden increase in the number and size of particles indicates imminent failure.

Temperature sensors have changed in a big way, with thermocouples rapidly being overtaken as a result of the improvement of RTDs (Resistance Temperature Devices). RTDs rely on the principle that the electrical resistance of metallic films changes with variation in temperature. Most RTDs use a thin-film platinum detector, which offers an approximately linear relationship between temperature and resistance. RTDs are available in platinum, nickel or copper, each giving a different resistance-to-temperature coefficient curve. For cryogenic applications, RTDs are made with ceramic substrates.

Thin-film pressure sensor technology has advanced dramatically during the last few years, and has made possible dramatic reductions in the size of pressure sensors. One of the leading companies in this technology is Sensor-Technik (www.sensor-technik.co.uk) in Germany, whose production techniques for manufacturing the titanium nitride thin film strain gauges used in its pressure sensors are entirely the company's own creation. The thin film can be deposited on, and bonded to various different substrates, including ceramics but more commonly high-grade special steels, to create an IP69 sealed transmitter filled with a dry inert gas. Sensor-Technik is now supplying this advanced technology in standard OEM sensors, mainly targeted at higher pressure environments such as hydraulics and vehicle applications.

Right: The new Sensor-Technik MOI OEM standard pressure sensors are targeted at higher pressure applications, such as hydraulics

Piezoelectric sensors for dynamic measurements of force, pressure and vibration use well-established principles but have been progressively refined, made more precise and reduced in size. As well as their well-known use as accelerometers in vehicles, particularly aircraft, piezoelectric high frequency miniature sensors can be used to detect very small component vibrations and shock. Force sensors using similar technology can be used for impact measurements and fatigue monitoring and piezoelectric pressure sensors are used to monitor very fast changes in pressure.

Vibration measurement in potentially explosive atmospheres Page 9 ▶