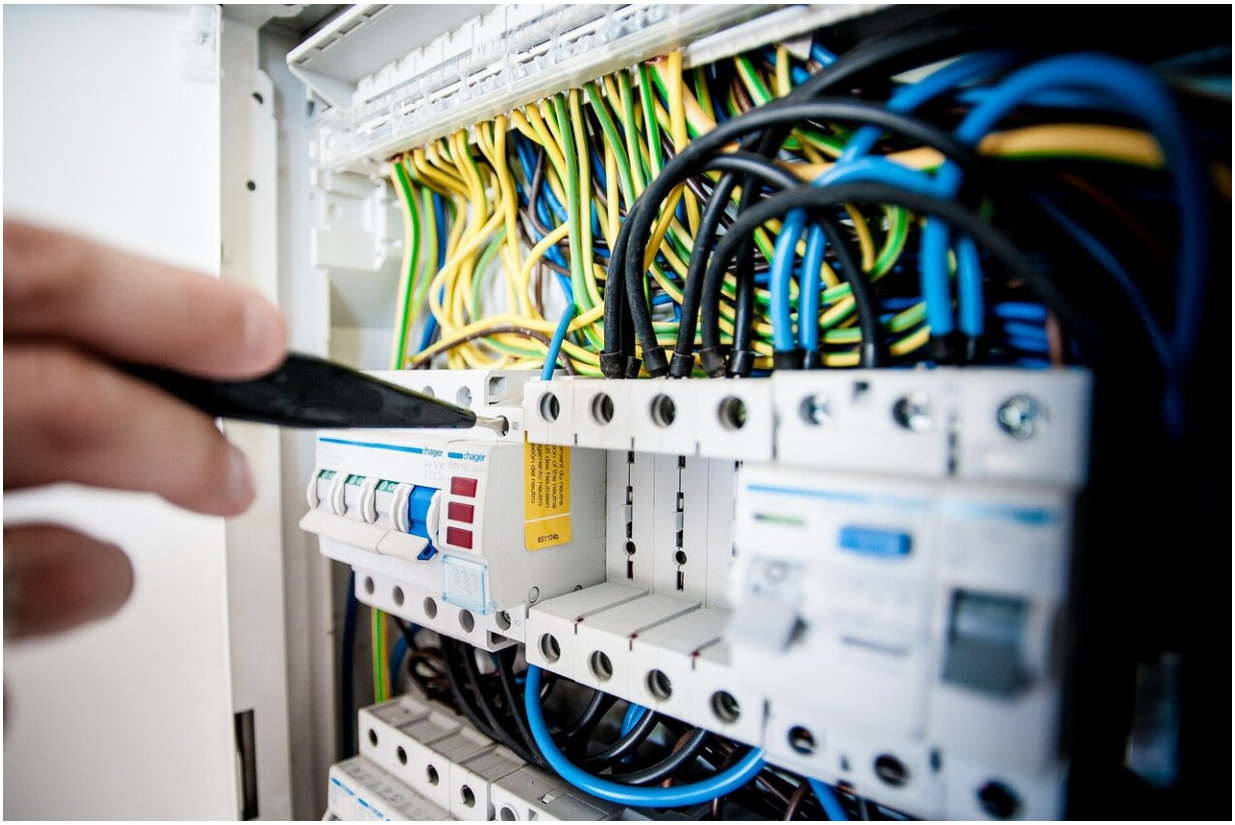
Sensors and metrology as the driving force for digitalization

June 20 2019



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Many digitalized processes depend on data collected by increasingly powerful sensors and other test and measurement technology. When this data is processed, it provides precise and reliable information about the

operating environment. Nine Fraunhofer Institutes will be presenting the results of their research into sensor technology and its applications in the field of testing and measurement at Sensor+Test 2019 in Nürnberg from June 25 to 27 (Booth 248 in Hall 5).

A great many innovations in today's digital era rely on the ability to transfer information from the real world to the digital universe—examples include advances in gesture recognition, non-contact materials testing and artificial respiration. In applications like these, sensors and other test and measurement systems can be equated to enabling technologies because many new developments are based on them. At this year's edition of Sensor+Test, the leading forum in this field worldwide, Fraunhofer will once again be presenting examples of its research in the many areas that make up its wide-ranging technology portfolio.

Wider-spectrum contact-free materials testing

Terahertz imaging is one of the new technologies that is being used increasingly to monitor industrial processes and test new materials. This non-contact method can be used to measure coating thickness, analyze the structure of polymer composites, or detect defects in non-conductive materials. The Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI, will be presenting the next generation of fiber-coupled terahertz transceivers. The integrated sensor probe permits reflection measurements orthogonal to the surface of the test sample and can be used without modification in combination with commercially available terahertz measuring systems.

Reducing machine downtime, manufacturing defects and reject rates

The Fraunhofer Institute for Digital Media Technology IDMT will demonstrate how the quality of workpieces and components can be assured using a non-contact, non-destructive test method based on audio sensing of product and process parameters combined with machine learning. Visitors can learn more about this method, which can be used both to monitor production processes and to perform end-of-line product testing, in a series of interactive exhibits.

Supplying sensors with energy created by tiny vibrations

One of the challenges in the Internet of Things (IoT) is how to supply power to wireless sensors—a question that Fraunhofer Institute for Integrated Circuits IIS is tackling by developing energy harvesting solutions. Even the slightest vibrations generating a pressure of 100 mg at a frequency of 60 hertz are sufficient for a vibration transformer to produce the electrical energy needed to operate several sensors and transmit data once per second. The Maximum Power Point Tracker provides an effective means of controlling the charge converter so as to guarantee a maximum power yield. The energy harvesting solution recharges the battery while the device is in operation and enables the design of IoT sensors with an unlimited service life, without power cable or swapping batteries.

CMOS optical filter for low-cost chip-size spectrometers

Given the already high cost of six-band multispectral sensors, sensors with more than six spectral bands are too expensive for applications in many price-sensitive markets. The nanoSPECTRAL technology developed by Fraunhofer IIS is based on optical nanostructures and enables a very cost-effective monolithic production of the required

optical filters directly in CMOS semiconductor processes, together with the optical sensor elements. The chip-size spectrometer shown at the fair already has more than 30 spectral bands and is thus e.g. suitable for agricultural applications, analytics, food analysis and medical applications.

Gentler artificial respiration

To minimize discomfort for the patient, the apparatus used to apply artificial ventilation must be rapidly and precisely adjustable to a multitude of parameters depending on the patient in question. This is particularly critical in the case of newborns or infants, whose lungs are so tiny they can only take in a few milliliters of air with each breath, and so fragile that any excess pressure can lead to permanent damage. This is why ventilators must be capable of responding to the first sign of spontaneous breathing within a fraction of a second. The Fraunhofer Institute for Manufacturing Engineering and Automation IPA has developed a new technique that enables spontaneous respiratory movements to be detected almost instantly and without physical contact. This opens the way to highly flexible breathing assistance devices, especially for very young patients with fragile lungs.

Ultrasound-based gesture recognition

A team of researchers at the Fraunhofer Institute for Photonic Microsystems IPMS is using a new class of micromechanical ultrasonic transducers to reliably detect three-dimensional distance changes, movement patterns and gestures within a range of up to 500 centimeters. The miniaturized components are cheap to produce and generate high sound pressures, with a frequency response that allows them to be tuned to the optimum balance between distance and sensitivity. Applications for the non-contact motion sensors include automation and safety

systems, medical devices, the automotive industry, entertainment electronics and household appliances. Fraunhofer IPMS will show one of its first function demonstrators at Sensor+Test.

Pocket-sized laboratory for monitoring water quality

A highly selective and sensitive, autonomous test system is capable of detecting trace amounts of predefined chemical substances (in the micromol range) in waste water. Uses of this pocket-sized laboratory include evaluating the quality of water bodies. Its main component is a chemical sensor based on microfluidic technology, hence its very compact design. By reducing the size of the system to such small dimensions, it can operate in situ without human intervention. The consortium of eleven partners working on this EU-funded project includes the Fraunhofer Institute for Reliability and Microintegration IZM and the Fraunhofer Institute for Integrated Circuits IIS.

High-performance hydrogen sensor

The Fraunhofer Institute for Chemical Technology ICT has developed an extremely sensitive hydrogen sensor in collaboration with industrial partner LAMTEC as part of a publicly funded research project. The Low Hydrogen Concentration measurement sensor (LHyCon) can replace standard helium-based leak detectors, offers high measurement sensitivity, and moreover costs significantly less than other methods with a comparable performance.

Provided by Fraunhofer-Gesellschaft