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DynoSense 300: The Fast and Versatile Fiber Optic Sensor Interrogator System

Xenics, Europe's leading developer of innovative infrared imaging systems, in a cooperation with FOS&S, has designed a novel evaluation system for fiber optic sensors based on Fiber Bragg gratings. With its high scan rate of 3.3kHz, Xenics' DynoSense enables fiber optic measurement technology to analyze up to 40 sensors per fiber. With this approach, DynoSense 300 opens up a multitude of new applications based on fiber optics.

Fiber optic sensors on a march

Fiber optic measurement technology currently is emerging at a rapid pace. It excels by its robustness, it is corrosion-free, transmits the sensor signal optically over long distances, and is immune against electromagnetic radiation. Thus, the fiber optic measurement method is especially well suited for safety-critical application areas such as in mining or aerospace. Further advantages are offered by using sensors based on Fiber Bragg Gratings (FBG): they transform the measured temperature, pressure or pull force data into a corresponding spectral shift of the impending infrared light. And, due to their thinness, they can be easily embedded in advanced fiber reinforced composite materials used in airplane construction. Embedded sensors can spatially combine multiple sensor areas in one fiber, so enabling the capture of critical temperature and pressure profiles spread over flat surfaces or having a 3-D structure. This is achieved by positioning sensor fibers in an appropriately meandering pattern within the material to be analyzed.

Adaptation of measurement technique facilitates broad-based applications

Application-friendly evaluation methods offering broad functionalities, housed in compact cabinets, now significantly enhance the practicability of this sensor technology. Among these practical systems is DynoSense 300, an evaluation system for FBG sensors developed by Xenics in cooperation with FOS&S. DynoSense 300 contains all the necessary analytic components, such as broad-band light source, polychromator, coupler and references, as well as sufficient intelligence for the preprocessing of the measured properties.

Here is the way DynoSense 300 operates: IR light is coupled into the sensor fiber via the optical 2 x 2 coupler. The reflected radiation is guided back and fed to a polychromator, which projects the received spectrum (1520 to 1680nm) via its concave mirror grating, onto a high-resolution line sensor. This way, up to 40 sensors integrated in one fiber can be monitored. Three operational modes cover wide applications: in wavelength mode, DynoSense 300 acquires the sensors' wavelength signals as a function of time, at a scan rate of 3,3 kHz. This way, higher-frequency mechanical vibrations within the

analyzed material are safely caught. Second, in spectral mode, DynoSense 300 visualizes the entire optical spectrum. This offers a very valuable method for a self test of the sensor network. Finally, in FFT mode, a Fast Fourier Transform of the captured wavelength signals is performed. This eases the work load of the higher-level host system.

The wavelength resolution of DynoSense 300 is better than 1 pm, and its repeatability is within 5 pm. Wavelength capture accuracy is specified to 35 pm over the duration of one year.

The DynoSense 300 interrogator unit is controllable through a simple user interface, with control signals connected via the USB port, and data signals via Camera Link or Gigabit Ethernet. Besides the optical FC/APC connection to the fiber, the system also has an interface for external triggering if event-driven capture of measurement signals is required. Among the software-selectable parameters is the integration time to optimally adapt the system's 20 dB dynamic range to the measured light intensity.

Conclusion

The favorable performance features of Xenics' DynoSense 300 put system designers in a position of easily solving complex measurement tasks by means of FBG sensor technology to yield meaningful, repeatable and accurate results.

About Xenics:

Xenics is the leading developer of innovative infrared detection solutions for a wide range of applications. Xenics designs, manufactures and sells infrared detectors and cameras, both line-scan and 2D, covering the infrared wavelength ranges from 1 to 14 micrometers. In addition, Xenics delivers custom products according to the agreed specification and planning.

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