

Optics-Based Strain Sensing System

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An optics-based strain sensing system is being developed for quazi-distributed strain sensing in locations and environments that are not accessible to conventional strain sensors. The system comprises an Optical Interrogator that has been designed and constructed by Southern Photonics [1], and optical fibre coupled Bragg grating strain sensors. It has been tested using commercial fibre Bragg gratings [2] that were attached to 316 stainless steel test samples and cycled in strain and temperature using an Instron mechanical testing machine and temperature controlled cabinet. The results have been compared to the performance of conventional electrical resistance strain gauges. Pairs of fibre Bragg gratings were simultaneously interrogated at 1535 and 1550 nm centre wavelengths to demonstrate the ability of the system to use multiple sensors for quazi-distributed sensing and temperature compensation. The Optical Interrogator resolution is approximately 10 microstrains, accounting for longer term temperature drift, and it is capable of resolving dynamic strains at rates of up to 45 Hz.

Conventional fibre Bragg gratings are ideally designed for the measurement of the strain magnitude. However, there are applications where the strain tensor is also required. Furthermore, strain sensors are also needed for strain measurements at high temperatures. For these reasons we have been researching new materials and methods for strain tensor and high temperature strain measurements. In this report we discuss our optics-based strain sensing system as well as our progress towards the development of new strain sensors for the measurement of the strain tensor as well as for high temperature applications.

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References

[1] <http://www.southernphotonics.com>

[2] <http://www.avensys.com>