Waterford Institute *of* Technology
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Optical Sensor Interrogation

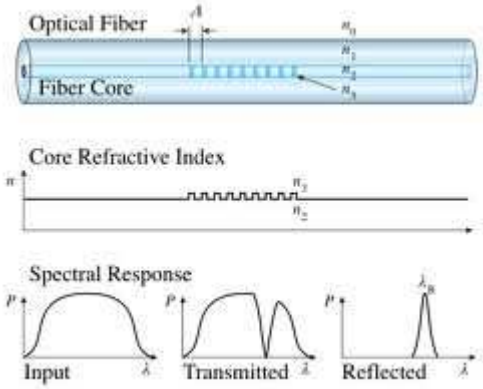
Background

Optical fibre bases sensors are important, and becoming even more so, in monitoring the state of large complex structures – from bridges and buildings to oil/gas pipelines and drilling rigs for example. Such installations may require hundreds to thousands of individual sensors. Interrogation of large numbers of sensors distributed across a web of optical fibre with the desired accuracy and speed represents a significant challenge and cost using existing techniques. This work promises to significantly simplify and improve both the economics and performance of sensor interrogation systems.

Technology Description

Established techniques for optical (Fibre Bragg Grating) sensor interrogation —**tunable filter, tunable laser, diode array**— are limited in their ability to:

- **Interrogate sensors over broad wavelength ranges.**
- **Provide simultaneous measurement of all sensors** in a wavelength division multiplexed (WDM) array, (a tunable laser scans each sensor sequentially as the lasing wavelength is swept through the sensor resonant wavelength and as a result there is the possibility that a critical event may be missed).



Fibre Bragg Grating: Light with a wavelength matching the gratings resonant wavelength experiences strong reflection back along the fibre. This resonant wavelength is strain/temperature dependent which provides the basis of strain and temperature sensing using the device.

Common problem: Interrogation of multiple arrays of WDM devices—interferometer/spectrometer or some form of time division multiplexing (TDM) scheme is required for interrogation of each individual array.

Interferometric interrogation exhibits a fundamental advantage over these established techniques: The ability to interrogate all of the WDM devices in an array simultaneously (the so called Fellgett , or multiplex, advantage).

This solution developed by the Optics Research Group at WIT allows:

- **The interrogation of multiple arrays of optical sensors using a single unit.**
- **The interrogation of mesh networks of optical sensors.**
- **MHz interrogation of arrays of arrays of single sensors.**
- **Provide signals ideally suited to transport on existing telecoms networks.**

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Market Opportunity

Application Areas:
This technology has application wherever optical sensors are used in either large numbers or in situations where very high speed interrogation is advantageous. Such domains include Aerospace & Marine Engineering, Oil and Gas (wells, pipelines and refining), destructive & non-destructive testing, and Structural Health Monitoring (transportation infrastructure in particular).

IP Status

The Optics Research Group has developed several patent pending technologies in the areas of optical devices, sensors and systems - including a solution which combines the capabilities of an interferometer and a time division multiplexing scheme for multi-array interrogation with no extra hardware requirements. For more information please contact either of the parties listed below.

Contact

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