Optical sensor at high sampling rate

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Invention

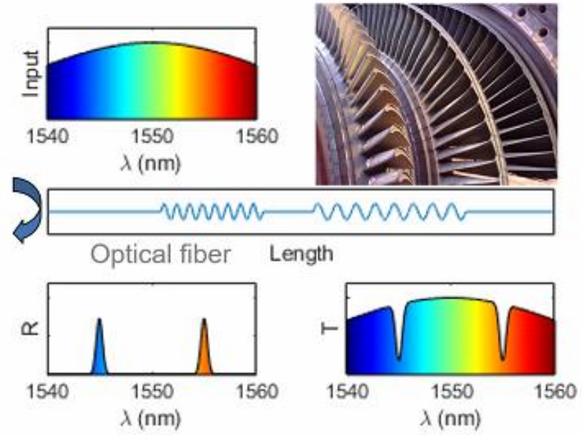
The invention is within the optical fiber sensor technology, and in particular, sensors that measure physical perturbations (temperature, mechanical vibrations, pressure), where the wavelength of the reflected light responds to these parameters, such as fiber Bragg grating (FBG) sensors or Fabry-Perot sensors. The sensor proposed in the invention allows reading these sensors at sampling rate beyond hundreds of kHz, which is not possible using commercially available sensors, but necessary in many applications.

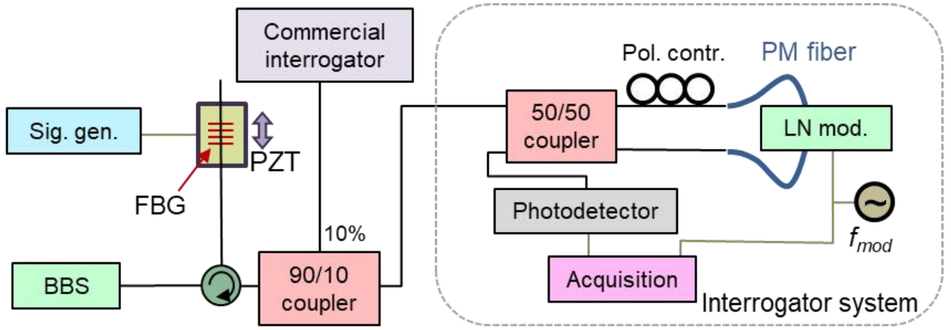
The invention describes an optical sensor comprising: sensing elements with a wavelength sensitivity to perturbations; an optical broadband source covering the wavelength range of the sensing elements; an interferometer; a signal generator; a receiver, to detect optical signals reflected from the sensors. The interferometer proposed is a Sagnac fiber interferometer, and the innovation regards the interrogation of the interferometer, where a rapid phase generated carrier (PGC) technique is proposed by making use of a lithium-niobate-type phase modulator used as a birefringent modulator, allowing for modulation bandwidths beyond the MHz range, which enables sensing sampling rates beyond hundreds of kHz. The proof of concept has been demonstrated in the laboratory and the results and details are published in a scientific journal [C. J. Oton et al, J. Lightwave Tech., 38 (16) 4513 (2020)].

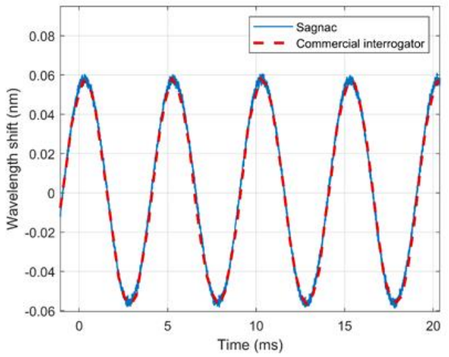
The main advantages of this invention are represented by:

- Flexibility
- Immunity to electromagnetic interference
- Small dimensions
- Multiplexable along a single fiber
- Passive at the sensing point
- High sampling rate
- Low cost

Drawings & pictures







Industrial applications

APPLICATIONS:

- Turbomachine monitoring (turbines and compressors)
- Dynamic pressure sensing
- Vibration monitoring at high frequencies

Possible developments

The invention has been demonstrated in a laboratory (Current TRL 3-4), and the inventor has received funding from the Italian Ministry for Economic Development for the generation of a prototype to be tested in relevant environment, which will take the TRL to level 5-6 in the second quarter of 2022.

The inventor and the asignee (Scuola Superiore Sant’Anna) are looking for industrial partners for the industrial exploitation of the invention. The inventor will be able to provide prototype versions for testing in specific applications.

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