Improvements in BOTDA for fiber optic sensors (Ramot)

code: 7-2013-554

Moshe Tur, T.A.U Tel Aviv University, Engineering, School of Electrical Engineering
Yair Peled, T.A.U Tel Aviv University, Engineering, School of Electrical Engineering

Technology

This method is based on the Brillouin effect in optical fibers. By using a simple single mode optical fiber, strain is measured in a distributed manner along the entire fiber length, simultaneously, in high repetition rate. By attaching/planting the optical fiber to/in a mechanical structure, its mechanical behavior can be dynamically measured.

The Need

While most non-fiber-optic sensors, sense in a discrete manner (e.g. a piezo element) fiber-optic-distributed sensor can reduce the cost and the complexity of a sensor system, for which a large number of measuring points is required. One single simple optical fiber can replace thousands of discreet sensors.

Potential Application

1. Studying the mechanical and physical dynamic behavior of large structures such as skyscrapers, bridges, highways, aircraft, missiles, rocket motors and many more.
2. Monitoring the mechanical and physical dynamic behavior of large structures for long-term nondestructive testing (NDT).
3. Detection and analysis of earthquakes, tunnel revelation and other homeland security.
4. Lange scale phase-array sensor for mechanical waves, obtained with a single optical fiber.

Stage of Development

Proof of concept was obtained using a prototype. Distributed-dynamic strain sensing was demonstrated on a 100m long fiber, which was simultaneously interrogated at an effective repetition rate of 10,000 [samples/sec], archiving a precision of 5 microstrain with spatial resolution of 1m. Spatial resolution of 5cm was obtained as well.

Patents

“FAST BRILLOUIN OPTICAL TIME DOMAIN ANALYSIS FOR DYNAMIC SENSING”.
"PUMP-POWER-INDEPENDENT DOUBLE SLOPE-ASSISTED DISTRIBUTED AND FAST BRILLOUIN FIBER-OPTIC SENSOR".

Supporting Publications

Yair Peled, Avi Motil, and Moshe Tur, "Fast Brillouin optical time domain analysis for dynamic sensing," Opt. Express 20, 8584-8591 (2012).
http://www.opticsinfobase.org/oe/abstract.cfm?URI=oe-20-8-8584
A. Motil, O. Danon, Y. Peled, and M. Tur, "Pump-power-independent Double Slope-Assisted distributed and fast Brillouin fiber-optic sensor, " Photonics Technology Letters, IEEE , vol.26, no.8, pp.797,800 (2014). http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6725651&tag=1
A. Motil, O. Danon, Y. Peled, and M. Tur, “Fast Pump-Power-Independent Brillouin Fiber Optic sensor,” in Optical Fiber Communication Conference/National Fiber Optic Engineers Conference 2014, OSA Technical Digest (online) (Optical Society of America, 2014), paper M3J.5.
https://www.osapublishing.org/abstract.cfm?uri=OFC-2014-M3J.5

Contact for more information:

Ofer Shneyour, VP Business Development, ICT, +972.3.640.6496

Ramot at Tel Aviv University Ltd. P.O. Box 39296, Tel Aviv 61392 ISRAEL
Phone: +972-3-6406608

Fax: +972-3-6406675