Journal of
Materials Engineering and Applications

Abstract

Brillouin Optical Correlation Domain Analysis in Composite Material Beams

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Abstract:
Composite materials are widely employed within critical structures in the aerospace, construction, automotive and healthcare sectors, due to their favorable ratio of strength to weight and the large freedom in the design of their mechanical properties and geometry. The potential consequences of failure in many composite material structures are catastrophic. Hence the structural health monitoring (SHM) of composites is often necessary at the design phase, during production, as part of in-service preventive maintenance procedures and in damage assessment [1]. Static strain analysis is often restricted to the reading of point-sensors, such as strain gauges, accelerometers or non-contact laser Doppler vibrometers. The scaling of these sensors to the continuous coverage of large areas is often challenging or altogether impractical. Optical fibers constitute an exceptional sensing platform [2]. They may be readily embedded within most structures with little effect on functionality, are immune to electro-magnetic interference, can be addressed from a long standoff distance, and may be used in hazardous environments where electricity is forbidden. Optical fibers also support distributed analysis protocols of both temperature and strain, based on the principles of Raman, Rayleigh or Brillouin scattering [3], in which every section of the fiber itself serves as an independent sensing node. Distributed Brillouin sensors were introduced to SHM in large-scale composite structures in 2003 [4]. State-of-the-art Brillouin sensing demonstrations reach a measurement range of hundreds of km, more than a million resolution points, acquisition rates of several kHz, and millimeter-scale spatial resolution.

Biography:

Avinoam (Avi) Zadok received the B.Sc. degree in physics and mathematics from the Hebrew University of Jerusalem, Israel in 1994, the M.Sc. degree in physical electronics from Tel-Aviv University, Israel in 1999, and the Ph.D. degree in electrical engineering from the same University in 2007. Between 2007 and 2009 he was a post-doctoral research fellow at the Department of Applied Physics, California Institute of Technology. In 2009 he joined the Faculty of Engineering of Bar-Ilan University, Israel, where he is a Full Professor since 2017. He is the co-author of 150 papers in scientific journals and proceedings of international conferences. His research interests include fiber-optics, nonlinear optics, integrated photonic devices and opto-mechanics. Dr. Zadok received the Krill Award of the Wolf Foundation in 2013. He received a Starter Grant from the European Research Council (ERC) in 2015. Dr. Zadok was the Chair of the Israel Young Academy for 2020.

Recent Publications:

1. Avi Zadok, et al; Observation of anti-parity-time-symmetry, phase transitions and exceptional points in an optical fibre, 2020.
2. Avi Zadok, et al; Integrated high-resolution optical spectrum analyzer with broad operational bandwidth, 2020.
3. Avi Zadok, et al; Sequence-coded coherent laser ranging with high detection sensitivity, 2020.
4. Avi Zadok, et al; Opto-Mechanical Interactions in Multi-Core Optical Fibers and Their Applications, 2020.
5. Avi Zadok, et al; Distributed cladding mode fiber optic sensor, 2019.

Webinar on Industrial Chemistry; October 25, 2020; Paris, France.

Citation: Avi Zadok; Brillouin Optical Correlation Domain Analysis in Composite Material Beams; Industrial Chemistry Webinar; October 25, 2020; Paris, France.