PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 8794

, "Front Matter: Volume 8794," Proc. SPIE 8794, Fifth European Workshop on Optical Fibre Sensors, 879401 (20 May 2013); doi: 10.1117/12.2027228

SPIE.

Event: Fifth European Workshop on Optical Fibre Sensors, 2013, Krakow, Poland

PROCEEDINGS OF SPIE

Fifth European Workshop on Optical Fibre Sensors

Leszek R. Jaroszewicz
Editor

19–22 May 2013
Kraków, Poland

Organized by
Photonics Society of Poland (Poland)
Military University of Technology (Poland)
Warsaw University of Technology (Poland)
Jagiellonian University in Krakow (Poland)

Sponsored by
Innovative Economy National Cohesion Strategy (Poland)
InPhoTech Ltd. (Poland)
AMS Technologies (Germany)
PHOENIX (Germany)

Cooperating Organization and Publisher
SPIE

Volume 8794

Proceedings of SPIE 0277-786X, V. 8794

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Fifth European Workshop on Optical Fibre Sensors, edited by Leszek R. Jaroszewicz, Proc. of SPIE Vol. 8794,
879401 · © 2013 SPIE · CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2027228

Proc. of SPIE Vol. 8794 879401-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Fifth European Workshop on Optical Fibre Sensors*, edited by Leszek R. Jaroszewicz, Proceedings of SPIE Vol. 8794 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819496348

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2013, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/13/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

xix	Conference Committee
xxi	Introduction
xxiii	Invited Lectures

SESSION 1 SPECIAL SESSION

8794 02	Optofluidics: a new tool for sensing (Invited Paper) [8794-96] G. Testa, G. Persichetti, IREA-CNR (Italy); L. Zeni, Second Univ. of Naples (Italy); P. M. Sarro, Technische Univ. Delft (Netherlands); R. Bernini, IREA-CNR (Italy)
---------	---

SESSION 2 ELECTROMAGNETIC, PHYSICAL, AND MECHANICAL PHENOMENA SENSORS; INTERFEROMETRIC AND POLARIMETRIC SENSORS

8794 03	Fabrication of higher order Bragg gratings in microstructured polymer fibers [8794-12] G. Statkiewicz-Barabach, D. Kowal, Wrocław Univ. of Technology (Poland); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); W. Urbanczyk, Wrocław Univ. of Technology (Poland)
8794 04	Focussed ion beam machining of an in-fibre 45° mirror for fibre end sensors [8794-28] J. Li, J. N. Sun, M. M. Miliar, J. M. Ritchie, Heriot-Watt Univ. (United Kingdom); X. Luo, Univ. of Huddersfield (United Kingdom); R. R. J. Maier, D. P. Hand, W. N. MacPherson, Heriot-Watt Univ. (United Kingdom)
8794 05	Fibre optic pressure and temperature sensor for applications in harsh environments [8794-32] R. D. Pechstedt, Oxsensis Ltd. (United Kingdom)
8794 06	Plasmonic sensor based microstructured optical fibers with silver nanowires [8794-41] C. Hao, Y. Lu, B. Wu, H. Cui, L. Duan, R. Wang, J. Yao, Tianjin Univ. (China)
8794 07	Fibre-optic sensors for partial discharge-generated ultrasound in elastomeric high-voltage insulation materials [8794-51] P. Rohwetter, W. Habel, BAM Federal Institute for Materials Research and Testing (Germany)
8794 08	Thermal monitoring of the diamond deposition process using regenerated FBG [8794-89] N. J. Alberto, Instituto de Telecomunicações (Portugal) and Univ. de Aveiro (Portugal); R. Simões, Univ. de Aveiro (Portugal); V. de Oliveira, H. J. Kalinowski, Federal Univ. of Technology – Paraná (Brazil); V. F. Neto, Univ. de Aveiro (Portugal); R. N. Nogueira, Federal Univ. of Technology – Paraná (Brazil)

- 8794 09 **Radiation hard humidity sensors based on polyimide-coated fiber Bragg gratings** [8794-94]
G. Berruti, M. Consales, Univ. of Sannio (Italy); M. Giordano, L. Sansone, CNR, Institute for Composite and Biomedical Materials (Italy); P. Petagna, European Organization for Nuclear Research, CERN (Switzerland); S. Buontempo, Istituto Nazionale di Fisica Nucleare (Italy); G. Breglio, Univ. of Naples Federico II (Italy); A. Cusano, Univ. of Sannio (Italy)
- 8794 0A **Fiber Bragg grating based angular accelerometer: a first approach** [8794-101]
M. M. Carvalho, R. M. Cazo, V. R. Almeida, C. L. Barbosa, Instituto de Estudos Avançados (Brazil)
- 8794 0B **Optical sapphire fiber Bragg gratings as high temperature sensors** [8794-116]
T. Habisreuther, T. Elsmann, Z. Pan, A. Graf, H.-J. Pißler, M. Rothhardt, R. Willsch, H. Bartelt, M. A. Schmidt, Institute of Photonic Technology (Germany)
- 8794 0C **Humidity sensor fabricated by deposition of SnO₂ layers onto optical fibers** [8794-122]
P. Sanchez, C. R. Zamarreño, M. Hernaez, I. del Villar, I. R. Matias, F. J. Arregui, Public Univ. of Navarra (Spain)
- 8794 0D **Optical inclinometer based on phase-shifted Bragg grating in a taper configuration** [8794-149]
J. P. P. Moura, INESC Porto (Portugal) and Univ. do Porto (Portugal); S. O. Silva, INESC Porto (Portugal); M. Becker, M. Rothardt, H. Bartelt, Institute of Photonic Technology (Germany); O. Frazão, INESC Porto (Portugal)
- 8794 0E **Sensing structure based on surface plasmonic resonance in single mode optical fibers chemically etched** [8794-179]
L. Coelho, INESC TEC (Portugal) and Univ. do Porto (Portugal); J. M. Almeida, INESC TEC (Portugal) and Univ. de Trás-os-Montes e Alto Douro (Portugal); J. L. Santos, INESC TEC (Portugal) and Univ. do Porto (Portugal); R. A. S. Ferreira, Univ. de Aveiro (Portugal); P. S. André, Instituto de Telecomunicações (Portugal), D. Viegas, INESC TEC (Portugal)
- 8794 0F **Fabrication of a spun elliptically birefringent photonic crystal fiber and its characterization as an electrical current sensor** [8794-192]
A. C. S. Brígida, INESC Porto (Brazil) and Univ. Federal do Pará (Brazil); I. M. Nascimento, INESC Porto (Portugal) and Univ. do Porto (Portugal); G. Chesini, J. G. Hayashi, Univ. Estadual de Campinas (Brazil); J. M. Baptista, INESC Porto (Portugal) and Univ. da Madeira (Poland); J. C. W. A. Costa, INESC Porto (Brazil); M. A. G. Martinez, Ctr. Federal de Educação Tecnológica (Brazil); P. A. S. Jorge, INESC Porto (Portugal); C. M. B. Cordeiro, Univ. Estadual de Campinas (Brazil)
- 8794 0G **Bicell fibre optics homodyne phase demodulator: experimental results** [8794-6]
Z. Holdynski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); I. Merta, Military Univ. of Technology (Poland); T. Nasilowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); L. R. Jaroszewicz, Military Univ. of Technology (Poland)
- 8794 0H **Pressure sensor based on an all-fiber Fabry-Pérot interferometer for different gaseous environments** [8794-10]
S. Silva, L. Coelho, INESC Porto (Portugal) and Univ. do Porto (Portugal); O. Frazão, INESC Porto (Portugal)

- 8794 0I **HiBi triangular optical nanowire in suspended-core fiber for sensing applications** [8794-11]
R. M. André, INESC Porto (Portugal) and Univ. do Porto (Portugal); M. Becker, K. Schuster, M. Rothhardt, H. Bartelt, Institute of Photonic Technology (Germany); M. B. Marques, INESC Porto (Portugal) and Univ. do Porto (Portugal); O. Frazão, INESC Porto (Portugal)
- 8794 0J **Fiber optic extrinsic FPI/FBG sensor for temperature-compensated pressure measurement in medical applications** [8794-13]
S. Poeggel, D. Tosi, G. Leen, E. Lewis, Univ. of Limerick (Ireland)
- 8794 0K **Static pressure and temperature compensated wideband fiber laser hydrophone** [8794-14]
F.-X. Launay, R. Lardat, R. Bouffaron, G. Roux, M. Doisy, C. Bergogne, Thales Underwater Systems (France)
- 8794 0L **Refractive index sensor based on terahertz multimode interference fiber device** [8794-25]
A. L. S. Cruz, Instituto Tecnológico de Aeronáutica (Brazil); A. C. C. Migliano, M. A. R. Franco, Instituto Tecnológico de Aeronáutica (Brazil) and Instituto de Estudos Avançados (Brazil)
- 8794 0M **Spectral measurements of polarimetric sensitivity of holey fiber to strain, temperature, and hydrostatic pressure** [8794-34]
P. Hlubina, Technical Univ. of Ostrava (Czech Republic); J. Olszewski, T. Martynkien, Wrocław Univ. of Technology (Poland); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); W. Urbańczyk, Wrocław Univ. of Technology (Poland)
- 8794 0N **All-optical acoustic array for underwater surveillance** [8794-36]
R. Bouffaron, F.-X. Launay, Thales Underwater Systems (France); S. Molin, Thales Research & Technology (France); A. Mugnier, Quantel (France); P. Brechat, Rakon (France); D. Billet, R. Lardat, G. Roux, M. Doisy, C. Bergogne, Thales Underwater Systems (France); D. Pureur, Quantel (France); Y. Léguillon, P. Besnard, CNRS, FOTON (France)
- 8794 0O **Measurements of intermodal sensitivity of a two-mode holey fiber to strain, temperature, and hydrostatic pressure** [8794-37]
M. Kadulová, P. Hlubina, Technical Univ. of Ostrava (Czech Republic); J. Olszewski, T. Martynkien, Wrocław Univ. of Technology (Poland); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); W. Urbańczyk, Wrocław Univ. of Technology (Poland)
- 8794 0P **Ultracompact optical fiber Fabry-Perot interferometer based on in-line integrated sub-micron silicon film** [8794-68]
A. Micco, G. Quero, A. Crescitelli, A. Ricciardi, A. Cusano, Univ. of Sannio (Italy)
- 8794 0Q **Results from a borehole optical fiber interferometer for recording Earth strain** [8794-74]
M. A. Zumberge, S. DeWolf, F. K. Wyatt, D. C. Agnew, D. Elliott, W. Hatfield, Univ. of California, San Diego (United States)
- 8794 0R **Measurements of the birefringence temperature dependence in polarization maintaining fibre optics using Bragg gratings** [8794-80]
I. Abe, V. de Oliveira, H. J. Kalinowski, Federal Univ. of Technology – Paraná (Brazil)
- 8794 0S **Double closed-loop resonator fiber optic gyro with improved digital serrodyne modulation** [8794-103]
H. Ma, X. Yu, Z. Jin, Zhejiang Univ. (China)

- 8794 OT **Influence of the mode geometry on the strain and temperature sensitivity of different fibers** [8794-105]
M. Murawski, Z. Holdynski, M. Szymanski, T. Tenderenda, L. Ostrowski, A. Lukowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); H. Krisch, Krohne Messtechnik GmbH (Germany); M. Napierała, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); L. R. Jaroszewicz, Military Univ. of Technology (Poland); T. Nasilowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland)
- 8794 OU **Improvement of sensitivity for hybrid fiber optic sensor for application in perimeter protection** [8794-125]
M. Życzkowski, M. Szustakowski, P. Markowski, M. Karol, Military Univ. of Technology (Poland)
- 8794 OV **Investigation of acoustic sensitivity of hollow-core photonic bandgap fibers** [8794-137]
F. Yang, W. Jin, H. L. Ho, The Hong Kong Polytechnic Univ. (Hong Kong, China); F. Wang, W. Liu, L. Ma, Y. Hu, National Univ. of Defense Technology (China)
- 8794 OW **Ultrasensitive refractive index sensor with temperature insensitivity based on concatenated LPGs** [8794-152]
S. M. Tripathi, W. J. Bock, Univ. du Québec en Outaouais (Canada); A. Kumar, Indian Institute of Technology Delhi (India); P. Mikulic, Univ. du Québec en Outaouais (Canada); K. J. Bock, Carleton Univ. (Canada)
- 8794 OX **Dynamics for different light sources of the polarimetric fiber sensor used for strain measurement in composite material** [8794-154]
A. W. Domański, M. Bieda, P. Lesiak, T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 8794 OY **Refractive index sensors based on optical fiber hetero-core structures and Fabry-Pérot interferometers** [8794-155]
A. Bueno, C. Caucheteur, D. Kinet, P. Mégret, Univ. of Mons (Belgium)
- 8794 OZ **Parallel Fabry-Pérot interferometer in suspended twin-core fiber** [8794-162]
R. M. André, INESC Porto (Portugal) and Univ. do Porto (Portugal); J. Kobelke, K. Schuster, H. Bartelt, Institute of Photonic Technology (Germany); M. B. Marques, INESC Porto (Portugal) and Univ. do Porto (Portugal); O. Frazão, INESC Porto (Portugal)

SESSION 3 CHEMICAL, ENVIRONMENTAL, BIOLOGICAL, AND MEDICAL SENSORS; PASSIVE AND ACTIVE DEVICES FOR PHOTONIC SENSING

- 8794 10 **Simple oxygen gas sensor based on side-illuminated polymer optical fiber** [8794-9]
Ó. Esteban, C. Pulido, Univ. de Alcalá (Spain)
- 8794 11 **Plastic optical fibre sensor for quality control in food industry** [8794-15]
C. Novo, Univ. de Aveiro (Portugal); L. Bilro, Instituto de Telecomunicações (Portugal); R. Ferreira, Univ. de Aveiro (Portugal); N. Alberto, Instituto de Telecomunicações (Portugal) and Univ. de Aveiro (Portugal); P. Antunes, C. Leitão, Univ. de Aveiro (Portugal) and Instituto de Telecomunicações (Portugal); R. Nogueira, Instituto de Telecomunicações (Portugal); J. L. Pinto, Univ. de Aveiro (Portugal) and Instituto de Telecomunicações (Portugal)

- 8794 12 **Detection of trinitrotoluene based on SPR in molecularly imprinted polymer on plastic optical fiber** [8794-24]
N. Cennamo, Second Univ. of Naples (Italy); M. Pesavento, G. D'Agostino, Univ. of Pavia (Italy); R. Galatus, Technical Univ. of Cluj-Napoca (Romania); L. Bibbò, L. Zeni, Second Univ. of Naples (Italy)
- 8794 13 **Tuning properties of long-period gratings by atomic layer deposited zinc oxide nano-coating** [8794-38]
M. Śmietana, M. Myśliwiec, J. Grochowski, Warsaw Univ. of Technology (Poland); W. J. Bock, P. Mikulic, Univ. du Québec en Outaouais (Canada); Ł. Wachnicki, B. S. Witkowski, M. Godlewski, Institute of Physics (Poland)
- 8794 14 **Evanescent wave DNA-aptamer biosensor based on long period gratings for the specific recognition of *E. coli*** [8794-44]
R. B. Queirós, INESC Porto (Portugal) and Univ. do Porto (Portugal); C. Gouveia, INESC Porto (Portugal) and Univ. da Madeira (Portugal); J. R. A. Fernandes, INESC Porto (Portugal) and Univ. de Trás-os-Montes e Alto Douro (Portugal); P. A. S. Jorge, INESC Porto (Portugal)
- 8794 15 **Detection and quantification of hogwash oil in soybean oils using low-cost spectroscopy and chemometrics** [8794-53]
A. G. Mignani, L. Ciaccheri, A. A. Mencaglia, CNR-Istituto di Fisica Applicata Nello Carrara (Italy); A. Cichelli, Univ. degli Studi G. D'Annunzio (Italy); J. Xing, X. Yang, W. Sun, L. Yuan, Harbin Engineering Univ. (China)
- 8794 16 **Extension of surface plasmon resonance in fiber optic sensors into the visible region** [8794-55]
M. C. Navarrete, N. Díaz-Herrera, A. González-Cano, Univ. Complutense (Spain); Ó. Esteban, Univ. de Alcalá (Spain)
- 8794 17 **Preparation of a novel drug sensor using a molecular imprinted polymer approach** [8794-57]
S. P. Wren, T. H. Nguyen, City Univ. London (United Kingdom); P. Gascoine, Smiths Detection (United Kingdom); D. Lacey, Home Office Scientific Development Branch (United Kingdom); T. Sun, K. T. V. Grattan, City Univ. London (United Kingdom)
- 8794 18 **Radiotherapy dosimetry based on plastic optical fibre sensors** [8794-67]
S. O'Keeffe, Univ. of Limerick (Ireland); M. Grattan, A. Hounsell, Belfast City Hospital (United Kingdom); D. McCarthy, Univ. of Limerick (Ireland); P. Woulfe, J. Cronin, Galway Clinic (Ireland); E. Lewis, Univ. of Limerick (Ireland)
- 8794 19 **Lab on fiber technology: a versatile fabrication path for optimized nanoprobe** [8794-70]
G. Quero, M. Consales, Univ. of Sannio (Italy); A. Crescitelli, Univ. of Sannio (Italy) and CNR-ICIB "E. Caianiello" (Italy); A. Ricciardi, Univ. of Sannio (Italy); E. Esposito, CNR-ICIB "E. Caianiello" (Italy); A. Cutolo, Univ. of Sannio (Italy); A. Cusano, Univ. of Sannio (Italy) and CNR-ICIB "E. Caianiello" (Italy)
- 8794 1A **Radiation-induced optical attenuation of Co/Fe co-doped alumino-silicate optical fiber for radiation dosimeter application** [8794-77]
Y. Kim, S. Ju, S. Jeong, Gwangju Institute of Science and Technology (Korea, Republic of); J.-Y. Kim, N.-H. Lee, H.-K. Jung, Korea Atomic Energy Research Institute (Korea, Republic of); W.-T. Han, Gwangju Institute of Science and Technology (Korea, Republic of)

- 8794 1B **Suspended-core optical fibres for organic dye absorption spectroscopy** [8794-93]
B. Wajnchold, A. Umińska, M. Grabka, D. Kotas, S. Pustelny, W. Gawlik, Jagiellonian Univ. in Krakow (Poland)
- 8794 1C **In the trial of a fiber Bragg grating sensor to assess the central arterial pressure wave profile** [8794-98]
C. Leitão, P. Antunes, Univ. de Aveiro (Portugal) and Instituto de Telecomunicações (Portugal); J. M. Bastos, Univ. de Aveiro (Portugal); P. André, Univ. de Aveiro (Portugal) and Instituto de Telecomunicações (Portugal); J. L. Pinto, Univ. de Aveiro (Portugal)
- 8794 1D **Surface plasmon resonance based optical fiber riboflavin sensor by using molecularly imprinted gel** [8794-102]
R. Verma, B. D. Gupta, Indian Institute of Technology Delhi (India)
- 8794 1E **Fiber optic hydrogen sulfide gas sensor utilizing surface plasmon resonance of Cu/ZnO thin films** [8794-109]
R. Tabassum, S. K. Mishra, B. D. Gupta, Indian Institute of Technology Delhi (India)
- 8794 1F **Sensitivity enhancement of surface plasmon resonance based fiber optic refractive index sensor using an additional layer of zinc oxide** [8794-110]
S. K. Mishra, C. Varshney, B. D. Gupta, Indian Institute of Technology Delhi (India)
- 8794 1G **Fiber optic ammonia gas sensor utilizing surface plasmon resonance of copper/bromocresol purple thin films** [8794-112]
S. K. Mishra, S. Bhardwaj, B. D. Gupta, Indian Institute of Technology Delhi (India)
- 8794 1H **Optical fibre Bragg grating cladding mode sensors** [8794-115]
M. D. Baiad, M. Gagné, E. de Montigny, W.-J. Madore, N. Godbout, C. Boudoux, R. Kashyap, Ecole Polytechnique de Montréal (Canada)
- 8794 1I **Detection of volatile organic compounds (VOCs) using an optical fibre long period grating with a calixarene anchored mesoporous thin film** [8794-131]
S. Korposh, F. Davis, S. W. James, Cranfield Univ. (United Kingdom); T. Wang, S.-W. Lee, The Univ. of Kitakyushu (Japan); S. Higson, R. P. Tatam, Cranfield Univ. (United Kingdom)
- 8794 1J **Fiber optic liquid-level sensor using a long fiber Bragg grating** [8794-147]
A. L. Ricchiuti, D. Barrera, Univ. Politècnica de València (Spain); K. Nonaka, Kochi Univ. of Technology (Japan); S. Sales, Univ. Politècnica de València (Spain)
- 8794 1K **High-temperature optical sensor based in high birefringence regenerated FBGs and a simple interrogation scheme** [8794-148]
D. Barrera, S. Sales, Univ. Politècnica de València (Spain)
- 8794 1L **Application of a photonic crystal fiber LPG for vibration monitoring** [8794-153]
I. M. Nascimento, INESC Porto (Portugal) and Univ. do Porto (Portugal); G. Chesini, Univ. Estadual de Campinas (Brazil); M. Sousa, Univ. Federal do Pará (Brazil); J. H. Osório, Univ. Estadual de Campinas (Brazil); J. M. Baptista, INESC Porto (Portugal) and Univ. da Madeira (Portugal); C. M. B. Cordeiro, Univ. Estadual de Campinas (Brazil); P. A. S. Jorge, INESC Porto (Portugal)

- 8794 1M **A comprehensive experimental investigation of sensitivity enhancement for optical fiber humidity sensor employing localized surface plasmon resonance spectroscopy** [8794-156]
R. Aneesh, S. Khijwania, Indian Institute of Technology Guwahati (India)
- 8794 1N **Porphyrin coated fiber optic probes for acid vapor detection** [8794-163]
A. Bahrapour, Univ. of Naples Federico II (Italy); A. Iadicicco, Univ. of Naples "Parthenope" (Italy); G. De Luca, Univ. di Messina (Italy) and Consiglio Nazionale delle Ricerche (Italy); M. Giordano, A. Borriello, Consiglio Nazionale delle Ricerche (Italy); A. Cutolo, A. Cusano, Univ. of Sannio (Italy); L. Monsù Scolaro, Univ. di Messina (Italy)
- 8794 1O **Optimized photonic crystal fibers supporting efficient capillary electrophoresis** [8794-169]
M. Calcerrada, C. García-Ruiz, Univ. de Alcalá (Spain); P. Roy, Xlim Fibres Photoniques, CNRS, Univ. de Limoges (France); M. Gonzalez-Herraez, Univ. de Alcalá (Spain)
- 8794 1P **New theoretical and experimental methods for the design of fiber optic tweezers** [8794-174]
R. S. Rodrigues Ribeiro, A. Guerreiro, INESC Porto (Portugal) and Univ. do Porto (Portugal); C. Ecoffet, O. Soppera, Institut de Sciences des Matériaux, CNRS, Ecole Nationale Supérieure de Chimie de Mulhouse (France); P. A. S. Jorge, INESC Porto (Portugal)
- 8794 1Q **Miniaturised optical fiber pH sensor for gastro-esophageal applications** [8794-177]
F. Baldini, F. Chiavaioli, F. Cosi, A. Giannetti, S. Tombelli, C. Trono, CNR-Istituto di Fisica Applicata Nello Carrara (Italy)
- 8794 1R **Personal protective equipment with integrated POF sensors** [8794-185]
J. Witt, M. Schukar, K. Krebber, BAM Federal Institute for Materials Research and Testing (Germany); H. Pažoutová, J. Demuth, Safibra, s.r.o. (Czech Republic); N. Santostefano, Aero Sekur S.p.A. (Italy); H. Mäkinen, Finnish Institute of Occupational Health (Finland); P. Pietrowski, National Research Institute (Poland)
- 8794 1S **A multi-sensor dosimeter for brachytherapy based on radioluminescent fiber sensors** [8794-187]
A. Correia, S. Chiquita, INESC Porto (Portugal); N. S. Hussain, INESC Porto (Portugal) and Univ. do Porto (Portugal); R. Piraco, IPOFG Porto (Portugal); C. C. Rosa, INESC Porto (Portugal) and Univ. do Porto (Portugal)
- 8794 1T **Fabrication tolerances in long-period fiber grating refractometric sensors** [8794-188]
A. Beltrán-Hernández, S. Khotiaintsev, Univ. Nacional Autónoma de México (Mexico)
- 8794 1U **Polarization effects in a fiber optic refractometric sensor with semi-cylindrical plastic detection element** [8794-190]
S. Perez-Garcia, S. Khotiaintsev, Univ. Nacional Autónoma de México (Mexico)
- 8794 1V **Concept of all-fiber bend sensor based on photonic crystal fibers with asymmetric air-hole structure** [8794-42]
M. Napierała, InPhoTech Ltd. (Poland) and Military Univ. of Technology (Poland); Ł. Szostkiewicz, InPhoTech Ltd. (Poland); M. Szymanski, InPhoTech Ltd. (Poland) and Military Univ. of Technology (Poland); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); L. R. Jaroszewicz, Military Univ. of Technology (Poland); T. Nasilowski, InPhoTech Ltd. (Poland) and Military Univ. of Technology (Poland)

- 8794 1W **Changes of propagation light in optical fiber submicron wires** [8794-45]
K. A. Stasiewicz, A. Łukowski, L. R. Jaroszewicz, Military Univ. of Technology (Poland)
- 8794 1X **9000 hours-long high temperature annealing of regenerated fiber Bragg gratings** [8794-56]
G. Laffont, R. Cotillard, P. Ferdinand, CEA, LIST (France)
- 8794 1Z **FBG inscription in non-hydrogenated SMF28 fiber with a ns Q-switched Nd:VO₄ laser at 213 nm** [8794-60]
B. Berrang, L. Polz, R. Kuttler, Munich Univ. of Applied Sciences (Germany); J. Bartschke, Xiton Photonics GmbH (Germany); J. Roths, Munich Univ. of Applied Sciences (Germany)
- 8794 20 **Two regimes of grating regeneration in hydrogen loaded photosensitive fiber** [8794-63]
L. Polz, Q. Nguyen, Munich Univ. of Applied Sciences (Germany); H. Bartelt, Institute of Photonic Technology (Germany); J. Roths, Munich Univ. of Applied Sciences (Germany)
- 8794 21 **Four-port microfiber long-period grating sensors** [8794-85]
L.-P. Sun, J. Li, L. Jin, B.-O. Guan, Jinan Univ. (China)
- 8794 22 **Asymmetric fiber tapers fabricated with a pulsed CO₂ laser** [8794-100]
A. S. Paterno, R. Kremer, D. S. Matos, R. Zolet, A. Felipe, Santa Catarina State Univ. (Brazil); H. J. Kalinowski, Federal Univ. of Technology – Paraná (Brazil)
- 8794 23 **Inscription of narrow bandwidth Bragg gratings in polymer optical fibers** [8794-120]
C. A. F. Marques, L. Bilro, Instituto de Telecomunicações (Portugal); D. J. Webb, Aston Univ. (United Kingdom); R. N. Nogueira, Instituto de Telecomunicações (Portugal)
- 8794 24 **Temperature and strain characterization of long period gratings in air guiding fiber** [8794-159]
A. Iadicicco, Univ. of Naples "Parthenope" (Italy); A. Cutolo, A. Cusano, Univ. of Sannio (Italy); S. Campopiano, Univ. of Naples "Parthenope" (Italy)
- 8794 25 **Polarizing optical fiber for single-frequency laser transmission and interferometry based characterization thereof** [8794-166]
T. Villedieu, T. Robin, ixFiber SAS (France); H. Lefèvre, iXBlue SAS (France)
- 8794 26 **Analysis of phase interrogation in SPR-based sensing supported by tapered optical fibres** [8794-183]
H. Moayyed, I. T. Leite, L. Coelho, J. L. Santos, INESC Porto (Portugal) and Univ. do Porto (Portugal); D. Viegas, INESC Porto (Portugal) and Cabelte, S.A. (Portugal)

SESSION 4 ADVANCED AND NEW WAVEGUIDING STRUCTURES; NEW CONCEPTS FOR PHOTONIC SENSING; SMART STRUCTURES AND SMART MATERIALS

- 8794 27 **Analysis of temperature and strain sensitivity of fiber Bragg gratings written in dual-mode highly birefringent microstructured fibers** [8794-27]
T. Tenderenda, M. Murawski, M. Szymanski, InPhoTech Ltd. (Poland) and Military Univ. of Technology (Poland); M. Becker, M. Rothhardt, H. Bartelt, Institute of Photonic Technology (Germany); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); K. Poturaj, Military Univ. of Technology (Poland) and Maria Curie-Skłodowska Univ. (Poland); M. Makara, Maria Curie-Skłodowska Univ. (Poland); K. Skorupski, Military Univ. of Technology (Poland) and Maria Curie-Skłodowska Univ. (Poland); P. Marc, L. R. Jaroszewicz, Military Univ. of Technology (Poland); T. Nasilowski, InPhoTech Ltd. (Poland) and Military Univ. of Technology (Poland)
- 8794 28 **A new approach to obtain single-polarization hollow-core photonic bandgap fiber** [8794-61]
V. A. Serrão, Instituto de Estudos Avançados (Brazil); M. A. R. Franco, Instituto de Estudos Avançados (Brazil) and Instituto Tecnológico de Aeronáutica (Brazil)
- 8794 29 **Attenuation of the photonic liquid crystal fibers with various core diameters** [8794-75]
M. M. Tefelska, S. Ertman, T. R. Wolinski, Warsaw Univ. of Technology (Poland); P. Mergo, R. Dabrowski, Maria Curie-Skłodowska Univ. (Poland)
- 8794 2A **Mode field expansion in index-guiding microstructured optical fibers** [8794-90]
D. K. Sharma, A. Sharma, Indian Institute of Technology Delhi (India)
- 8794 2B **Investigation of ferroelectric liquid crystal orientation in the silica microcapillaries** [8794-99]
D. Budaszewski, A. W. Domański, T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 8794 2C **Numerical analysis of birefringence tuning in high index microstructured fiber selectively filled with liquid crystal** [8794-106]
K. Milenko, S. Ertman, T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 8794 2D **Electric control of state of polarization in index-guiding photonic liquid crystal fibers** [8794-121]
S. Ertman, A. Siarkowska, Warsaw Univ. of Technology (Poland); D. Pysz, Institute of Electronic Materials Technology (Poland); R. Buczyński, Univ. of Warsaw (Poland); E. Nowinowski-Kruszelnicki, R. Dąbrowski, Military Univ. of Technology (Poland); T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 8794 2E **Microcavity tip temperature sensor based on post-processing** [8794-126]
M. S. Ferreira, INESC Porto (Portugal) and Univ. do Porto (Portugal); J. Bierlich, K. Schuster, Institute of Photonic Technology (Germany); J. L. Santos, INESC Porto (Portugal) and Univ. do Porto (Portugal); O. Frazão, INESC Porto (Portugal)
- 8794 2F **Temperature dependence analysis of the parameters in double clad hollow core fibers** [8794-140]
H. Stawska, E. Bereś-Pawlik, Wrocław Univ. of Technology (Poland)
- 8794 2G **Optical fiber bend sensor based on fiber Bragg grating in germano-silicate glass optical fiber with depressed-index structure** [8794-165]
S. Ju, S. Jeong, Y. Kim, M.-J. Jang, O. Kim, W.-T. Han, Gwangju Institute of Science and Technology (Korea, Republic of)

- 8794 2H **Design and analysis of photonic quasi-crystal hollow core fibers** [8794-186]
A. Bahrapour, Univ. of Naples Federico II (Italy); A. Iadicicco, Univ. of Naples "Parthenope" (Italy); A. R. Bahrapour, Sharif Univ. of Technology (Iran, Islamic Republic of); S. Campopiano, Univ. of Naples "Parthenope" (Italy); A. Cutolo, A. Cusano, Univ. of Sannio (Italy)
- 8794 2I **Enhancement of Brillouin signal in plastic optical fibers using pulsed pump with multimode-fiber-assisted coupling** [8794-1]
Y. Mizuno, N. Hayashi, K. Nakamura, Tokyo Institute of Technology (Japan)
- 8794 2J **Thermo-optic properties of Co nanofluid filled microstructured fiber** [8794-4]
P. Marć, A. Gieraj, Military Univ. of Technology (Poland); M. Murawski, Ł. Ostrowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); P. Piliszek, A. Januszko, L. R. Jaroszewicz, Military Univ. of Technology (Poland); T. Nasitowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland)
- 8794 2K **Real-time distributed measurement of detonation velocities inside high explosives with the help of chirped fiber Bragg gratings** [8794-78]
S. Magne, CEA, LIST (France); A. Lefrançois, J. Luc, CEA DAM DEA/SDMT (France); G. Laffont, P. Ferdinand, CEA, LIST (France)
- 8794 2L **Experimental study of temperature response of a microfiber coupler sensor with a liquid crystal overlay** [8794-88]
Y. Semenova, L. Bo, P. Wang, S. Mathews, Q. Wu, Dublin Institute of Technology (Ireland); M. Teng, C. Yu, Beijing Univ. of Posts and Telecommunications (China); G. Farrell, Dublin Institute of Technology (Ireland)
- 8794 2M **Theoretical modeling of the Faraday effect within a gas-filled photonic bandgap fiber** [8794-108]
M. Grabka, Jagiellonian Univ. in Krakow (Poland); F. V. Englich, D. G. Lancaster, The Univ. of Adelaide (Australia); W. Gawlik, Jagiellonian Univ. in Krakow (Poland); T. M. Monro, The Univ. of Adelaide (Australia)
- 8794 2N **Temperature and thermo-optic coefficient measurements using optical fibre long period gratings operating at phase matching turning point** [8794-138]
S. Korposh, R. Wong, S. James, R. Tatam, Cranfield Univ. (United Kingdom)
- 8794 2O **Turning a low Q fiber resonator into a high-sensitivity displacement sensor using slow light concepts** [8794-146]
M. Bravo, Univ. Pública de Navarra (Spain); X. Angulo-Vinuesa, S. Martin-Lopez, Consejo Superior de Investigaciones Científicas (Spain); M. Lopez-Amo, Univ. Pública de Navarra (Spain); M. Gonzalez-Herraez, Univ. de Alcalá (Spain)
- 8794 2P **Ultrasensitive nanoprobe based on metallo-dielectric crystals integrated onto optical fiber tips using the breath figures technique** [8794-157]
M. Pisco, G. Quero, Univ. of Sannio (Italy); A. Iadicicco, Univ. of Naples "Parthenope" (Italy); M. Giordano, Institute for Composite and Biomedical Materials, CNR (Italy); F. Galeotti, Istituto per lo Studio delle Macromolecole, CNR (Italy); A. Cusano, Univ. of Sannio (Italy)

- 8794 2Q **Bragg gratings inscription at 1550 nm in photosensitive step-index polymer optical fiber** [8794-167]
X. Hu, D. Kinet, K. Chah, P. Mégret, C. Caucheteur, Univ. of Mons (Belgium)
- 8794 2R **Temperature and strain effects discrimination inside composite materials with embedded weakly tilted fibre Bragg grating** [8794-59]
D. Kinet, Univ. of Mons (Belgium); D. Garray, Sirris (Belgium); P. Mégret, C. Caucheteur, Univ. of Mons (Belgium)
- 8794 2S **A technique to evaluate the good operation of FBG sensors embedded in a carbon fiber beam** [8794-64]
G. Cazzulani, S. Cinquemani, L. Comolli, Politecnico di Milano (Italy)
- 8794 2T **Weakly intrusive optical fibre connector for composite materials applications: vibration and temperature validation tests** [8794-65]
D. Kinet, Univ. of Mons (Belgium); B. Guerra, D. Garray, Sirris (Belgium); C. Caucheteur, P. Mégret, Univ. of Mons (Belgium)
- 8794 2U **Embedding metallic jacketed fused silica fibres into stainless steel using additive layer manufacturing technology** [8794-117]
R. R. J. Maier, D. Havermann, W. N. MacPherson, D. P. Hand, Heriot-Watt Univ. (United Kingdom)
- 8794 2V **Low-coherence interferometric measurements of optical losses in autoclave cured composite samples with embedded optical fibers** [8794-134]
R. Di Sante, DIN, Univ. of Bologna (Italy); F. Bastianini, SestoSensor S.r.l. (Italy); L. Donati, DIN, Univ. of Bologna (Italy)
- 8794 2W **Simplified sensor design for temperature-strain discrimination using fiber Bragg gratings embedded in laminated composites** [8794-136]
L. Rodriguez-Cobo, Univ. de Cantabria (Spain); A. T. Marques, Univ. do Porto (Portugal); J. M. Lopez-Higuera, Univ. de Cantabria (Spain); J. L. Santos, O. Frazão, INESC Porto (Portugal)
- 8794 2X **Dynamic response of fiber Bragg gratings strain sensors** [8794-150]
G. E. Silva, J. C. Santos, Univ. of São Paulo (Brazil)
- 8794 2Y **Highly birefringent polymer microstructured optical fibers embedded in composite materials** [8794-161]
P. Lesiak, M. Szeląg, M. Kuczkowski, A. W. Domański, T. R. Woliński, Warsaw Univ. of Technology (Poland)
- 8794 2Z **Influence of the composite material thermal expansion on embedded highly birefringent polymer microstructured optical fibers** [8794-172]
M. Szeląg, P. Lesiak, M. Kuczkowski, A. W. Domański, T. R. Woliński, Warsaw Univ. of Technology (Poland)

SESSION 5 DISTRIBUTED SENSING, MULTIPLEXING, AND SENSOR NETWORKING; SYSTEM APPLICATIONS AND FIELD TRIALS

- 8794 30 **Integration of Cu-coated single-mode optical fiber into carbon/PEEK composite for distributed structural health monitoring based on Rayleigh backscatter reflectometry** [8794-7]
M. Steffen, M. Schukar, BAM Federal Institute for Materials Research and Testing (Germany)
- 8794 31 **L-BOFDA: a new sensor technique for distributed Brillouin sensing** [8794-8]
A. Wosniok, BAM Federal Institute for Materials Research and Testing (Germany); Y. Mizuno, Tokyo Institute of Technology (Japan); K. Krebber, BAM Federal Institute for Materials Research and Testing (Germany); K. Nakamura, Tokyo Institute of Technology (Japan)
- 8794 32 **A novel quasi-distributed fiber optic sensor for 3D vector measurement of static magnetic fields** [8794-16]
L. Palmieri, E. Autizi, Univ. of Padova (Italy); A. Galtarossa, Univ. of Padova (Italy) and Southeast Univ. (China)
- 8794 33 **Field examples for optical fibre sensor condition diagnostics based on distributed fibre optic strain sensing** [8794-17]
N. Kusche, V. Schukar, D. Hofmann, F. Basedau, W. Habel, BAM Federal Institute for Materials Research and Testing (Germany); H. Woschitz, W. Lienhart, Technische Univ. Graz (Austria)
- 8794 34 **Distributed and dynamic monitoring of 4km/sec waves using a Brillouin fiber optic strain sensor** [8794-20]
Y. Peled, L. Yaron, A. Motil, M. Tur, Tel-Aviv Univ. (Israel)
- 8794 35 **Cable development for distributed geophysical sensing with a field trial in surface seismic** [8794-23]
P. Lumens, A. Franzen, K. Hornman, S. Grandi Karam, G. Hemink, B. Kuvshinov, Shell Global Solutions International B.V. (Netherlands); J. La Follett, B. Wyker, Shell Exploration & Production Inc. (United States); P. Zwartjes, Shell Global Solutions International B.V. (Netherlands)
- 8794 36 **Observation and characterization of stimulated Brillouin gain spectra in plastic optical fibers** [8794-26]
N. Hayashi, Y. Mizuno, K. Nakamura, Tokyo Institute of Technology (Japan)
- 8794 37 **Colour simplex coding for Brillouin distributed sensors** [8794-33]
S. Le Floch, F. Sausser, M. Llera, Haute Ecole Arc Ingénierie Siège (Switzerland); M. A. Soto, L. Thévenaz, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8794 38 **Validation of TW-COTDR method for 25km distributed optical fiber sensing** [8794-39]
S. Delepine-Lesoille, ANDRA (France); A. Guzik, Neubrex Co., Ltd. (Japan); J. Bertrand, ANDRA (France); J.-M. Henault, Electricité de France (France); K. Kishida, Neubrex Co., Ltd. (Japan)
- 8794 39 **Brillouin scattering properties in partially chlorinated plastic optical fibers estimated with ultrasonic pulse-echo technique** [8794-48]
K. Minakawa, N. Hayashi, Y. Mizuno, K. Nakamura, Tokyo Institute of Technology (Japan)

- 8794 3A **Raman-assisted vector Brillouin optical time domain analysis** [8794-71]
X. Angulo-Vinuesa, Focus S.L. (Spain); D. Bacquet, Lab. PhLAM, CNRS, Univ. Lille 1 (France); S. Martin-Lopez, Univ. de Alcalá (Spain); P. Corredera, Consejo Superior de Investigaciones Científicas (Spain); P. Szriftgiser, Lab. PhLAM, CNRS, Univ. Lille 1 (France); M. Gonzalez-Herraez, Univ. de Alcalá (Spain)
- 8794 3B **Numerical simulation for optimization of temporal gatings in Brillouin optical correlation domain analysis** [8794-79]
R. K. Yamashita, K. Hotate, The Univ. of Tokyo (Japan)
- 8794 3C **Railway traffic monitoring using Brillouin distributed sensors** [8794-81]
A. Minardo, Second Univ. of Naples (Italy); G. Porcaro, Tecnomatica SaS (Italy); D. Giannetta, Ferrovie del Gargano (Italy); R. Bernini, CNR, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy); L. Zeni, Second Univ. of Naples (Italy) and CNR, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy)
- 8794 3D **Modal analysis of a cantilever beam by use of the slope-assisted BOTDA method for damage identification** [8794-82]
A. Minardo, A. Coscetta, S. Pirozzi, Second Univ. of Naples (Italy); R. Bernini, CNR, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy); L. Zeni, Second Univ. of Naples (Italy) and CNR, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy)
- 8794 3E **Modulation instability-induced visibility fading in phase-sensitive OTDR** [8794-111]
H. F. Martins, INESC Porto (Portugal) and Univ. do Porto (Portugal); S. Martin-Lopez, Univ. de Alcalá (Spain); P. Corredera, P. Salgado, Consejo Superior de Investigaciones Científicas (Spain); O. Frazão, INESC Porto (Portugal); M. González-Herráez, Univ. de Alcalá (Spain)
- 8794 3F **High visibility phase-sensitive optical time domain reflectometer for distributed sensing of ultrasonic waves** [8794-119]
H. F. Martins, INESC Porto (Portugal) and Univ. do Porto (Portugal); S. Martin-Lopez, Univ. de Alcalá (Spain); P. Corredera, M. L. Filograno, Consejo Superior de Investigaciones Científicas (Spain); O. Frazão, INESC Porto (Portugal); M. González-Herráez, Univ. de Alcalá (Spain)
- 8794 3G **Phase-shift based BOTDA measurements tolerant to non-local effects** [8794-124]
J. Urricelqui, M. Sagues, A. Loayssa, Univ. Pública de Navarra (Spain)
- 8794 3H **Monitoring of the ground settlement during a tunnel excavation using 4D optical fiber sensing system** [8794-127]
A. Guzik, M. Yokoyama, K. Matsuda, K. Kishida, Neubrex Co., Ltd. (Japan)
- 8794 3I **Time gated phase-correlation distributed Brillouin fibre sensor** [8794-129]
A. Denisov, M. A. Soto, L. Thévenaz, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8794 3J **Mitigating modulation instability in Brillouin distributed fibre sensors** [8794-133]
M. A. Soto, M. Alem, Ecole Polytechnique Fédérale de Lausanne (Switzerland); W. Chen, National Univ. of Defense Technology (China); L. Thévenaz, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8794 3K **Dual-wavelength highly doped fiber laser for temperature measurements** [8794-139]
S. Diaz, M. Lopez-Amo, Univ. Pública de Navarra (Spain)

- 8794 3L **High spatial resolution BOTDA using simultaneously launched gain and loss pump pulses** [8794-143]
A. Motil, O. Danon, Y. Peled, M. Tur, Tel-Aviv Univ. (Israel)
- 8794 3M **Analytical investigation of the Brillouin interaction between multiple pulsed pump tones and probe waves** [8794-158]
A. Voskoboinik, A. E. Willner, Univ. of Southern California (United States); M. Tur, Tel-Aviv Univ. (Israel)
- 8794 3N **Quasi-distributed measurement on femtosecond laser-induced scattering voids using incoherent OFDR and OTDR** [8794-164]
S. Liehr, BAM Federal Institute for Materials Research and Testing (Germany); J. Burgmeier, Fraunhofer Heinrich Hertz Institute (Germany)
- 8794 3O **Comparison of simulated and experimental results for distributed radiation-induced absorption measurement using OFDR reflectometry** [8794-168]
A. V. Faustov, SCK•CEN (Belgium), Univ. of Mons (Belgium), and St. Petersburg State Polytechnical Univ. (Russian Federation); A. Gusarov, SCK•CEN (Belgium); L. B. Liokumovich, St. Petersburg State Polytechnical Univ. (Russian Federation); A. A. Fotiadi, Univ. of Mons (Belgium), Ioffe Physical-Technical Institute (Russian Federation), and Ulyanovsk State Univ. (Russian Federation); M. Wulpart, P. Mégret, Univ. of Mons (Belgium)
- 8794 3P **Brillouin distributed fibre sensing using phase modulated probe** [8794-171]
X. Lu, M. A. Soto, Ecole Polytechnique Fédérale de Lausanne (Switzerland); M. Gonzalez Herraiz, Univ. de Alcalá (Spain); L. Thévenaz, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 8794 3Q **Connectorisation of fibre Bragg grating sensors recorded in microstructured polymer optical fibre** [8794-173]
A. Abang, D. Saez-Rodriguez, Aston Univ. (United Kingdom); K. Nielsen, O. Bang, Technical Univ. of Denmark (Denmark); D. J. Webb, Aston Univ. (United Kingdom)
- 8794 3R **Enhancing temperature sensing features of FBGs by use of thin film aluminium coating** [8794-184]
M. A. Caponero, F. Bonfigli, S. Libera, A. Polimadei, M. A. Vincenti, A. Zini, R. M. Montereali, ENEA (Italy)
- 8794 3S **Fiber designs for micro-seismic sensing** [8794-193]
A. M. Gillooly, M. D. Hill, Fibercore Ltd. (United Kingdom)
- 8794 3T **Interrogation of multiple ferrule-top-cantilever sensors for acoustic emission sensing** [8794-40]
L. Schenato, Institute for Geo-Hydrological Protection, CNR (Italy); L. Palmieri, E. Autizi, Univ. of Padova (Italy); G. Gruca, D. Iannuzzi, Vrije Univ. Amsterdam (Netherlands); A. Pasuto, Institute for Geo-Hydrological Protection, CNR (Italy); A. Galtarossa, Univ. of Padova (Italy) and Southeast Univ. (China)

- 8794 3U **Switchable fiber optic laser system for high and low-strain fiber optic sensors remote multiplexing** [8794-47]
S. Rota-Rodrigo, Univ. Pública de Navarra (Spain); L. Rodríguez-Cobo, M. A. Quintela, J. M. López-Higuera, Univ. de Cantabria (Spain); M. López-Amo, Univ. Pública de Navarra (Spain)
- 8794 3V **Fiber optic sensor networks based on OADM devices with a bus configuration** [8794-130]
M. Bravo, M. Fernandez-Vallejo, M. Lopez-Amo, Univ. Pública de Navarra (Spain); J. Kobelke, K. Schuster, Institute of Photonic Technology (Germany)
- 8794 3W **Birefringent microfiber-based fiber loop mirrors for tunable filters and refractive index sensors** [8794-141]
W. Jin, H. Xuan, W. Jin, The Hong Kong Polytechnic Univ. (Hong Kong, China)
- 8794 3X **Solid state interferometric interrogator and multiplexer for high-speed dynamic and absolute FBG wavelength measurement** [8794-160]
P. Orr, M. Perry, G. Fusiek, P. Niewczas, Univ. of Strathclyde (United Kingdom)
- 8794 3Y **Long term reliability and machine operation diagnosis with fiber optic sensors at large turbine generators** [8794-2]
T. Bosselmann, S. Strack, M. Villnow, J. R. Weidner, M. Willsch, SIEMENS AG (Germany)
- 8794 3Z **A mobile wireless sensor network platform for use with optical fibre sensors** [8794-3]
B. Zhou, S. Yang, T. Sun, K. T. V. Grattan, City Univ. London (United Kingdom)
- 8794 40 **Numerical aperture analysis of specialty microstructured fibres in a broad wavelength range** [8794-30]
L. Ostrowski, M. Murawski, M. Szymanski, Z. Holdynski, T. Tenderenda, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); P. Pura, Military Univ. of Technology (Poland); P. Mergo, Maria Curie-Skłodowska Univ. (Poland); P. Marć, Military Univ. of Technology (Poland); T. Nasilowski, Military Univ. of Technology (Poland) and InPhoTech Ltd. (Poland); L. R. Jaroszewicz, Military Univ. of Technology (Poland)
- 8794 41 **Fiber Bragg grating sensors for on-line welding diagnostics** [8794-31]
L. Rodríguez-Cobo, J. Mirapeix, R. Ruiz-Lombera, A. Cobo, J. M. Lopez-Higuera, Univ. de Cantabria (Spain)
- 8794 42 **Application of new optical load cells for in-line measurement of pantograph-catenary contact force** [8794-62]
M. Bocciolone, G. Bucca, A. Collina, L. Comolli, Politecnico di Milano (Italy)
- 8794 43 **Thermal behavior of a high power generator exciter bridge measured by optical fiber sensors** [8794-87]
W. K. Probst, Munich Univ. of Applied Sciences (Germany); F. Bortolotti, K. de Moraes Sousa, H. J. Kalinowski, C. Martelli, J. C. Cardozo da Silva, Federal Univ. of Technology – Paraná (Brazil)
- 8794 44 **An optical device for an automated temporization of diagnostic tools for medium voltage substation** [8794-91]
L. De Maria, RSE SpA (Italy); N. C. Pistoni, Optoelectronics and Fibre Optics Consultant (Italy); D. Bartalesi, RSE SpA (Italy)

- 8794 45 **Measurement of displacement in the micrometer range using speckle pattern correlation in multimode fibers** [8794-175]
M. Lomer, J. Abascal, Univ. de Cantabria (Spain); J. Castellon-Urbe, Univ. Autónoma del Estado de Morelos (Spain); J. Lopez-Higuera, Univ. de Cantabria (Spain)
- 8794 46 **Optical fiber instrumentation of a high power generator and turbine** [8794-176]
E. V. da Silva, Tractebel Energia (Brazil); U. J. Dreyer, K. de Morais Sousa, V. J. Babinski, J. Somenzi, F. Mezzadri, I. de Lourenço Junior, C. Martelli, J. C. Cardozo da Silva, Federal Univ. of Technology – Paraná (Brazil)
- 8794 47 **Static and dynamic pile testing of reinforced concrete piles with structure integrated fibre optic strain sensors** [8794-181]
C. Schilder, H. Kohlhoff, D. Hofmann, F. Basedau, W. R. Habel, M. Baeßler, E. Niederleithinger, S. Georgi, BAM Federal Institute for Materials Research and Testing (Germany); M. Herten, BAW Federal Waterways Engineering and Research Institute (Germany)

Author Index

Conference Committee

Conference General Chairs

Tomasz R. Woliński, Warsaw University of Technology (Poland)
Wojciech Gawlik, *cochair*, Jagiellonian University in Krakow (Poland)

Conference Technical Program Chairs

Brian Culshaw, University of Strathclyde (United Kingdom)
José Miguel López-Higuera, University of Cantabria (Spain)
William MacPherson, Heriot-Watt University (United Kingdom)

International Advisory Committee

Wojtek J. Bock, Université du Québec en Outaouais (Canada)
Jiri Homola, Institute of Photonics and Electronics (Czech Republic)
Kazuo Hotate, University of Tokyo (Japan)
Wei Jin, The Hong Kong Polytechnic University (China)
Hypolito José Kalinowski, Federal University of Technology - Paraná (Brazil)
Raman Kashyap, École Polytechnique de Montréal (Canada)
Byoung Yoon Kim, Korea Advanced Institute of Science and Technology (Korea, Republic of)
Yanbiao Liao, Tsinghua University (China)
Robert Lieberman, Intelligent Optical Systems Inc. (United States)
Alexis Mendez, MCH Engineering Inc. (United States)
Anna Grazia Mignani, IFAC-CNR (Italy)
Bishnu P. Pal, Indian Institute of Technology Delhi (India)
David D. Sampson, University of Western Australia (Australia)
Fernando Mendoza Santoyo, Centro de Investigaciones en Óptica, A. C. (Mexico)
Karsten Rottwitt, Technical University of Denmark (Denmark)
Moshe Tur, Tel-Aviv University (Israel)

Technical Program Committee

Jean-Louis Auguste, XLIM (France)
Francesco Baldini, IFAC-CNR (Italy)
Anders Bjarklev, Technical University of Denmark (Denmark)
Thomas Bosselman, SIEMENS AG (Germany)
Adolfo Cobo, University of Cantabria (Spain)
Andrea Cusano, University of Sanno (Italy)
Sylvie Delepine-Lesoille, ANDRA (France)

Denis Donlagic, University of Maribor (Slovenia)
Avishay Eyal, Tel-Aviv University (Israel)
Pierre Ferdinand, CEA LIST (France)
Luís Alberto Ferreira, INESC Porto (Portugal)
Daniele Inaudi, SMARTEC (Switzerland)
Stephen James, Cranfield University (United Kingdom)
Julian D. C. Jones, Heriot-Watt University (United Kingdom)
Kyriacos Kalli, Cyprus University of Technology (Cyprus)
Ladislav Kalvoda, Czech Technical University (Czech Republic)
Katerina Krebber, BAM Federal Institute for Materials Research and Testing (Germany)
Elfed Lewis, University of Limerick (Ireland)
Guillermo Orellana, Madrid Complutense University (Spain)
Dominique Pagnoux, University of Limoges (France)
Luca Palmieri, University of Padova (Italy)
António Lobo Ribeiro, University Fernando Pessoa (Portugal)
Manuel Lopez-Amo, Public University of Navarra (Spain)
Walter Margulis, ACREO (Sweden)
Mario Martinelli, University of Milano (Italy)
Marco N. Petrovich, University of Southampton (United Kingdom)
José Luís Santos, University of Porto (Portugal)
Kay Schuster, Institute of Photonic Technology (Germany)
Tong Sun, City University London (United Kingdom)
Luc Thévenaz, École Polytechnique Fédérale de Lausanne (Switzerland)
Hugo Thienpont, Vrije Universiteit Brussel (Belgium)
Marc Wuilpart, University of Mons (Belgium)
Wacław Urbańczyk, Wrocław University of Technology (Poland)
Mark R.-H. Voet, FBGS International BVBA (Belgium)
Reinhardt Willsch, Institute of Photonic Technology (Germany)

Local Organizing Committee

Leszek R. Jaroszewicz, *chair*, Military University of Technology (Poland)
Andrzej W. Domański, *treasurer*, Warsaw University of Technology (Poland)
Tomasz Nasiłowski, Military University of Technology (Poland)
Paweł Marć, Military University of Technology (Poland)
Paweł Mergo, Maria Curie-Skłodowska University (Poland)
Maciek Wieczorek, WIMA Convention (Poland)
Magda Wieczorek, WIMA Convention (Poland)

Introduction

Following the successful Workshops in Peebles (1998), Santander (2004), Napoli (2007), and Porto (2010), the Photonics Society of Poland invites the optical fibre sensors community to Kraków (Poland) in 2013 for the fifth edition of the European Workshop on Optical Fibre Sensors, 5th EWOFs'2013. This initiative aimed to promote a scientific meeting with a high level of interaction between participants, enabling an open debate and the assessment of new concepts, technologies and applications in the domain of optical fibre sensors, as well as establishment of new collaborations and networks. EWOFs'2013 also intended to complement in time and geographical location the international conferences in this area, and in particular the International Conference on Optical Fibre Sensors (OFS).

Addressing scientific achievements, technological applications, and commercial exploitation, our goal was to create a programme that would be attractive for both academics and professionals working in this area. We intended to assure a set of high-level invited talks that would consider, not only topics related to optical fibre sensors, but also other scientific domains that might cause an impact on their future development. Also, we were seeking to strengthen the Workshop's unique features, including the discussion of technical contributions between young researchers and experienced scientists, identifying and highlighting the most significant contributions. Since everyone's active participation was an important issue, we also intended to organize a Workshop with an invigorating and appealing Social Programme that would encourage a true scientific socialisation.

Since past and future meet in the present, we intended to make EWOFs'2013 an opportunity to promote productive interactions between young scientists, engineers, and mature practitioners in this scientific and technological adventure around the subject of optical fibre sensors. At the same time, we wanted to honour the pioneers who have significantly contributed to its development, and encourage young researchers who had chosen to work in this field. EWOFs'2013 took place a decade after the beginning of this new century, of this new millennium. Humankind is currently facing great challenges in the search for a future characterized by global justice, fair and sustainable progress, as well as economic and social wealth. This is a demanding, yet necessary purpose, and science and technology create opportunities so that society may evolve in that sense. In its specific domain, EWOFs'2013 should encourage scientific and technological advances, and provide a forum where young and experienced researchers and entrepreneurs may interact in a mutually profitable relationship that is oriented to the development of optical fibre sensors and its impact on society. Pursuing this central objective, we committed ourselves to do our best to create the proper atmosphere. Therefore, our intention was to invite all of you to

participate in this meeting that took place in the metropolitan area of Kraków, a historical capital of Poland, in May 2013.

Tomasz R. Woliński
Wojciech Gawlik
Brian Culshaw
José Miguel López-Higuera
William N. MacPherson

Invited Lectures

1 Special session (Monday, 20 May 2013)

Novel fibres for sensing

Jonathan Knight, University of Bath, United Kingdom

Conventional optical fibres have been widely exploited in sensing systems, and have led to fibre sensing systems being a preferred solution in many environments. Recent and current developments in fibre-optic technology are leading not just to a range of new fibres, but to possibilities for designing future systems incorporating purpose-designed fibre structures. We describe recent developments in the burgeoning field of speciality and microstructured fibre optics, in the context of their relevance for future sensing applications.

The ever-surprising supercontinuum

John M. Dudley, University of Franche-Comté, CNRS Institute FEMTO-ST, Besançon, France

The generation of new frequencies from laser light has been extensively studied since the early 1960s since shortly after the invention of the laser itself. The particular process of supercontinuum generation arises when a narrowband laser undergoes extreme spectral broadening in a nonlinear medium to yield a spectrally continuous output. Supercontinuum generation was first reported by focusing pulsed lasers into bulk crystals and glasses, but it was its observation in photonic crystal fiber in 1999 that revolutionized the field. Bright, broadband and spatially coherent, supercontinuum light reveals has enabled new applications in precision metrology, imaging and microscopy, and also reveals fascinating nonlinear physics with unexpected links to the infamous and destructive "rogue waves" on the ocean. This talk will provide a survey of recent results in our understanding of supercontinuum generation and its applications.

Minimally invasive 3D tissue imaging and elastography with optical fibre needles

David D. Sampson, Optical+Biomedical Engineering Laboratory, School of Electrical, Electronic and Computer Engineering Centre for Microscopy, Characterisation and Analysis The University of Western Australia, Perth, Australia

Optical fibers provide a unique vehicle for designing ultra-small, minimally invasive microscopic imaging and monitoring systems for use within the human body. Embedding of such optical probes within a rigid needle provides access to deep tissues impossible with surface-based imaging, and as well, a natural actuator for optical elastography. In this talk, we present a series of advances in

engineering the optics of such systems, and in their use in 3D tissue morphological micro-imaging and probing of the micro-mechanical properties of tissue. We describe applications in the breast, lungs and skeletal muscle.

Optofluidics: a new tool for sensing

Romeo Bernini, CNR-IREA, Italy in cooperation with Genni Testa, Gianluca Perisichetti, IREA-CNR, Italy; Luigi Zeni, DII-SUN, Italy and Pasqualina M. Sarro, TuDelft, the Netherlands

Over the last years optofluidics has emerged has a very promising field for sensing applications. Optofluidics essentially merges optics and microfluidics at micro and nano scales. This approach permits to realize innovative optical system in which fluids can act as an optical material providing a providing significantly enhanced performance and functionality that cannot be achieved without this seamless integration. In particular, the possibility to guiding light through a fluid offers very interesting applications in sensing fields enabling unprecedented sensitivity and limit-of-detection.

This paper reviews the present state of the art on optofluidics devices and microsystems for sensing applications, discusses emerging trends, and presents recent results of research into optofluidic sensors at the Institute for Electromagnetic Monitoring of the Environment (IREA-CNR), Naples. The developments discussed in detail include optofluidic waveguides and devices like photonic crystals and photonic crystal fibres, as well as interferometric structures such as ring resonators, Mach-Zehnder interferometers, and Fabry-Pérot cavities. Examples of applications of optofluidic sensors for chemical and biological analysis are given.

Nanoscale optical and magnetic imaging using color centers in diamond nanoparticles

Jean-François Roch, Laboratoire Aimé Cotton, CNRS, Université Paris-Sud & ENS Cachan, France

Numerous works have been devoted to the development of efficient probes for nanoscale imaging. I will report the application of optically and magnetically active nanodiamonds to nanoscale mapping using the unique properties of the nitrogen-vacancy (NV) color center. The NV center is hosted in a diamond nanocrystal which is attached to the tip of an atomic force microscope. Combining nanometer scale spatial resolution, high sensitivity and room temperature operation, this NV-based scanning microscope opens up numerous perspectives in nanotechnology.

2 Regular session (Monday, 20 May 2013)

Fibre optics as a functional platform to combine new science

Kyunghwan Oh, Yonsei University, South Korea

Fibre optics has paved a solid pathway to information revolution in 20th century, and optical fibres are recently becoming a technical commodity with well-defined international standards. With maturing communication applications, fibre optics has been applied to other related areas such as sensing, and metrology but these applications have been moderate expansions. In this talk, a few innovative and venturous attempts to combine fibre optics with other areas of emerging science will be reviewed as below:

1. Combining fibre optics and Fourier optics for micro beam shaping
2. Combining Plasmonics with fibre optics for novel light source
3. Combining Atmospheric Plasma with fibre optics for new active fibre devices

Social event (Monday, 20 May 2013)

Sagnac effect centenary: a special occasion to share the "serendipity" of the fibre-optic gyroscope

Herve C. Lefevre, iXBlue, Marly le Roi, France

One hundred years ago, Georges Sagnac demonstrated that a closed ring interferometer detects rotation with respect to inertial space. This effect, bearing now his name, remained a physics curiosity for many decades until the laser, in the 1960s, and fibre optics, in the 1970s, opened ways to enhance the effect by recirculation and make sensitive measurement. The word "serendipity" was used very early about the fibre-optic gyroscope, or FOG, and this talk will present several examples showing that "nature is rarely that cooperative."

There was also an important engineering work, but taking big advantage of technologies developed for optical fibre communication. Today, best results of FOG long-term bias stability go down to the 10^{-5} °/h range, which corresponds to a phase difference of 10^{-9} radian! FOG was firstly seen in the 90's as limited to medium-grade performance, but it has actually a unique potential and today it surpasses its well-established competitor, the ring-laser gyroscope, or RLG.

3 Regular session (Tuesday, 21 May 2013)

Multicomponent fibres: a new platform for nanophotonic devices

Markus A. Schmidt, Institute for Photonic Technologies, Jena and Max Planck
Institute for the Science of Light, Erlangen, Germany

Hybrid optical fibres are fibre-type waveguides including multimaterial large-aspect ratio nano- and microstructures. Using our pressure-assisted melt-filling approach various hybrid waveguides have been fabricated inside photonic crystal fibres by filling the air holes with materials such as noble metals, semiconductors, fluids or low-melting compound glasses. In this talk I will review our latest results on fibre-based plasmonics and nonlinear optics. I will also give an outlook about ongoing experiments in our lab and future developments of the entire field of in-fiber devices.

4 Regular session (Tuesday, 21 May 2013)

Enhanced sensing sensitivity using slow light: myths and realities

Luc Thévenaz, EPFL Swiss Federal Institute of Technology, Switzerland

The common belief that sensing sensitivity can be improved by slowing down a light signal – with the underlying idea to let more time for the interaction – turns out to be misleading and results in erroneous concepts. The interaction efficiency is actually strengthened by optical systems enhancing the electric field intensity, which can lead only coincidentally to a slowing down of the light. After explaining the physical nature of the light-atom interaction and the essential differences between material and structural slow light, it will be demonstrated through simple experimental tests that slowing down the light does not lead automatically to enhanced sensing and a better sensitivity can be only obtained using smartly designed structural slow light systems.

Gala dinner (Tuesday, 21 May 2013)

Novel light-matter interactions in microstructured fibers

Philip St. J. Russell, Max Planck Institute for the Science of Light, Erlangen,
Germany

The talk will touch on optomechanical and optoacoustic nonlinearities in nanostructured fibres, optothermal particle trapping in hollow core photonic crystal fibre (PCF) and the optical properties of helical solid-core PCF.

Fibre optic sensing based on modal interferometry

José Luís Santos, INESC Porto in cooperate with O. Frazão INESC Porto,
J.M. Baptista, Universidade de Madera, P.A.S. Jorge INESC Porto, Portugal

Fibre optic modal interferometry has been around as a sensing concept since the outcome of fibre optic sensing. Initially supported by the utilization of standard Hi-Bi fibres associated to polarimetric modal interference, later this sensing approach evolved to modal interference based on spatial modes propagating in the core and in the cladding with coupling performed by fibre devices such as long period gratings and tapers, and more recently on several types of modes propagating in photonic crystal fibres. This presentation will address fibre optic sensing based on modal interferometry and configurations of different type researched in last years will be presented and their performance compared.