9th OPTICAL FIBER SENSORS CONFERENCE
Palazzo dei Congressi, Firenze, Italia

CONFERENCE PROCEEDINGS

Organized by:

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Associazione Elettrotecnica ed Elettronica Italiana (AEI)

Istituto di Ricerca sulle Onde Elettromagnetiche
del Consiglio Nazionale delle Ricerche (IROE - CNR)
Area della Ricerca di Firenze del CNR

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European Optical Society (EOS)
IEEE Laser and Electrooptics Society (IEEE - LEOS)
IEE The Institution of Electrical Engineers
Optical Society of America (OSA)
The International Society for Optical Engineering (SPIE)
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**Session Tu1**

**Session Tu2**
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M.G. Xu, L. Reekie, Y.T. Chow, J.P. Dakin
Optoelectronics Res. Centre, Univ. of Southampton, UK

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S.E. Kanellopoulos, V.A. Handerek, A.J. Rogers
Dept. of Electronic & Electrical Eng., King's College London, UK

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Y.W. Koh, S.H. Yun, B.Y. Kim
Dept. of Physics, KAIST, Taejon, Korea

Tu2.5 Fiber Fabry-Perot Demodulator for Bragg Grating Strain-Sensors
A.D. Kersey, T.A. Berkoff
Optical Sciences Div., NRL, Washington, DC, USA
W.W. Morey
UTRC, East Hartford, CT, USA

Tu2.6 Simultaneous Interrogation of Fibre Optic Grating Sensors
D.A. Jackson
Physics Lab., University of Kent, Canterbury, UK
A.B. Lobo Ribeiro
INESC, Optoelectronics Group, Porto, Portugal
L. Reekie, J.L. Archambault, P. St. Russell
ORC, University of Southampton, UK

Session Tu3
MULTIPLEXED AND DISTRIBUTED SENSORS
Chair: Alan J. Rogers, King's College, London, UK

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W.A. Gambling
University of Southampton, UK

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F. Farahi
Phys. Dept., Univ. of North Carolina, Charlotte, NC, USA

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J.L. Santos, A.P. Leite
INESC Porto, Laboratório de Física, U. Porto, Portugal

Tu3.4 Simple Multiplexing Schemes for Sensor Networks Exploiting Low Coherence Interferometry
A.B. Lobo Ribeiro
INESC, Optoelectronics Group, Porto, Portugal
T.Y. Liu
University College of Swansea, UK
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Physics Lab., University of Kent, Canterbury, UK
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M.Tur, Y.S.Boger
Faculty of Engineering, Tel-Aviv University, Israel
H.J.Shaw
Ginzton Laboratory, Stanford University, CA, USA

Tu3.6 Non-Incremental and Quasi-Distributed Fiber-Optic Thermometer
V.Gusmeroli, M.Martinelli, A.Barberis, C.Mariottini
CISE Tecnologie Innovative SpA, Milano, Italia

Tu3.7 Optical Fibre Based Distributed Temperature Sensor with a 22Km Sensing Length
X.Bao, D.J.Webb, D.A.Jackson
Physics Lab., University of Kent, Canterbury, UK

Tu3.8 A Practical Kerr-Effect Distributed Optical-Fibre Sensor with Polarization-Diversity Detection
I.Cokgor, V.A.Handerek, A.J.Rogers
Dept. of Electronic & Electrical Eng., King’s College London, UK

Tu3.9 Distributed Interferometry Using Rayleigh Backscattering in Optical Fibres
R.Juskaitis
Dept. of Eng. Science, Oxford University, UK
A.M.Mamedov, V.T.Potapov, S.V.Shatalin
Inst. of Radio Eng. & Electronics, Fryazino, Russia

Session Tu4
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Chair: Byoung Yoon Kim, KAIST, Taejon, Korea

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Fiber Optic Gyro: Technologies and Applications in Japan
K.Hotate
The University of Tokyo, Japan

Tu4.2 Mode Locked Fiber Laser Gyroscope
M.Y.Jeon, H.J.Jeong, B.Y.Kim
Dept. of Physics, KAIST, Taejon, Korea

Tu4.3 Suppression of Lock-In Closed-Loop Fibre Optic Gyro
M.Kemmler, P.Gröllmann, P.Krasselt
LITEF GmbH, Freiburg, Germany

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S.Huang, K.Toyama, H.J.Shaw
Edward L. Ginzton Lab., Stanford University, CA, USA
L.Thevenaz
Swiss Federal Inst. of Tech., Lab. de Metrologie, Lausanne, Switzerland
B.Y.Kim
KAIST, Taejon, Korea
**Tu4.5** Single Mode Fiber Based Fiber Optic Gyroscope for Automobile Navigation System
Y.Nishi, T.Iwashita, K.Okamoto, A.Ooka
Automotive Electric & Electronics Div., Sumitomo Electric Industries Ltd., Osaka, Japan
Y.Nishiura, K.Washimi
Information & Electronics Laboratory, Sumitomo Electric Industries Ltd., Osaka, Japan

*Poster Session 1*

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H.Huang,
Shanghai University of Science & Technology, China

**P1.2** Signal Recovering in Fiber Optic Sensors based on Nonlinear FMCW Technique
S.A.Egorov, I.G.Likhachiev, A.N.Mamaev, A.S.Polyantsev
SVET Corp., Moscow, Russia

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S.Tanaka, S.Sawae, Y.Ohtsuka
Dept. of Eng. Science, Hokkaido Univ., Sapporo, Japan

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V.S.Sudarshanam, R.O.Claus
Fiber & Electro Optics Research Centre, Bradley Dept. of Electrical Eng., Virginia Polytechnic Inst. & State University, Blacksburg, VA, USA

**P1.5** Noise in Amplified Fiber Optic Recirculating-Ring Delay Lines
J.T.Krinelebotn
Optoelectronics Res. Centre, Univ. of Southampton, UK
K.Blotekjaer
Dept. of Physical Electronics, The Norwegian Institute of Technology, Trondheim, Norway

**P1.6** Electronically Scanned White-Light Interferometric Sensor for High Hydrostatic Pressure Measurements
W.J.Bock
Lab. d’Optoélectronique, Dép. d’Informatique, Université du Québec à Hull, Canada
W.Urbanczyk
Inst. of Physics, Technical University of Wroclaw, Poland

**P1.7** Effect of SBS on the Noise Performance of a Remotely Interrogated Interferometric Sensor
M.A.Davis, A.D.Kersey, A.Dandridge
Optical Science Division, NRL, Washington, DC, USA
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C.Mc Garrity, R.D.Pechstedt, R.Pitcher, D.A.Jackson  
Physics Lab., University of Kent, Canterbury, UK  

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P.R.Forman  
Los Alamos National Laboratory, NM, USA  

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S.Oho, H.Sonobe  
Hitachi Res. Lab., Hitachi Ltd., Japan  
T.Kumagai, H.Kajioka  
Hitachi Cable Ltd., Japan  

P1.11 Fiber-Optic Microphone Using a Fabry-Perot Interferometer  
H.Naono, M.Matsumoto, K.Fujimura, K.Hattori  
Acoustic Research Lab., Matsushita Electric Ind. Co. Ltd., Osaka, Japan  

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S.R.Kidd, J.S.Barton, M.N.Inci, J.D.C.Jones  
Dept. of Physics, Heriot-Watt University, Edinburgh, UK  

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A.Asseh, G.Edwall, T.Johansson, A.Kotsinas  
Physics Dept. II, Royal Inst. of Tech., Stockholm, Sweden  
B.Sahlgren, R.Stubbe  
Institute of Optical Research, Stockholm, Sweden  

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I.G.Clarke, I.M.Bassett  
OFTC, School of Physics, University of Sydney, Australia  
D.Geake, A.D.Stokes  
OFTC, School of Electrical Eng., University of Sydney, Australia  
S.B.Poole  
OFTC, University of Sydney, Australia  

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C.Blanchet, J.M.Maillard, M.Lequime  
BERTIN & Cie, Optics & Optoelectronics Division, Aix-en-Provence, France  

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K.A.Murphy, R.May, A.Wang, G.Wang, R.O.Claus  
Fiber & Electro-Optics Res. Center, Virginia Polytechnic Inst. & State University, Blacksburg, VA, USA  
T.A.Tran  
Fiber & Sensors Technologies Inc., Blacksburg, VA, USA  

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H. Poisel
Fachhochschule Nürnberg, Germany
G. F. Trommer
Deutsche Aerospace AG, Dynamics Systems, Munich, Germany

Session W1
CHEMICAL AND ENVIRONMENTAL SENSORS
Chair: John Dakin, University of Southampton, UK

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A. G. Mignani
IROE - CNR, Firenze, Italia

W1.2 Electrochemically Controlled Optical Waveguide Sensors
C. R. Lavers, C. Piraud, J. S. Wilkinson
Optoelectronics Res. Centre, Univ. of Southampton, UK
M. Brust, K. O' Dwyer, D. J. Schiffrin
Chemistry Dept., University of Liverpool, UK

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A. Del Bianco, F. Baldini
IROE - CNR, Firenze, Italia

W1.4 MIR-fiber sensors for remote spectroscopy and pyrometry in 4-16 µm region
V. Artjushenko, W. Neuberger
CeramOptec GmbH, Bonn, Germany
A. Kryukov, A. Lerman, V. Plotnichenko, F. Stepanov
CeramOptec Systems, Moscow, Russia

W1.5 Characterization of Monodispersive Particulates by Optical Fibers
M. Brenici, D. Guzzi, A. Mencaglia, A. G. Mignani
IROE - CNR, Firenze, Italia

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X. P. Dong
Univ. of Science & Tech., China
H. O. Edwards, J. P. Dakin
Optoelectronics Res. Centre, Univ. of Southampton, UK
E. Shafir
Soreq NRC, Yavne, Israel
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Chair: Gordon W. Day, NIST, Boulder, CO, USA

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B.Y.Kim
KAIST, Taejon, Korea

W2.2 Adaptive Optical Multimode-Guide Sensors Employing Neural Processing Technique
S.Aisawa, K.Noguchi, T.Matsumoto
NTT Transmission Systems Labs., Kanagawa, Japan

W2.3 Polarimetric Laser Sensors
H.K.Kim, S.K.Kim, B.Y.Kim
Dept. of Physics, KAIST, Taejon, Korea

W2.4 Acousto-Optically Q-Switched Fibre Laser Source of High Peak Power and Short Duration Pulses for Fibre Sensor Applications
Optoelectronics Research Centre, Optical Fibre Group, Southampton University, UK

W2.5 Polarization-Independent Reflectometric Fiber Ring-Resonator Configuration
M.A.Davis, A.D.Kersey
Optical Technology Branch, NRL, Washington, DC, USA
K.H.Wanser
Physics Dept., California State Univ., Fullerton, CA, USA

W2.6 Gain-Switched Fabry-Perot Laser Diodes as Sources for Low Coherence Interferometry
R.A.Griffin, D.D.Sampson, D.A.Jackson
Physics Lab., University of Kent, Canterbury, UK

Session W3
LOW AND HIGH COHERENCE INTERFEROMETRIC SENSORS
Chair: Brian Culshaw, University of Strathclyde, Glasgow, UK

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W.V.Sorin
Hewlett Packard Laboratories, Palo Alto, CA, USA

W3.2 Bistable Fiber-Optic Michelson Interferometer with Sawtooth Fringes for Unambiguous Fringe Counting
N.Fürstenau, W.Schmidt
German Aerospace Research Establishment (DLR), Institute for Flight Guidance, Braunschweig, Germany
W3.3 Analysis of the Dynamic Response of a Ring Resonator to a Time Varying Input Signal
K. Kalli, D.A. Jackson
Applied Optics Group, University of Kent, Canterbury, UK

W3.4 Measurement of Fundamental Thermal Phase Fluctuations in Optical Fiber
K.H. Wanser
Physics Dept., California State Univ., Fullerton, CA, USA
A.D. Kersey, A. Dandridge
Optical Sciences Division, NRL, Washington, DC, USA

W3.5 Ultrasonic Hydrophone Using a Push-Pull Transducer in a Sagnac Interferometer
S. Knudsen, K. Blotekjaer
Norwegian Institute of Technology, Faculty of Electrical Engineering & Computer Science, Trondheim, Norway

W3.6 High Performance Integrated Acousto-Optical Heterodyne Interferometer in LiNbO3
F. Tian, R. Ricken, W. Sohler
Universität-GH Paderborn, Angewandte Physik, Germany

W3.7 Thermally-Scanned, In-Line, Fibre Polarimetric Interrogator For "White-Light" Interferometry
M. G. Xu, M. Johnson, J. P. Dakin
Optoelectronics Res. Centre, Univ. of Southampton, UK
M. Farhadiroushan
Sensor Dynamics Ltd., Winchester, UK

W3.8 White Light Fiber Optic Sensor Network for the Thermal Monitoring of the Stator in a Nuclear Power Plant Alternator
C. Lecot, J. J. Guerin, M. Lequime
BERTIN & Cie, Aix-en-Provence, France
M. Rioual
EDF/DER, Clamart, France

W3.9 Compounded Source for White-Light Interferometric Systems
Y. J. Rao, Y. N. Ning, D. A. Jackson
Physics Lab., University of Kent, Canterbury, UK

Poster Session 2

P2.1 Fiber Optic Electric Field Microsensor
A. Mendez, T. F. Morse
Laboratory for Lightwave Technology, Brown University, Providence, RI, USA
D. Ciarlo
Lawrence Livermore National Lab., CA, USA
P2.2 30 Km Long Remote Sensing of Methane Gas Using a 1.65 μm DFB LD and Single Mode Fiber
M.Aizawa, T.Okamoto, J.Ono, Y.Araki, H.Nagai
Research Laboratory, Anritsu Co., Kanagawa, Japan

P2.3 A Theoretical and Experimental Investigation of a Practicable Fibre Optic Current Sensor Using Sagnac Interferometer
A.Yu, A.S.Siddiqui
Dept. of Electronic Systems Eng., University of Essex, Colchester, UK

P2.4 Vectorial Magnetic-Field Fiberoptic Sensor based on Accurate Birefringence Control
V.Annovazzi-Lodi, S.Donati, S.Merlo, L.Zucchelli
Dipartimento di Elettronica, Università di Pavia, Italia

P2.5 Comparison of 4 Different Optical Fibre Coil Concepts for High Voltage Magnetooptic Current Transformers
T.Bosselmann
SIEMENS AG, Corporate R&D, Erlangen, Germany

P2.6 Practical Compact High Performance Fiber-Optic Frequency Shifter
J.Blake, P.Siemsen
Dept. of Electrical Engineering, Texas A&M University, College Station, TX, USA

P2.7 A Miniature Optical Current Clamp
Y.N.Ning, D.A.Jackson
Physics Lab., University of Kent, Canterbury, UK

P2.8 Detection of Gases and Chemical Vapors with a Specifically Coated Optical Fibre Sensor
C.Ronot, H.Gagnaire, J.P.Goure
Laboratoire du Traitemen du Signal et Instrumentation, Université Jean Monnet, Saint Etienne, France
N.Jaffrezic-Renault
Lab. de Physico-Chimie des Interfaces, Ecole Centrale de Lyon, Ecully, France
T.Pichery
Gaz de France, La Plaine Saint Denis, France

P2.9 Superluminescent Diodes for Visible (670 nm) Spectral Range Based on AlGaInP/GaInP Heterostructures with Tapered Grounded Absorber
A.T.Semenov, V.R.Shidlovski, S.A.Safin
Superlum Ltd., Moscow, Russia
V.P.Konyaev, M.V.Zverkov
RTC "Micro laser", Moscow, Russia

P2.10 A Multi-Function Gyro Chip Based on Ti-Indiffusion and Proton-Exchange
A.Watanabe, T.Kawazoe, H.Mori
Electronics Materials Lab., Sumitomo Metal Mining Co. Ltd., Tokyo, Japan
P2.11 An Optical Fibre Sensor for Eye-Length Measurement
S.Chen
School of Electronic, Electrical & Information Eng., South Bank University, London, UK
D.Wang, K.T.V.Grattan, A.W.Palmer
Dept. of Electronic, Electrical & Information Eng., City University, London, UK
G.L.Dick
School of Optometry, University of New South Wales, Kensington, Australia

P2.12 A Photon Scanning Tunneling Microscope at I.N.O.
A.Mannoni, F.Quercioli
Istituto Nazionale di Ottica, Firenze, Italia

P2.13 Generation of 111kW (0.5mJ) Pulses at 1.5μm Using a Gated Cascade of Three Fibre Amplifiers
B.Desthieux
Fujitsu Laboratories Ltd., Kawasaki, Japan
R.I.Laming, D.N.Payne
Optoelectronics Res. Centre, Univ. of Southampton, UK

P2.14 Simultaneous Measurement of Temperature and Strain By Dispersive Fourier Transform Spectroscopy
D.A.Flavin
Dept. of Physical Sciences, Waterford Regional Technical College, Waterford, Rep. of Ireland
R.Mc Bride, J.D.C.Jones
Dept. of Physics, Heriot-Watt University, Edinburgh, UK

P2.15 Optoelectronic ESPI: Applications to Surface Contouring and Vibration Measurements
H.Atcha, R.P.Tatam
Optical Sensor Group, School of Mechanical Engineering, Cranfield Institute of Technology, UK

P2.16 "Continuous Fibre" Wavelength Selective Elements for Fibre Optic Sensing Systems
W.Johnstone, D.Moodie, K.Mc Callion, G.Fawcett, G.Thursby
University of Strathclyde, Dept. of Electronic & Electrical Eng., Glasgow, UK

P2.17 Narrow Band WDMs and Broad Band Filters Using Birefringent Optical Fibre
H.D.Ford, R.P.Tatam
Optical Sensors Group, School of Mechanical Engineering, Cranfield Institute of Technology, UK

P2.18 Embedded, Tapered, Elliptical-Core, Dual-Mode, Spatially Weighted Optical Fiber Sensors for Structural Vibration-Mode Analysis and Filter
T.A.Tran
Fiber & Sensors Technologies Inc., Blacksburg, VA, USA
K.A.Murphy, A.Wang, S.Rudraraju, R.O.Claus
Fiber & Electro-Optics Research Center, Virginia Polytechnic Inst. & State University, Blacksburg, VA, USA
P2.19 Elimination of Instability in Fiber-Optic Magnetometer
Z. Wei, Z. Zhipeng
Dept. of Electrical Power Engineering Huazhong, University of Science & Technology, Wuhan, China

P2.20 A Novel Lightning Location Sensing System Making Use of Relativistic Faraday Effect
O. Aso, A. Fujisaki
Opto-Tech. Lab. Furukawa Electric Co. Ltd., Chiba, Japan
H. Yasuda
Communication Group, Electric R&D Center, Chubu Electric Power Co. Inc., Nagoya, Japan

Thursday, May 6

Session Th1
MECHANICAL AND RELATED SENSORS
Chair: Reinhardt Willsch, Institut für Phys. Hochtechnologie, Jena, Germany

Th1.1 Flight Tests of a Fiber-Optic Interferometric Strain Gauge
N. Fürstenau, D. D. Janzen, W. Schmidt
German Aerospace Research Establishment (DLR), Institute for Flight Guidance, Braunschweig, Germany

Th1.2 Polarimetric In-Fibre based Linear Position Sensor
B. Meggitt, S. Chen, A. W. Palmer, K. T. V. Grattan
Dept. of Electronic, Electrical & Information Eng., City University, London, UK
R. A. Pinnock
Lucas Advanced Engineering Centre, Solihull, UK

Th1.3 A Planar Fibre Optic Strain Sensor Using Micromechanical Resonators Fabricated from (110) Silicon Wafers
D. Uttamchandani, J. D. Chalmers
Dept. of Electronics & Electrical Eng., University of Strathclyde, Glasgow, UK
A. M. Mazzolini
Dept. of Physics, Swinburne University of Technology, Hawthorn, Victoria, Australia

Th1.4 A Micromachined Fiber-Optic Silicon Impact Sensor
D. Liang
Centro de Fisica Molecular, Univ. de Lisboa, Portugal
B. Culshaw
Optoelectronics Division, Dept. Electronics & Electrical Eng., University of Strathclyde, Glasgow, UK

Th1.5 Vibration Phase Measurement By Fibre Optic Electronic Speckle Pattern Interferometry (ESPI) with Stroboscopic Illumination
J. D. Valera, A. F. Doval, J. D. C. Jones
Dept. of Physics, Heriot-Watt University, Edinburgh, UK
Th1.6 Interferometric Displacement Sensor Integrated On Glass
O.G.Helleso, P.Benech, R.Rimet
LEMO (ENSERG INPG), Grenoble, France

Th1.7 Application of Embedded Optical Fiber Sensors to Monitoring of Fatigue Loading of Reinforced Concrete Cross-Beams
M.de Vries, R.O.Claus
Fiber & Electro-Optics Res. Center, Bradley Dept. of Electrical Eng., Virginia Tech, Blacksburg, VA, USA
S.Masri, M.Mustafa
Dept. of Civil Eng., University of Southern California, Los Angeles, CA, USA

Th1.8 Impact Detection in Composite Structures: Experimental Results and Simulation
M.Turpin, M.Brevignon, H.Stoppiglia
THOMSON-CSF Laboratoire Central de Recherches, Orsay, France
J.Chazelas, P.Bonniau
THOMSON-CSF Division RCM, Malakoff, France

Th1.9 A Fresnel Drag Flow Meter
R.T.de Carvalho, J.Blake
Dept. of Electrical Eng., Texas A&M University, College Station, TX, USA
W.V.Sorin
Hewlett-Packard Laboratories, Palo Alto, CA, USA

Session Th2
ELECTRICAL AND MAGNETIC SENSORS
Chair: Silvano Donati, Università di Pavia, Italia

Th2.1 Invited paper
Applications of Optical Fiber Sensors in Electrical Power Plants: Opportunity and Challenge for the Coherent Sensors
M.Martinelli
CISE Tecnologie Innovative SpA, Milano, Italia

Th2.2 Invited paper
High Speed, High Sensitivity Magnetic Field Sensors Based on the Faraday Effect in Iron Garnets
M.Deeter
NIST, Boulder, CO, USA

Th2.3 Faraday Effect Current Sensor Using Flint Glass Fiber For The Sensing Element
K.Kurosawa
I.Masuda, T.Yamashita
Material Research Lab., Hoya Corporation, Tokyo, Japan
Th2.4 Polarization Independent Current Sensor Using an Orthoconjugating Fiber Loop Mirror
M.J. Marrone, A.D. Kersey, I.N. Duling, III, R.D. Esman
Optical Sciences Division, NRL, Washington, DC, USA

Th2.5 Electric Current Measurement with a Vibration Insensitive Optical Fiber Current Sensor
N.C. Pistoni, M. Martinelli
CISE Tecnologie Innovative SpA, Milano, Italia

Th2.6 Integrated Optic High Voltage Sensor Using a Z-Cut LiNbO3 Channel-Waveguide Cutoff Modulator
S. Lee, M. Oh, S. Shin
Dept. of Electrical Engineering, KAIST, Taejon, Korea
K. Keh
Goldstar Cable Co. Ltd., Anyang, Korea

Th2.7 Fiber-Optic Voltage Sensor with Optical Feedback
P. Boffi, N.C. Pistoni, M. Martinelli
CISE Tecnologie Innovative SpA, Milano, Italia

Th2.8 The Response of Faraday-Effect Fiber-Optic Current Sensors to Noncentered Currents
E. Shafir, N. Shaked
Soreq Nuclear Research Center, Yavne, Israel
A. Ben-kish, M. Tur
Faculty of Engineering, Tel-Aviv University, Israel

Th2.9 A Method with Two Light Sources for Accurate D.C. Current Measurement Using Faraday Effect
K. Kurosawa

Th2.10 Interferometric Dual-Mode Fiber Voltage Sensor with Remote Coherence-Tuned Interrogation
K. Bohnert, G.C. de Wit, J. Nehring
Asea Brown Boveri, Corporate Research Center, Baden, Switzerland

Th2.11 Undersea Test of a Fiber Optic Magnetometer System
F. Bucholtz, C.A. Villarruel, A. Dandridge
NRL, Optical Sciences Division, Washington, DC, USA
C.K. Kirkendall, A.R. Davis
University Research Foundation, Greenbelt, MD, USA
J.A. Mc Vicker, D.M. Dagenais, K.P. Koo
SFA, Landover, MD, USA
S.S. Patrick
Virginia Polytechnic & State Univ., Blacksburg, VA, USA
K.G. Wathen
Dynamic System Inc., Alexandria, VA, USA
G. Wang, T. Lund, H. Valo
Norwegian Defence Res. Establishment, Kjeller, Norway
Th2.12 Invited paper
In-Line Fiber Components: A New Way to Integrate Functional Devices
S.Kawakami
Tohoku University, Sendai, Japan

Session Th3
MEDICAL SENSORS
Chair: Annamaria Scheggi, IROE - CNR, Firenze, Italia

Th3.1 Invited paper
Fifty Thousand Pressure Sensors per Year: A Successful Fiber Sensor for Medical Applications
B.Trimble
Camino Laboratories, San Diego, CA, USA

Th3.2 Catheter-Type Disposable Fiber Optic Pressure Transducer
G.He, M.T.Wlodarczyk
FiberOptic Sensor Technologies Inc., Ann Arbor, MI, USA

Th3.3 Integrated Optical E-Field Probe Using Segmented Modulator Electrode for Hyperthermia On-Line Measurements
T.Meier, B.Schüppert, K.Petermann, C.Kostrzewa
Technische Universität Berlin, Germany

Th3.4 The Optical Waveguide Sensor for High-Resolution Electrocardiographs
H.Ohno, Y.Asahina
Fukuda Denshi Co. Ltd., Tokyo, Japan
Y.Ohno
College of Science & Tech., Nihon Univ., Chiba, Japan