

Contents

Part I	Components and Special Fibers	
---------------	--------------------------------------	--

101 Uses for Single Mode Fiber Directional Couplers*		
By H.J. Shaw		2
LiNbO ₃ and LiTaO ₃ Integrated Optic Components for Fiber Optic Sensors*		
By F.J. Leonberger, T.K. Findakly, and P.G. Suchoski (With 4 Figures)		5
Broader Spectral Width 1.5 μ m InGaAsP Superluminescent Diode of Stacked Active Layers		
By O. Mikami, Y. Noguchi, H. Yasaka, and K. Magari (With 4 Figures)		10
Third-Harmonic Measurement of Surface Temperature of a Thermal Fibre-Modulator		
By J.B. Brown, J.D.C. Jones, S.J. Rogers, R.K.Y. Chan, and H.H. Wong (With 2 Figures)		15
Fluoride Glass Fiber-Optic Sensors: Realizations and Prospects		
By G. Mazé, V. Cardin, F. Chiquet, and M. Poulain (With 4 Figures)		20
Novel Single Mode Channel Waveguide Fabricated by Photopolymerization for Integrated Optic Sensors		
By H. Hosokawa, J. Takagi, N. Horie, S. Aoyama, S. Ogata, and T. Yamashita (With 6 Figures)		30

Part II	Interferometer Signal Processing I: Narrow Band Sources	
----------------	--	--

Passive Quadrature Phase Detector for Coherent Fiber Optic Systems		
By S.Y. Huang, H.G. Park, and B.Y. Kim (With 4 Figures)		38

*Invited paper

Polarimetric Resonator Sensor with High Sensitivity and Large Dynamic Range By F. Maystre and R. Dändliker (With 2 Figures)	44
Absolute Fiber-Optic Interferometric Strain Sensor with Insensitive Leading Fiber By L. De Maria, V. Gusmeroli, and M. Martinelli (With 4 Figures) . .	47
Multimode Fiber Interferometry and Several-Mode Fiber Polarimetry via Phase Conjugation By P.R. Forman, F.C. Jahoda, B.L. Mason, and C.B. Netterfield (With 3 Figures)	53

Part III Interferometer Signal Processing II: White Light Interferometry and Coherence Modulation

Interferometric and Polarimetric Sensors Using White-Light Interferometry* By R. Ulrich	62
Reflectometry with High Spatial Resolution and No Moving Parts by Means of Source-Coherence Modulation By K. Hotate and O. Kamatani (With 5 Figures)	64
Interferometric Spectrally Encoded Sensor Using a Superradiant Diode By P. Sansonetti, M. Lequime, and H. Giovannini (With 5 Figures) . .	71
Interferometric Displacement Sensing by Visibility Modulation By T.A. Berkoff and A.D. Kersey (With 5 Figures)	78

Part IV Ring Resonators

Fiber-Optic Resonant Ring Sensors: System and Device Technology* By K. Kyuma, S. Tai, K. Kojima, and M. Takahashi (With 8 Figures)	84
Bias of an Optical Passive Ring-Resonator Gyro due to the Misalignment of the Polarization Axis in the Resonator Formed by the Polarization-Maintaining Fiber By K. Hotate, K. Takiguchi, and M. Murakami (With 3 Figures)	94
An All Fibre Ring Resonator Gyroscope Using a Low Coherence Length Source By F. Farahi, K. Kalli, and D.A. Jackson (With 4 Figures)	101

Evaluation of a Sawtooth Generator in a Closed-Loop Fiber-Optic Gyroscope By A. Kurokawa, K. Kajiwara, N. Usui, Y. Hayakawa, M. Haruna, and H. Nishihara (With 6 Figures)	107
Polarisation Effects in Highly Birefringent Fibre Ring Resonators By Z.K. Ioannidis, R. Kadiwar, and I.P. Giles (With 7 Figures)	115

Part V Optical Fiber Gyroscopes and Special Sources

Evolution of the Fiber Optic Gyroscope* By H.C. Léfèvre (With 5 Figures)	124
Fiber Optic Gyroscope with All-Digital Closed-Loop Processing By H.J. Arditty, P. Graindorge, H.C. Léfèvre, P. Martin, J. Morisse, and P. Simonpiétri (With 7 Figures)	131
Fiber Superfluorescent Sources for Fiber Gyro Applications By W.K. Burns, I.N. Duling III, L. Goldberg, R.P. Moeller, C.A. Villarruel, E. Snitzer, and H. Po (With 7 Figures)	137
Erbium-Doped Fibre Superfluorescent Source for the Fibre Gyroscope By P.R. Morkel (With 4 Figures)	143

Part VI Noise in Interferometers

Limitations on the Dynamic Range and Sensitivity of Optical Interferometric Sensors Excited by Semiconductor Lasers with Non-Lorentzian Lineshapes By A. Arie and M. Tur (With 4 Figures)	150
Noise Characteristics of Optical Systems Driven by Quasimonochromatic Thermal Sources By Y. Weissman, E. Shafir, M. Tur, and K. Bløtekjaer (With 2 Figures)	159
Demonstration of Lead Sensitivity of a Fiber Interferometer due to Magneto-optically Induced Input Polarization Fluctuation By A.D. Kersey, M.J. Marrone, and A. Dandridge (With 5 Figures)	166
Characterization of a Diode Laser-Pumped Nd:YAG Ring Laser for Fiber Sensor Applications By A.D. Kersey, K.J. Williams, A. Dandridge, and J.F. Weller (With 8 Figures)	172

1.3 μm Operation of a Coherence Multiplexed Interferometric Sensor By A.M. Yurek, A.B. Tveten, A. Dandridge, and A.D. Kersey (With 5 Figures)	179
--	-----

Part VII Systems and Applications

Optical Fiber Environmental Sensors* By J.P. Dakin (With 4 Figures)	186
Multimode Fiber-Optic Vibrometer By G. Conforti, M. Brenci, A. Mencaglia, A.G. Mignani, and A.M. Scheggi (With 7 Figures)	194
An Optical Hot-Fiber Anemometer By A. Samouris, J.P. Davis, L.C. Bobb, and D.C. Larson (With 4 Figures)	201
Extrinsic Dual-Wavelength Fibre-Optic Based Accelerometer with Common Mode Compensation By A.S. Gerges, T.P. Newson, and D.A. Jackson (With 4 Figures)	207
High Sensitivity Transducer for Fibre-Optic Pressure Sensing Applied to Dynamic Mechanical Testing and Vehicle Detection on Roads By A. Tardy, M. Jurczynszyn, J.-M. Caussignac, G. Morel, and G. Briant (With 4 Figures)	215
A Continuous Liquid Level Sensor Using Fluorescent Fibre By J.W. Snow, P.D. Colbourne, S.H. Woodside, and B.E. Paton (With 3 Figures)	222
Prototype Industrial Multi-parameter F.O. Sensor Using White Light Interferometry By D. Trouchet, B. Laloux, and P. Graindorge (With 4 Figures)	227
Integrated Optics Displacement Sensor Connected with Optical Fibers By C. Erbeia, S. Valette, J.P. Jadot, P. Gidon, and S. Renard (With 6 Figures)	234
A Sensor for Dimensional Metrology with an Interferometer in Integrated Optics Technology By G. Ulbers (With 6 Figures)	240

Part VIII Current and Magnetic Field Sensors

Recent Advances in Faraday Effect Sensors* By G.W. Day	250
---	-----

Heterodyne Detection of Magnetic Fields from 0.1 Hz to 10MHz in a Magnetostrictive Fiber Sensor By D.M. Dagenais, F. Bucholtz, and K.P. Koo (With 5 Figures)	255
Input Polarization Coding in Fibre Current Sensors By Z.B. Ren and Ph. Robert (With 3 Figures)	261
Magneto-optic Current Sensor Using a Helical Fiber Fabry-Perot Resonator By F. Maystre and A. Bertholds (With 3 Figures)	267
A Polarization-Based Fibre Optical Sensor System Using a YIG Optical Waveguide for Magnetic Field Sensing By H. Sohlström, U. Holm, and K. Svantesson (With 7 Figures)	273
Fidelity/Sensitivity Evaluation of Fiber Optic Magnetic Gradiometer By R.D. Rempt (With 4 Figures)	279
All-Fiber Faraday-Rotation Current Sensor with Remote Laser-FM Based Heterodyne Detection By A.D. Kersey and M.A. Davis (With 6 Figures)	285
Fiber-Optic Sensing with Micromechanical Resonant Metallic Glass Structure By H. Wölfelschneider, J. Philip, and R. Kist (With 11 Figures)	291

Part IX Poster Papers

Thermal Characteristics of Semiconductor Ring Laser Sources for Integrated Optical Sensor Devices By W. Chen, P.J.R. Laybourn, A.F. Jezierski, and P.W. Webb (With 14 Figures)	302
Optical Fiber Interferometer Sensor with Immunity from Environmental Disturbance Induced in the Lead-Fiber By Der-Tsair Jong and K. Hotate (With 4 Figures)	313
A Coiled Fiber Displacement Sensor Immune to Temperature Noise By Y. Imai, M.A. Rodrigues, and K. Iizuka (With 7 Figures)	321
Optical-Fibre Surface-Plasma-Wave Polarisers By M.N. Zervas (With 4 Figures)	327
Wavelength-Flattened Couplers Fabricated from Single-Mode Fibers with Different Core Parameters By H. Hanafusa, Y. Takeuchi, and J. Noda (With 6 Figures)	334

Temperature Dependence of Magnetic Field Sensors Using (Cd _{1-x} Mn _x)Te By N. Mikami, C. Nagao, T. Sawada, Y. Furukawa, and E. Aikawa (With 8 Figures)	339
Splicing of Polarization-Maintaining Fibers By T. Watanabe, K. Osaka, E. Sasaoka, S. Tanaka, and Y. Asano (With 7 Figures)	346
Fiber Coupled Analog Rotary Position Sensor By R.W. Huggins, E.C. Goldstick, and B. Van Deventer (With 5 Figures)	353
Fiber Optic Current Density Measurement Based on the Faraday Effect By L. Bager, J.E. Schrøder, and C.J. Nielsen (With 3 Figures)	359
Amorphous Metal Wire Transducers for Fiber Optic Magnetometers By K.P. Koo, F. Bucholtz, D.M. Dagenais, and A. Dandridge (With 4 Figures)	366
A Digital Tracking Temperature Sensor By A.K. Prewett (With 6 Figures)	373
High Performance Polarization Maintaining Fiber Coils for Fiber Optic Gyroscopes By E. Sasaoka, Y. Kubo, O. Kawado, H. Suganuma, M. Takagi, and S. Tanaka (With 3 Figures)	383
International Standardization Activities for Optical Fiber Sensors By L.B. Jeunhomme	388

Part X Smart Structures and Strain Monitoring

Fiber Sensors for Smart Structures* By E. Udd (With 8 Figures)	392
Static Strain Monitoring OFS Using a FM Laser Diode By R. Ohba, S. Kakuma, H. Yamane, and I. Uehira (With 6 Figures)	400
Interferometric Displacement Sensor with Lateral Resolution Employing Fiber Tension Bending By N. Fürstenau (With 3 Figures)	408

Part XI Chemical and Biochemical Sensors

Novel Techniques and Materials for Fiber Optic Chemical Sensing* By O.S. Wolfbeis (With 7 Figures)	416
---	-----

Probe Performance Optimization for pH Continuous Monitoring By M. Bacci, F. Baldini, F. Cosi, G. Conforti, and A.M. Scheggi (With 6 Figures)	425
High Sensitivity Fiber Optic Evanescent Wave Sensing for Fluoroimmunoassay By W.F. Love, I.M. Walczak, and R.E. Slovacek (With 4 Figures) . . .	431
Development of pH-Sensitive Substrates for Optical Sensor Applications By G.E. Badini, K.T.V. Grattan, A.W. Palmer, and A.C.C. Tseung (With 4 Figures)	436
A Refractometer with a Fully Packaged Integrated Optical Sensor Head By W. Konz, A. Brandenburg, R. Edelhäuser, W. Ott, and H. Wölfelschneider (With 4 Figures)	443

Part XII Pressure Sensors

A Review of Fabry-Perot Interferometric Sensors* By G.L. Mitchell (With 3 Figures)	450
A Photo-elastic Pressure Sensor with Loss-Compensated Fiber Link By G. Martens, J. Kordts, and G. Weidinger (With 5 Figures)	458
High-Pressure Fiber-Optic Sensor Based on Polarization-Rotated Reflection By W.J.Bock and T.R. Wolinski (With 4 Figures)	464
Optically Powered Silicon Microresonator Pressure Sensor By L.M. Zhang, D. Uttamchandani, and B. Culshaw (With 5 Figures)	470
A Hybrid Resonant Differential Pressure Transmitter with Wavelength Multiplexed Power and Data Channels By E. Bois, R.C. Spooncer, and B.E. Jones (With 4 Figures)	478

Part XIII Multiplexed Sensors

Ten-Element Time-Division Multiplexed Interferometric Fiber Sensor Array By A.D. Kersey and A. Dandridge (With 5 Figures)	486
A New Approach to Digital Optical Sensor Networking By A. Pervez (With 8 Figures)	491

Multi-frequency Modulation for Passive Multiplexing of Fibre Optic Sensors By H.S. Al-Raweshidy, D. Uttamchandani, and B. Culshaw (With 4 Figures)	499
Specific Design of Optical Fiber Sensor Systems for Wavelength Division Multiplexed Networks By R. Durantis, G. Anglaret, C.J. Hugues, and G.W. Fehrenbach (With 9 Figures)	504
A Coherence-Multiplexed Quasi-Distributed Polarimetric Sensor Suitable for Structural Monitoring By V. Gusmeroli, P. Vavassori, and M. Martinelli (With 3 Figures) . .	513
Quasi-Distributed Fiber Optic Sensor System with Subcarrier Filtering By M.J. Marrone, A.D. Kersey, A. Dandridge, and C.A. Wade (With 5 Figures)	519
Bragg-Grating Temperature and Strain Sensors By W.W. Morey, G. Meltz, and W.H. Glenn (With 2 Figures)	526
<hr/>	
Part XIV Distributed Sensors	
<hr/>	
Rare-Earth-Doped Fibres for Sensors* By D.N. Payne	534
An Improvement of the Accuracy in the Distributed Fiber Temperature Measurement Using Raman Backscattering By Y. Tanabe, A. Takada, K. Ikawa, and N. Bando (With 8 Figures) .	537
A Fiber-Optic Distributed Temperature Sensor with High Distance Resolution By K. Ogawa, Y. Ozawa, H. Kawakami, T. Tsutsui, and S. Yamamoto (With 7 Figures)	544
Exploitation of Stimulated Brillouin Scattering as a Sensing Mechanism for Distributed Temperature Sensors and as a Means of Realizing a Tunable Microwave Generator By D. Culverhouse, F. Farahi, C.N. Pannell, and D.A. Jackson (With 4 Figures)	552
A New Technique for a Fiber Distribution Sensor By K. Nakamura, N. Kagi, and S. Yoshida (With 6 Figures)	560
White Light Interferometry for Distributed Sensing on Dual Mode Fibers By G. Kotrotsios and O. Parriaux (With 5 Figures)	568
Index of Contributors	575