PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 7389

, "Front Matter: Volume 7389," Proc. SPIE 7389, Optical Measurement Systems for Industrial Inspection VI, 738901 (17 June 2009); doi: 10.1117/12.835932

SPIE.

Event: SPIE Europe Optical Metrology, 2009, Munich, Germany

PROCEEDINGS OF SPIE

Optical Measurement Systems for Industrial Inspection VI

Peter H. Lehmann
Editor

15–18 June 2009
Munich, Germany

Sponsored by
SPIE Europe

Cooperating Organizations
EOS—European Optical Society
WLT—Wissenschaftliche Gesellschaft Lasertechnik e.V. (Germany)

Published by
SPIE

Volume 7389

Proceedings of SPIE, 0277-786X, v. 7389

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

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 *Optical Measurement Systems for Industrial Inspection VI*, edited by Peter H. Lehmann, Proceedings of SPIE Vol. 7389 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X

ISBN 9780819476722

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 © 2009, 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/09/\$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 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

Part One

xv *Conference Committee*

SESSION 1 MULTISENSOR APPROACHES AND STRATEGIES

- 7389 02 **Flexible optical metrology strategies for the control and quality assurance of small series production** [7389-01]
R. Schmitt, RWTH Aachen (Germany); A. Pavim, RWTH Aachen (Germany) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (Brazil)
- 7389 03 **Sensor and actuator conditioning for multiscale measurement systems on example of confocal microscopy** [7389-02]
W. Lyda, J. Zimmermann, A. Burla, J. Regin, W. Osten, O. Sawodny, E. Westkämper, Univ. Stuttgart (Germany)
- 7389 04 **Remote online monitoring and measuring system for civil engineering structures** [7389-03]
M. Kujawińska, R. Sitnik, G. Dymny, M. Karaszewski, K. Michoński, J. Krzesłowski, K. Mularczyk, P. Bolewicki, Warsaw Univ. of Technology (Poland)

SESSION 2 DIGITAL HOLOGRAPHY

- 7389 05 **Resolution-enhanced approaches in digital holography (Invited Paper)** [7389-04]
M. Paturzo, P. Ferraro, Istituto Nazionale di Ottica Applicata, CNR (Italy)
- 7389 06 **Investigation of the thermal lens effect of a NdYAG laser** [7389-05]
A. Ettemeyer, J. Jütz, Interstate Univ. of Applied Sciences of Technology Buchs NTB (Switzerland); M. Spiegel, K. Dobler, High Q Laser Production GmbH (Austria)
- 7389 07 **Microfluidic system based on the digital holography microscope for analysis of motile sperm** [7389-07]
G. Di Caprio, Istituto per la Microelettronica e Microsistemi, CNR (Italy) and Univ. degli Studi di Napoli Federico II (Italy); G. Coppola, Istituto per la Microelettronica e Microsistemi, CNR (Italy); S. Grilli, P. Ferraro, Istituto Nazionale di Ottica Applicata, CNR (Italy); R. Puglisi, D. Balduzzi, A. Galli, Istituto Sperimentale Italiano Lazzaro Spallanzani (Italy)
- 7389 08 **Automated compensation of fringe pattern in digital holography and TV holography** [7389-129]
J. Kornis, R. Sélél, Budapest Univ. of Technology and Economics (Hungary)

SESSION 3 FRINGE PROJECTION DEFLECTOMETRY

- 7389 09 **Calibration of a combined system with phase measuring deflectometry and fringe projection** [7389-09]
M. Breitbarth, P. Kühmstedt, G. Notni, Fraunhofer Institute for Applied Optics and Precision Engineering (Germany)
- 7389 0A **Predictive segmentation method for 3D inspection accuracy and robustness improvement** [7389-10]
J. Reiner, M. Stankiewicz, M. Wójcik, Wroclaw Univ. of Technology (Poland)
- 7389 0B **Quality-guided phase unwrapping for the modified Fourier transform method** [7389-11]
H. Guo, P. Huang, Stony Brook Univ. (United States)
- 7389 0C **3D reconstruction by polarimetric imaging method based on perspective model** [7389-12]
R. Rantson, C. Stolz, D. Fofi, F. Mériaudeau, Lab. Le2i, CNRS, Univ. de Bourgogne (France)
- 7389 0D **Optical 3D shape measurement for dynamic object using color fringe pattern projection and empirical mode decomposition** [7389-13]
X. Zhou, H. Zhao, P. Zhang, Xi'an Jiaotong Univ. (China)
- 7389 0F **Development of a high resolution pattern projection system using linescan cameras** [7389-15]
B. Denkena, P. Huke, Leibnitz Univ. Hannover (Germany)

SESSION 4 SPECKLE METROLOGY

- 7389 0G **Industrial inspections by speckle interferometry: general requirements and a case study (Invited Paper)** [7389-16]
M. R. Vioti, Univ. Federal de Santa Catarina (Brazil) and Photonita (Brazil);
A. Albertazzi G., Jr., Univ. Federal de Santa Catarina (Brazil)
- 7389 0H **Out-of-plane vibration analysis with a transmission holographic-optical-element-based electronic speckle pattern interferometer** [7389-17]
V. Bavigadda, V. Toal, R. Jallapuram, E. Mihaylova, Dublin Institute of Technology (Ireland)
- 7389 0I **Out-of-plane deformation dynamic measurement method by using virtual speckle pattern based on Carré algorithm** [7389-18]
Y. Arai, Y. Tsutsumi, Kansai Univ. (Japan); S. Yokozeki, Jyoutoku Applied Optics Lab. (Japan)

SESSION 5 MEASUREMENTS OF FIGURES AND PHASE OBJECTS

- 7389 0J **Measurement of chromatic dispersion of microstructured polymer fibers by white-light spectral interferometry** [7389-20]
P. Hlubina, D. Ciprian, Technical Univ. of Ostrava (Czech Republic); M. H. Frosz, K. Nielsen, Technical Univ. of Denmark (Denmark)
- 7389 0K **Characterization of optical fibers by digital holographic interferometry** [7389-21]
H. H. Wahba, Univ. of Mansoura (Egypt) and Bremer Institut für angewandte Strahltechnik (Germany); T. Kreis, Bremer Institut für angewandte Strahltechnik (Germany)

- 7389 OL **Digital holographic tomography of phase objects** [7389-22]
A. Anand, The Maharaja Sayajirao Univ. of Baroda (India); V. K. Chhaniwal, Parul Institute of Engineering & Technology (India); G. Pedrini, W. Osten, Univ. Stuttgart (Germany)
- 7389 OM **Phase object power mapping and cosmetic defects enhancement by Fourier-based deflectometry** [7389-23]
D. Beghuin, X. Dubois, L. Joannes, Lambda-X SA (Belgium)

SESSION 6 MEASUREMENT OF SHAPE AND ROUGHNESS

- 7389 ON **Extraction of shape and roughness using scattering light (Invited Paper)** [7389-24]
J. Seewig, Univ. Kaiserslautern (Germany); G. Beichert, Holo-Support (Germany); R. Brodmann, OptoSurf GmbH (Germany); H. Bodschiwinna, Consultant (Germany); M. Wendel, Univ. Kaiserslautern (Germany)
- 7389 OO **The complete acquisition of the topography of a special multi-mirror arrangement with the help of a Fizeau interferometer** [7389-25]
H. Xu, A. Müller, F. Balzer, B. Percle, E. Manske, G. Jäger, Ilmenau Univ. of Technology (Germany)
- 7389 OP **Ball bearing measurement with white light interferometry** [7389-26]
J. Schmit, S. Han, E. Novak, Veeco Instruments Inc. (United States)
- 7389 OQ **Highly sensitive wavefront sensor for characterization of micro- to nanometer-scale surface flatness deviations** [7389-27]
I. Lazareva, A. Nutsch, L. Pfitzner, L. Frey, Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany)
- 7389 OR **Profilometry of semiconductor components by two-colour holography with Bi₁₂TiO₂₀ crystals** [7389-28]
A. Oliveira Preto, E. Acedo Barbosa, CEETEPS, UNESP (Brazil)
- 7389 OS **Fast total scattering facility for 2D inspection of optical and functional surfaces** [7389-29]
P. Kadkhoda, W. Sakiew, S. Günster, D. Ristau, Laser Zentrum Hannover e.V. (Germany)
- 7389 OT **Soft x-ray projection system for robust roundness measurements** [7389-30]
R. Volk, E. Neumann, Hommel-Etamic GmbH (Germany); A. Warrikhoff, rtw Röntgentechnik Dr. Warrikhoff GmbH & Co. KG (Germany); R. Hanke, S. Kasperl, C. Funk, J. Hiller, M. Krumm, S. Acharya, F. Sukowski, N. Uhlmann, EZRT, IZFP Saarbrücken, und IIS Erlangen (Germany); R. Behrendt, Fraunhofer-Institut für Integrierte Schaltungen (Germany); R. Schmitt, A. Hamacher, B. Damm, RWTH Aachen (Germany)

SESSION 7 3D INTERFEROMETRY

- 7389 OU **Gauge block calibration by using a high speed phase shifting interferometer comprising two frequency scanning diode lasers** [7389-31]
J. W. Kim, J.-A. Kim, Korea Research Institute of Standards and Science (Korea, Republic of); R. Jang, Korea Advanced Institute of Science and Technology (Korea, Republic of); C.-S. Kang, Korea Research Institute of Standards and Science (Korea, Republic of)

- 7389 0V **Development of an ultrasensitive interferometry system as a key to precision metrology applications** [7389-32]
M. Gohlke, EADS Astrium (Germany) and Humboldt-Univ. zu Berlin (Germany); T. Schuldt, Humboldt-Univ. zu Berlin (Germany) and Hochschule Konstanz (Germany); D. Weise, U. Johann, EADS Astrium GmbH (Germany); A. Peters, Humboldt-Univ. zu Berlin (Germany); C. Braxmaier, EADS Astrium (Germany) and Hochschule Konstanz (Germany)
- 7389 0W **Common-path two-wavelength interferometer with submicron precision for profile measurements in online applications** [7389-33]
J. M. Enguita, I. Álvarez, M. Frade, Univ. of Oviedo (Spain); J. Marina, DSIPlus (Spain)
- 7389 0X **Digital interferometry using sequentially recorded intensity patterns** [7389-34]
B. Gombkötö, J. Kornis, Budapest Univ. of Technology and Economics (Hungary)

SESSION 8 OPTICS TESTING

- 7389 0Y **Small lens testing method using phase shift shearing interferometer** [7389-35]
R. Hanayama, K. Ishii, K. Matsuda, The Graduate School for the Creation of New Photonics Industries (Japan)
- 7389 0Z **Reproducibility of contact lens power measurements using the phase shifting schlieren method** [7389-36]
L. Joannes, T. Hough, X. Hutsebaut, X. Dubois, R. Ligot, B. Saoul, P. Van Donink, K. De Coninck, Lambda-X SA (Belgium)
- 7389 10 **Phase analysis error reduction in the Fourier transform method using a virtual interferogram** [7389-37]
H. Toba, Z. Liu, S. Udagawa, N. Fujiwara, S. Nakayama, T. Gemma, Nikon Corp. (Japan); M. Takeda, Univ. of Electro-Communications (Japan)
- 7389 11 **Parameter determination of biconvex lenses using confocal imaging** [7389-38]
V. K. Chhaniwal, Parul Institute of Engineering & Technology (India); A. Anand, The Maharaja Sayajirao Univ. of Baroda (India)
- 7389 12 **Optical testing of lens systems with concentric design** [7389-39]
A. V. Goncharov, National Univ. of Ireland, Galway (Ireland); L. Lobato Bailón, Univ. of Barcelona (Spain); N. M. Devaney, C. Dainty, National Univ. of Ireland, Galway (Ireland)

SESSION 9 NOVEL INTERFEROMETRIC SENSORS

- 7389 13 **Simplified laser Doppler distance sensor employing a single fan-shaped interference fringe system for dynamic position and shape measurement of laterally moving objects** [7389-40]
T. Pfister, L. Büttner, J. Czarske, Technische Univ. Dresden (Germany)
- 7389 14 **Surface profile analysis using a fiber optic low-coherence interferometer** [7389-41]
R. Schmitt, N. König, Fraunhofer Institute for Production Technology (Germany); E. Manfrin de Araújo, Fraunhofer Institute for Production Technology (Germany) and Univ. Federal de Santa Catarina (Brazil)

- 7389 15 **Fiber optic interferometric sensor based on mechanical oscillation** [7389-42]
P. Lehmann, M. Schulz, J. Niehues, Univ. of Kassel (Germany)

SESSION 10 OPTICS MEASUREMENT I: JOINT SESSION WITH EOS CONFERENCE ON METROLOGY OF ADVANCED OPTICS

- 7389 18 **New metrology approach for the production of aspheric lenses** [7389-45]
A. Beutler, Mahr GmbH (Germany)
- 7389 19 **Measuring aspheres with a chromatic Fizeau interferometer** [7389-46]
L. Seifert, Fraunhofer-Institut für Integrierte Schaltungen (Germany); C. Pruss, Univ. Stuttgart (Germany); B. Dörband, Carl Zeiss SMT AG (Germany); W. Osten, Univ. Stuttgart (Germany)
- 7389 1A **Noncontact methods for optical testing of convex aspheric mirrors for future large telescopes** [7389-47]
A. V. Goncharov, National Univ. of Ireland, Galway (Ireland); V. V. Druzhin, V. I. Batshev, Bauman Moscow State Technical Univ. (Russian Federation)
- 7389 1B **Dual-CGH interferometry test for x-ray mirror mandrels** [7389-48]
G. Gao, National Institute of Standards and Technology (United States); J. P. Lehan, Univ. of Maryland, Baltimore County (United States) and NASA Goddard Space Flight Ctr. (United States); U. Griesmann, National Institute of Standards and Technology (United States)

SESSION 11 OPTICS MEASUREMENT II: JOINT SESSION WITH EOS CONFERENCE ON METROLOGY OF ADVANCED OPTICS

- 7389 1C **Measurement and simulation of striae in optical glass** [7389-49]
H. Gross, Carl Zeiss AG (Germany); M. Hofmann, DILAS Diodenlaser GmbH (Germany); R. Jedamzik, P. Hartmann, Schott AG (Germany); S. Sinzinger, Technical Univ. Ilmenau (Germany)
- 7389 1D **Photothermal measurement of absorptance losses, temperature-induced wavefront deformation, and compaction in DUV optics** [7389-50]
B. Schäfer, B. Flöter, K. Mann, Laser-Lab. Göttingen e.V. (Germany)

SESSION 12 MICRO-TOPOGRAPHY AND THICKNESS MEASUREMENT

- 7389 1H **Several micron-range measurements with sub-nanometric resolution by the use of dual-wavelength digital holography and vertical scanning** [7389-54]
T. Colomb, Lyncée Tec SA (Switzerland); J. Kühn, C. Depeursinge, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Y. Emery, Lyncée Tec SA (Switzerland)
- 7389 1I **Digital holographic characterization of liquid microlenses array fabricated in electrode-less configuration** [7389-55]
L. Miccio, V. Vespini, S. Grilli, M. Paturzo, Istituto Nazionale di Ottica Applicata, CNR (Italy); A. Finizio, S. De Nicola, Istituto di Cibernetica Eduardo Caianiello, CNR (Italy); P. Ferraro, Istituto Nazionale di Ottica Applicata, CNR (Italy)

- 7389 1J **Optical, mechanical, and electro-optical design of an interferometric test station for massive parallel inspection of MEMS and MOEMS** [7389-56]
K. Gastinger, K. H. Haugholt, SINTEF (Norway); M. Kujawska, M. Jozwik, Warsaw Univ. of Technology (Poland); C. Schaeffel, Institut für Mikroelektronik- und Mechatronik- Systeme gemeinnützige GmbH (Germany); S. Beer, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland)
- 7389 1K **Thin film interferometer using a light source with spectrally nonequidistantly distributed sampling points** [7389-57]
F. Hirth, Technische Univ. München (Germany); S. Dudeck, Siemens AG (Germany); M. Jakobi, Technische Univ. München (Germany); D. Gerhard, Siemens AG (Germany); A. W. Koch, Technische Univ. München (Germany)

SESSION 13 POSITION, DISPLACEMENT, AND VIBRATION MEASUREMENT

- 7389 1L **All-interferometric six-degrees-of-freedom sensor based on laser self-mixing** [7389-58]
S. Ottonelli, F. De Lucia, M. Dabbicco, G. Scamarcio, CNR-INFM Regional Lab. LIT3 (Italy) and Univ. degli Studi di Bari (Italy)
- 7389 1M **Compensated laser encoder with symmetric and quasi-common-path heterodyne interferometry** [7389-59]
C.-C. Hsu, Yuan Ze Univ. (Taiwan); J.-Y. Lee, National Central Univ. (Taiwan); C.-C. Wu, Tamkang Univ. (Taiwan)
- 7389 1N **Pseudo-periodic patterns for subpixel accuracy visual control: principle, pattern designs, and performances** [7389-60]
J. A. Galeano Zea, P. Sandoz, Institut FEMTO-ST, CNRS, Univ. de Franche-Comté (France)
- 7389 1O **Determination of the frequency spectrum of Lamb waves from a sequence of maps of the instantaneous acoustic displacement obtained with TV holography** [7389-61]
J. L. Deán, C. Trillo, J. C. López-Vázquez, Á. F. Doval, J. L. Fernández, Univ. de Vigo (Spain)
- 7389 1P **Dynamic holographic interferometry for dilatation measurements in a vacuum-thermal environment** [7389-08]
C. Thizy, C. Barbier, P. Barzin, I. Tychon, S. Roose, Y. Stockman, M. Georges, Univ. de Liège (Belgium)
- 7389 1Q **In-situ position and vibration measurement of rough surfaces using laser Doppler distance sensors** [7389-63]
J. Czarske, T. Pfister, P. Günther, L. Büttner, Technische Univ. Dresden (Germany)
- 7389 1R **Study on the temporal coherence function of a femtosecond optical frequency comb** [7389-62]
D. Wei, S. Takahashi, K. Takamasu, H. Matsumoto, The Univ. of Tokyo (Japan)

Part Two

SESSION 14 OBJECT INSPECTION AND DEFECT DETECTION

- 7389 1S **Structural damage identification based on laser ultrasonic propagation imaging technology** [7389-64]
C.-C. Chia, S.-G. Jang, J.-R. Lee, Chonbuk National Univ. (Korea, Republic of); D.-J. Yoon, Korea Research Institute of Standards and Science (Korea, Republic of)
- 7389 1T **Real-time defect detection in transparent multilayer polymer films using structured illumination and 1D filtering** [7389-65]
W. Michaeli, K. Berdel, O. Osterbrink, RWTH Aachen (Germany)
- 7389 1V **Novel fiber-based technique for inspection of holes in narrow-bore tubes** [7389-67]
F. Bernard, T. Flaherty, G. M. O'Connor, National Univ. of Ireland, Galway (Ireland)
- 7389 1W **Development and application of a photogrammetric endoscopic system for measurement of misalignment and internal profile of welded joints in pipelines** [7389-68]
A. Albertazzi G., Jr., A. C. Hofmann, A. V. Fantin, Univ. Federal de Santa Catarina (Brazil); J. M. C. Santos, Petrobrás (Brazil)
- 7389 1X **Industrial online surface defects detection in continuous casting hot slabs** [7389-69]
I. Alvarez, Univ. de Oviedo (Spain); J. Marina, DSIPlus (Spain); J. M. Enguita, Univ. de Oviedo (Spain); C. Fraga, ArcelorMittal (Spain); R. Garcia, DSIPlus (Spain)
- 7389 1Y **Optical classification for quality and defect analysis of train brakes** [7389-70]
S. Glock, S. Hausmann, S. Gerke, A. Warok, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany); P. Spiess, Deutsche Bahn AG (Germany); S. Witte, V. Lohweg, Ostwestfalen-Lippe Univ. of Applied Sciences (Germany)

SESSION 15 NONDESTRUCTIVE TESTING

- 7389 1Z **Two-sided laser device for online paper caliper measurement and control** [7389-71]
M. K. Y. Hughes, Honeywell Process Solutions (Canada); M. Bengtsson, Honeywell Process Solutions (Sweden); P. Hui, G. Duck, Honeywell Process Solutions (Canada)
- 7389 20 **Calibration method for accurate optical measurement of thickness profile for the paper industry** [7389-72]
J. Graeffe, Metso Automation (Finland)
- 7389 21 **FASEP ultra-automated analysis of fibre length distribution in glass-fibre-reinforced products** [7389-73]
M. R. Hartwich, Hochschule Darmstadt (Germany); N. Höhn, H. Mayr, IDM Systems (Germany); K. Sandau, R. Stengler, Hochschule Darmstadt (Germany)
- 7389 22 **Electro-optic sensors dedicated to noninvasive electric field characterization** [7389-74]
A. Warzecha, M. Bernier, IMEP-LAHC, CNRS (France); G. Gaborit, L. Duvillaret, IMEP-LAHC, CNRS, Univ. de Savoie (France); J.-L. Lasserre, La Délégation Générale pour l'Armement (France)

- 7389 23 **Spectral peak tracking for enhanced fiber optic sensing** [7389-75]
M. P. Plattner, C. N. Brand, T. Mair, S. Schupfer, T. C. Buck, A. W. Koch, Technische Univ. München (Germany)

POSTER SESSION

- 7389 24 **A novel fiber grating array vibration monitoring system for large area safety** [7389-76]
F. Meng, B. Yang, Z. Li, Hebei Univ. of Technology (China); S. Dong, Z. Guo, AT Photonics, Inc. (United States)
- 7389 25 **New 3D high-accuracy optical coordinates measuring technique based on an infrared target and binocular stereo vision** [7389-77]
J. Li, Xi'an Jiaotong Univ. (China) and Xi'an Research Institute of Hi-Tech (China); H. Zhao, Q. Fu, P. Zhang, X. Zhou, Xi'an Jiaotong Univ. (China)
- 7389 26 **White-light spectral interferometry and reflectometry to measure thickness of thin films** [7389-78]
P. Hlubina, J. Luňáček, D. Ciprian, Technical Univ. of Ostrava (Czech Republic)
- 7389 27 **New approach to workpiece localization in subaperture stitching interferometric testing** [7389-79]
P. Zhang, H. Zhao, T. Jiang, J. Li, X. Zhou, L. Zhang, Xi'an Jiaotong Univ. (China)
- 7389 28 **Sheath flow stability controlling research in dynamic individual particles scattering measurement** [7389-80]
L. Zhang, H. Zhao, P. Zhang, X. Zhou, J. Li, Xi'an Jiaotong Univ. (China)
- 7389 29 **Non-metal elemental analysis by a compact low-energy high-repetition rate laser-induced-breakdown spectrometer** [7389-81]
C. Wagner, J. Ewald, G. Ankerhold, P. Kohns, RheinAhrCampus Remagen (Germany)
- 7389 2B **Study on laser vision measurement technology of large-size workpiece straightness** [7389-83]
X. Zhou, Wuhan Univ. of Science and Technology (China) and Tianjin Univ. (China); S. Ye, X. Qu, Tianjin Univ. (China)
- 7389 2C **Polarized optical scattering measurements of metallic nanoparticles upon a silicon wafer** [7389-84]
C.-Y. Liu, W.-E. Fu, Industrial Technology Research Institute (Taiwan)
- 7389 2D **Fabrication and optical characteristics of silicon-based two-dimensional photonic crystal wavelength division multiplexing splitter** [7389-85]
C.-Y. Liu, Industrial Technology Research Institute (Taiwan)
- 7389 2E **Simple method for the measurement of small wavelength differences by optical activity of cholesteric liquid crystal and heterodyne interferometer** [7389-86]
J.-H. Chen, K.-H. Chen, Feng Chia Univ. (Taiwan); J.-Y. Lin, National Changhua Univ. of Education (Taiwan); H.-Y. Hsieh, W.-Y. Chang, Feng Chia Univ. (Taiwan)

- 7389 2F **Study of the measurement of solution concentration by surface plasmon resonance heterodyne interferometer** [7389-87]
K.-H. Chen, J.-H. Chen, Feng Chia Univ. (Taiwan); J.-Y. Lin, National Changhua Univ. of Education (Taiwan); W.-Y. Chang, H.-Y. Hsieh, Feng Chia Univ. (Taiwan)
- 7389 2G **Wavelength-modulated heterodyne speckle interferometry for displacement measurement** [7389-89]
J.-Y. Lee, K.-Y. Lin, S.-H. Huang, National Central Univ. (Taiwan)
- 7389 2H **3D shape measurement using curvature data** [7389-92]
B. Kim, M. Kwon, Kyungnam Univ. (Korea, Republic of); B. Choo, I. Yoon, Samyang Optics Co. (Korea, Republic of)
- 7389 2I **Evaluation of aliasing influence on the performance of hybrid optical-digital speckle correlator** [7389-93]
L. I. Muravsky, O. M. Sakharuk, G. V. Karpenko Physico-Mechanical Institute (Ukraine); P. V. Yezhov, Institute of Physics (Ukraine)
- 7389 2J **Automated ethernet-based test setup for long wave infrared camera analysis and algorithm evaluation** [7389-94]
T. Edeler, K. Ohliger, Westcoast Univ. of Applied Sciences (Germany); S. Lawrenz, ITD GmbH (Germany); S. Hussmann, Westcoast Univ. of Applied Sciences (Germany)
- 7389 2K **Influence of material dispersion on the measurement accuracy of chromatic sensors** [7389-95]
A. Miks, J. Novak, P. Novak, P. Kajnar, Czech Technical Univ. in Prague (Czech Republic)
- 7389 2L **High-precision alignment technique through quality image analysis** [7389-96]
J. Arasa, Technical Univ. of Catalonia (Spain); E. Oteo, P. Blanco, SnellOptics (Spain)
- 7389 2M **Makyoh topography studies of the morphology of periodic and quasi-periodic surfaces** [7389-97]
F. Riesz, Research Institute for Technical Physics and Materials Science (Hungary)
- 7389 2O **Surface quality control in diamond abrasive finishing** [7389-99]
Y. D. Filatov, V. I. Sidorko, Bakul Institute for Superhard Materials (Ukraine); O. Yu. Filatov, V. P. Yaschuk, National Taras Shevchenko Univ. of Kyiv (Ukraine); U. Heisel, M. Storchak, Univ. Stuttgart (Germany)
- 7389 2P **Analysis of low activity in dynamic speckle patterns** [7389-100]
M. N. Guzmán, G. H. Sendra, Univ. Nacional de Mar del Plata (Argentina) and Ctr. de Investigaciones Ópticas (Argentina); H. J. Rabal, R. Arizaga, M. Trivi, Ctr. de Investigaciones Ópticas (Argentina)
- 7389 2Q **Rock porosity and fracture parameter estimation by image technique** [7389-101]
W. Wang, Ch. Z. Wang, Y. Z. Hu, Hubei Univ. of Technology (China)
- 7389 2R **Multiple object image segmentation algorithm based on wavelet theory** [7389-112]
W. Wang, Hubei Univ. of Technology (China); Z. Wang, Huawei Co. (China)

- 7389 2S **Auto-focusing in the scanning white-light interferometer** [7389-103]
W. C. Wang, J.-L. Chen, Industrial Technology Research Institute (Taiwan)
- 7389 2T **Spatial resolution enhancement for Brillouin optical time domain analysis distributed sensor by use of correlation peak** [7389-104]
S. Nouri Jouybari, H. Latifi, A. Ahmadlou, M. Karami, Shahid Beheshti Univ. (Iran, Islamic Republic of)
- 7389 2U **Simulation and fabrication of white light confocal microscope to attain the surface profile using CCD and image processing techniques** [7389-105]
E. Behroodi, A. Mousavian, H. Latifi, Shahid Beheshti Univ. (Iran, Islamic Republic of)
- 7389 2V **Weighted integral method in white-light interferometry: envelope estimation from fraction of interferogram** [7389-106]
S. Sato, S. Ando, The Univ. of Tokyo (Japan)
- 7389 2W **Development of 3D control of a tiny dew droplet by scattered laser light** [7389-107]
S. Matsumoto, Univ. of Industrial Technology (Japan)
- 7389 2X **Measurement of temperature, refractive index, density distribution, and convective heat transfer coefficient around a vertical wire by the Michelson interferometer** [7389-108]
K. Madanipour, S. Fatehi, P. Parvin, Amirkabir Univ. of Technology (Iran, Islamic Republic of)
- 7389 2Y **Novel instrumentation for interferometric nanoscale comparator** [7389-109]
M. Cizek, Z. Buchta, B. Mikel, J. Lazar, O. Cip, Institute of Scientific Instruments (Czech Republic)
- 7389 2Z **Dynamic evaluation of lateral and vertical displacement of thermally actuated MEMS devices** [7389-110]
K. Hanhijärvi, J. Aaltonen, Univ. of Helsinki (Finland); I. Kassamakov, L. Sainiemi, K. Grigoras, S. Franssila, Helsinki Univ. of Technology (Finland); E. Hæggström, Univ. of Helsinki (Finland)
- 7389 30 **Performance analysis of interrogators for fiber Bragg grating sensors based on arrayed waveguide gratings** [7389-111]
T. C. Buck, M. S. Müller, M. Plattner, A. W. Koch, Technische Univ. München (Germany)
- 7389 31 **Interferometric characterization of mono- and polycrystalline CVD diamond** [7389-102]
M. Vannoni, G. Molesini, Istituto Nazionale di Ottica Applicata, CNR (Italy); S. Sciortino, S. Lagomarsino, Univ. of Florence (Italy); P. Olivero, Univ. of Turin (Italy)
- 7389 32 **Effect of surface defects on the self-images produced by diffraction gratings** [7389-113]
L. M. Sanchez-Brea, F. J. Salgado-Remacha, F. J. Torcal-Milla, Univ. Complutense de Madrid (Spain)
- 7389 33 **Precise measurement of the length by means of DFB diode and femtosecond laser** [7389-114]
R. Šmíd, O. Číp, J. Lazar, J. Ježek, B. Růžicka, Institute of Scientific Instruments (Czech Republic)

- 7389 34 **Classification of mechanical parts using an optical-digital system and the Jacobi-Fourier moments** [7389-115]
C. Toxqui-Quitl, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) and Univ. Politécnica de Tulancingo (Mexico); A. Padilla-Vivanco, Univ. Politécnica de Tulancingo (Mexico); J. Baez-Rojas, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico)
- 7389 35 **Characterization of deformable elastic lenses using PDI and null screen** [7389-116]
A. Santiago Alvarado, Univ. Tecnológica de la Mixteca (Mexico); F. S. Granados Agustín, S. Vázquez Montiel, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); M. Campos García, R. Díaz Uribe, Univ. Nacional Autónoma de México (Mexico)
- 7389 36 **Correlating buried-finger photodetector for time-of-flight applications** [7389-117]
G. Zach, A. Nemecek, K. Oberhauser, H. Zimmermann, Vienna Univ. of Technology (Austria)
- 7389 37 **Modelling for characterizing defects in plates using two-dimensional maps of instantaneous ultrasonic out-of-plane displacement obtained by pulsed TV-holography** [7389-118]
J. C. López-Vázquez, J. L. Deán, C. Trillo, Á. F. Doval, J. L. Fernández, Univ. de Vigo (Spain); F. Amlani, O. P. Bruno, California Institute of Technology (United States)
- 7389 38 **Determination of thermal lens effect by white light interferometry** [7389-119]
D. Önal Tayyar, Gebze Institute of Technology (Turkey); A. Emir, Kocaeli Univ. (Turkey); Z. Saraç, Zonguldak Karaelmas Univ. (Turkey)
- 7389 39 **A Fizeau interferometer system with double-pass and stitching for characterizing the figure error of large (>1m) synchrotron optics** [7389-121]
G. D. Ludbrook, S. G. Alcock, K. J. S. Sawhney, Diamond Light Source Ltd. (United Kingdom)
- 7389 3A **Optical noncontact roughness measurements for the assessment of stress and deformation in tubular metallic parts of auto seats** [7389-123]
M. F. M. Costa, Univ. do Minho (Portugal); F. J. Quierós de Melo, Univ. de Aveiro (Portugal); J. A. O. Carneiro, Univ. do Minho (Portugal)
- 7389 3C **Combined stereovision and phase shifting method: a new approach for 3D shape measurement** [7389-125]
X. Han, P. Huang, Stony Brook Univ. (United States)
- 7389 3D **Sensor for measurement of hydrocarbons concentration based on optic fiber** [7389-126]
J. Pawtał, X. Li, T. Matsuo, Y. Zimin, T. Ueda, Waseda Univ. (Japan)
- 7389 3E **Three-dimensional shape measurement by means of depth-to-coherence coding of the object shape** [7389-127]
V. Micó, Univ. de Valencia (Spain); E. Valero, AIDO (Spain); Z. Zalevsky, Bar-Ilan Univ. (Israel); J. García, Univ. de Valencia (Spain)
- 7389 3F **Nondestructive testing of aerospace composites with an infrared matrix laser vibrometer** [7389-128]
J. Kilpatrick, A. Apostol, V. Markov, MetroLaser, Inc. (United States)

- 7389 3G **Multifocus microscope image fusion analysis based on Daubechies wavelets** [7389-130]
A. Padilla-Vivanco, Univ. Politécnica de Tulancingo (Mexico); C. Toxqui-Quitl, Univ. Politécnica de Tulancingo (Mexico) and Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); C. Santiago-Tepantlan, Univ. Politécnica de Tulancingo (Mexico)
- 7389 3H **Combined stereovision and phase shifting method: use of a visibility-modulated fringe pattern** [7389-131]
X. Han, P. Huang, Stony Brook Univ. (United States)

OPTICS MEASUREMENTS POSTER SESSION

- 7389 3K **AFM characterization of large area micro-optical elements** [7389-135]
M. Oliva, T. Benkenstein, M. Flemming, U. D. Zeitner, Fraunhofer Institute for Applied Optics and Precision Engineering (Germany)
- 7389 3L **Inspection of aspherical lenses by wavefront analysis** [7389-136]
U. Ceyhan, T. Henning, F. Fleischmann, Hochschule Bremen (Germany); D. Knipp, Jacobs Univ. Bremen (Germany)

Author Index

Conference Committee

Symposium Chairs

Wolfgang Osten, Universität Stuttgart (Germany)
Małgorzata Kujawińska, Politechnika Warszawska (Poland)
Pietro Ferraro, Istituto Nazionale di Ottica Applicata, CNR (Italy)

Conference Chair

Peter H. Lehmann, Universität Kassel (Germany)

Conference Cochairs

Wolfgang Osten, Universität Stuttgart (Germany)
Christophe Gorecki, Université de Franche-Comté (France)

Program Committee

Oleg V. Angelsky, Yuriy Fedkovych Chernivtsi National University (Ukraine)
Armando Albertazzi Goncalves, Jr., Universidade Federal de Santa Catarina (Brazil)
Anand K. Asundi, Nanyang Technological University (Singapore)
Klaus-Friedrich Beckstette, Carl Zeiss AG (Germany)
Ralf B. Bergmann, Bremer Institut für Angewandte Strahltechnik (Germany)
Harald Bosse, Physikalisch-Technische Bundesanstalt (Germany)
Yuri V. Chugui, Technological Design Institute of Scientific Instrument Engineering (Russian Federation)
Jürgen W. Czarske, Technische Universität Dresden (Germany)
Peter J. de Groot, Zygo Corporation (United States)
Cosme Furlong, Worcester Polytechnic Institute (United States)
Marc P. Georges, Université de Liège (Belgium)
Roger M. Groves, Technische Universiteit Delft (Netherlands)
Steen G. Hanson, Technical University of Denmark (Denmark)
Roland Höfling, ViALUX GmbH (Germany)
Pierre M. Jacquot, École Polytechnique Fédérale de Lausanne (Switzerland)
Gerd Jäger, Technische Universität Ilmenau (Germany)
Richard M. Kowarschik, Friedrich-Schiller-Universität Jena (Germany)
Małgorzata Kujawińska, Politechnika Warszawska (Poland)
Andrew J. Moore, Heriot-Watt University (United Kingdom)
Gunther Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany)

Eduard Reithmeier, Universität Hannover (Germany)
Robert Schmitt, RWTH Aachen (Germany)
Peter Seitz, CSEM and Swiss Federal Institute of Technology EPFL
 (Switzerland)
Jörg Seewig, Technische Universität Kaiserslautern (Germany)
Marcus Steinbichler, Steinbichler Optotechnik GmbH (Germany)
Mitsuo Takeda, The University of Electro-Communications (Japan)
Wim Van Paepegem, Universiteit Gent (Belgium)
Elmar E. Wagner, Fraunhofer-Gesellschaft (Germany)

Session Chairs

- 1 Multisensor Approaches and Strategies
Wolfgang Osten, Universität Stuttgart (Germany)
Peter H. Lehmann, Universität Kassel (Germany)
- 2 Digital Holography
Thomas M. Kreis, Bremer Institut für angewandte Strahltechnik
 (Germany)
- 3 Fringe Projection Deflectometry
Gunther Notni, Fraunhofer-Institut für Angewandte Optik und
 Feinmechanik (Germany)
- 4 Speckle Metrology
Pietro Ferraro, Istituto Nazionale di Ottica Applicata, CNR (Italy)
- 5 Measurements of Figures and Phase Objects
Armando Albertazzi Goncalves, Jr., Universidade Federal de Santa
 Catarina (Brazil)
- 6 Measurement of Shape and Roughness
Jürgen W. Czarske, Technische Universität Dresden (Germany)
- 7 3D Interferometry
Mitsuo Takeda, The University of Electro-Communications (Japan)
- 8 Optics Testing
Klaus-Friedrich Beckstette, Carl Zeiss AG (Germany)
- 9 Novel Interferometric Sensors
Steen G. Hanson, Technical University of Denmark (Denmark))
- 10 Optics Measurement I: Joint Session with EOS Conference on
 Metrology of Advanced Optics
Thomas Dresel, Universität Erlangen-Nürnberg (Germany)

- 11 Optics Measurement II: Joint Session with EOS Conference on
Metrology of Advanced Optics
Christof Pruss, Universität Stuttgart (Germany)
- 12 Micro-Topography and Thickness Measurement
Jörg Seewig, Technische Universität Kaiserslautern (Germany)
- 13 Position, Displacement, and Vibration Measurement
Marc P. Georges, Université de Liège (Belgium)
- 14 Object Inspection and Defect Detection
Peter H. Lehmann, Universität Kassel (Germany)
- 15 Nondestructive Testing
Christophe Gorecki, Université de Franche-Comté (France)