

PROCEEDINGS OF SPIE

Optical Methods for Inspection, Characterization, and Imaging of Biomaterials III

Pietro Ferraro
Simonetta Grilli
Monika Ritsch-Marte
Christoph K. Hitzenberger
Editors

26–28 June 2017
Munich, Germany

Sponsored by
SPIE

Cooperating Organisations
European Optical Society
German Scientific Laser Society (Wissenschaftliche
Gesellschaft Lasertechnik e.V.)

Published by
SPIE

Volume 10333

Proceedings of SPIE 0277-786X, V. 10333

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

Optical Methods for Inspection, Characterization, and Imaging of Biomaterials III, edited by Pietro Ferraro,
Simonetta Grilli, Monika Ritsch-Marte, Christoph K. Hitzenberger, Proc. of SPIE Vol. 10333, 1033301
© 2017 SPIE · CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2284340

Proc. of SPIE Vol. 10333 1033301-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Optical Methods for Inspection, Characterization, and Imaging of Biomaterials III*, edited by Pietro Ferraro, Simonetta Grilli, Monika Ritsch-Marte, Christoph K. Hitzenberger, Proceedings of SPIE Vol. 10333 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510611115

ISBN: 9781510611122 (electronic)

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 © 2017, 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/17/\$18.00.

Printed in the United States of America.

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

SPIE. DIGITAL LIBRARY

SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

Contents

vii	Authors
ix	Conference Committee

SESSION 1 OPTICAL IMAGING

- 10333 02 **Investigation on microfluidic particles manipulation by holographic 3D tracking strategies** [10333-1]
- 10333 03 **Characterization of the mechanical behavior and pathophysiological state of abdominal aortic aneurysms based on 4D ultrasound strain imaging (Invited Paper)** [10333-2]
- 10333 05 **Inspection of arterial-induced skin vibration by Moiré fringe with two-dimensional continuous wavelet transform** [10333-4]

SESSION 2 DIGITAL HOLOGRAPHY AND TOMOGRAPHY

- 10333 06 **Imaging cell clusters and tissue using learning tomography (Keynote Paper)** [10333-5]
- 10333 07 **Biophysical monitoring of cell cultures for quality assessment utilizing digital holographic microscopy** [10333-6]
- 10333 08 **Peripheral blood mononuclear cells analysis in microfluidic flow by coherent imaging tools** [10333-7]

SESSION 3 ADAPTIVE OPTICS

- 10333 0E **Scanless nonlinear optical microscope for image reconstruction and space-time correlation analysis** [10333-13]
- 10333 0F **Adaptive optics for in-vivo exploration of human retinal structures (Invited Paper)** [10333-14]

SESSION 4 INTERFEROMETRY

- 10333 0G **High-speed single-pixel digital holography** [10333-15]
- 10333 0I **Simultaneous shape and deformation measurements in a blood vessel model by two wavelength interferometry** [10333-17]
- 10333 0J **Multiplexed two in-line holographic recordings for flow characterization in a flexible vessel** [10333-18]

SESSION 5	OPTICAL MICROSCOPY I
10333 0K	Increasing the space-time product of super-resolution structured illumination microscopy by means of two-pattern illumination [10333-19]
10333 0L	In-focal-plane characterization of excitation distribution for quantitative fluorescence microscopy applications [10333-20]
10333 0M	Easy and versatile adaptive optics setup with deformable lens for high-resolution microscopy [10333-21]
SESSION 6	OPTICAL MICROSCOPY II
10333 0P	Digital holographic microscopy as a technique to monitor macrophages infected by leishmania [10333-24]
10333 0Q	On-axis programmable microscope using liquid crystal spatial light modulator [10333-25]
10333 0R	A pocket device for high-throughput optofluidic holographic microscopy [10333-26]
10333 0S	Label-free investigation of the effects of lithium niobate polarization on cell adhesion [10333-27]
SESSION 7	INTERFERENCE AND SPECKLE
10333 0W	Correlation plenoptic imaging (Invited Paper) [10333-32]
SESSION 8	OPTICAL COHERENCE TOMOGRAPHY
10333 0Z	Tomographic flow cytometry assisted by intelligent wavefronts analysis [10333-36]
10333 10	3D registration of depth data of porous surface coatings based on 3D phase correlation and the trimmed ICP algorithm [10333-37]
10333 11	RBCs as microlenses: wavefront analysis and applications [10333-38]
SESSION 9	SENSING AND DETECTION
10333 14	Simultaneous real-time application and direct comparison of optical resonance sensing and fluorescence tagging techniques for biochemical component detection [10333-41]

SESSION 10 OPTICAL METHODS

- 10333 18 **Using Shack-Hartmann wavefront sensors and Zernike coefficients for beam characterisation: numerical procedures** [10333-45]

SESSION 11 SPECTROSCOPY AND SCATTERING

- 10333 1A **Micro-Raman analysis of glistenings in intraocular lenses** [10333-47]
- 10333 1C **Technological aspects of manufacturing terahertz photonic crystal waveguides based on sapphire shaped crystals** [10333-50]

POSTER SESSION

- 10333 1E **Design of the algorithm of photons migration in the multilayer skin structure** [10333-49]
- 10333 1F **Polarization visualization of changes of anisotropic meat structure** [10333-51]
- 10333 1G **The original method for imaging of biological tissues in optical coherence tomography with usage of hyperchromatic lens** [10333-53]
- 10333 1H **Box fractal dimension in speckle images** [10333-54]
- 10333 1I **Nonlinear absorption coefficient measurement of nanofluids using Moiré deflectometry technique** [10333-56]
- 10333 1J **Refractive index effect on aberration correction of optical tweezers** [10333-57]
- 10333 1L **Line-field swept source optical coherence tomography system for evaluating microstructure of objects in near-infrared spectral range** [10333-60]
- 10333 1N **Food quality inspection by speckle decorrelation properties of bacteria colonies** [10333-62]
- 10333 1O **Interferometric measurement of film thickness during bubble blowing** [10333-63]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

- Acosta, Eva, 18
Andrés, Nieves, 0I, 0J
Araiza-Esquivel, Ma., 0G
Arines, Justo, 18
Arroyo, M. Pilar, 0I, 0J
Barroso, Álvaro, 11
Belashenkov, N. R., 0K
Bernard, André, 0L
Bertsch, Dietmar, 0L
Bezzubik, V. V., 0K
Bianco, V., 0R, 1N
Bijlsma, H., 0M
Birzhandi, Samaneh, 1J
Blase, Christopher, 03
Blokhina, Anastasia A., 1F
Bonora, S., 0M
Bosch, Salvador, 18
Bramanti, A., 0R
Brülsauer, Martina, 0L
Buffarini, Leandro, 1H
Bulykina, Anastasiia B., 1E
Cacace, Teresa, 02
Çağın, Emine, 0L
Camacho, M., 0P
Cap, Nelly, 1H
Causa, Filippo, 08
Ceffa, N. G., 0E
Chirico, G., 0E
Chiu, Shih-Yung, 05
Collini, M., 0E
D'alfonso, L., 0E
D'Angelo, Milena, 0W
Dannhauser, David, 08
Denz, Cornelia, 11
Derwich, Wojciech, 03
Dietrich, Klaus, 0L
Di Lena, Francesco, 0W
Di Maio, E., 1O
Dirksen, Dieter, 07
Egorov, D. I., 1G
Ferraro, Pietro, 02, 08, 0R, 0S, 0Z, 11, 1N, 1O
Ferraro, V., 1O
Finizio, Andrea, 08
Fraldi, Massimiliano, 02
Fritzen, Claus-Peter, 03
García-Martínez, Pascuala, 0Q
Garuccio, Augusto, 0W
Gennari, O., 0S, 1N
Ghanbari, Saeed, 1J
Gómez Climente, Marina, 0J
González, Humberto, 0G
Goy, A., 06
Grieve, Kate, 0F
Grilli, S., 0S, 1N
Grumel, Eduardo, 1H
Gurov, Igor, 1L
Hasani Shoreh, M., 06
Heeb, Peter, 0L
Hsu, Yu-Hsiang, 05
Inochkin, F. M., 0K
Isbach, Michael, 07
Kamilov, U., 06
Kastl, Lena, 07
Kästner, Markus, 10
Katyba, Gleb M., 1C
Kemper, Björn, 07
Kleshchenok, Maksim A., 1F
Korotaev, Valery V., 1E
Kurlov, Vladimir N., 1C
Lancis, Jesús, 0G
Lee, Chih-Kung, 05
Lee, Shu-Sheng, 05
Lim, J., 06
Lobanova, Anastasiya Y., 1F
Lobera, Julia, 0I, 0J
Lofffield, Nina, 10
López Torres, Ana M., 0J
Lüthi, Stefan, 0L
Madanipour, Khosro, 1I, 1J
Maffettone, P. L., 1O
Mandracchia, B., 0R, 0S, 1N, 1O
Marchesano, V., 1N
Margaryants, Nikita, 1L
Martinez, A., 1A
Martínez, José Luís, 0Q
Martínez-León, Lluís, 0G
Marzoa, Antonio, 18
Meimon, Serge, 0F
Memmolo, Pasquale, 02, 08, 0Z, 11
Mendoza-Rodríguez, E., 0P
Mensitieri, Giuseppe, 02
Merola, Francesco, 0Z, 11
Miccio, Lisa, 0Z, 11
Monroy-Ramírez, F., 0P
Moreno, Ignacio, 0Q
Mugnano, Martina, 0Z, 11
Nazzaro, F., 1N
Netti, Paolo A., 08

Organista-Castelblanco, C., 0P
Ostendorf, Andreas, 14
Palero, Virginia, 0I, 0J
Paques, Michel, 0F
Paturzo, Melania, 02, 0R, 0S, 1N
Pepe, Francesco V., 0W
Pesce, G., 1A
Pimenov, Aleksei, 1L
Pinto, Cristina, 0I
Pioggia, G., 0R
Pozzi, P., 0E, 0K, 0M
Psaltis, D., 06
Quintavalla, M., 0M
Rabal, Héctor, 1H
Radaelli, F., 0E
Reithmeier, Eduard, 10
Roche, Eva M., 0J
Rossant, Florence, 0F
Rossi, Domenico, 08
Rossolenko, Sergey N., 1C
Rusciano, G., 1A
Ryzhova, Victoria A., 1E, 1F
Saetchnikov, Anton V., 14
Saetchnikov, Vladimir A., 14
Samokhin, Nikita Y., 1E
Sasso, A., 1A
Schmitz-Rixen, Thomas, 03
Schnekenburger, Jürgen, 07
Shahabi Farahani, Shahrzad, 1I, 1J
Shikunov, Sergey L., 1C
Shikunova, Irina A., 1C
Sironi, L., 0E
Soldevila, Fernando, 0G
Stärker, Ulrich, 0L
Stryukov, Dmitriy O., 1C
Tajahuerce, Enrique, 0G
Tammaro, D., 1O
Tcherniavskaya, Elina A., 14
Trivi, Marcelo, 1H
Unser, M., 06
Vallmitjana, Santiago, 18
Vassalli, Massimo, 02
Verhaegen, M., 0M
Verstraete, H., 0M
Wang, Chun-Hsiung, 05
Wang, Z., 0R, 1O
Wittek, Andreas, 03
Yurchenko, Stanislav O., 1C
Zaytsev, Kirill I., 1C
Zito, G., 1A

Conference Committee

Symposium Chair

Wolfgang Osten, Universität Stuttgart (Germany)

Conference Chairs

Pietro Ferraro, Institute of Applied Sciences and Intelligent Systems
(ISASI-CNR) (Italy)

Simonetta Grilli, Institute of Applied Sciences and Intelligent Systems
(ISASI-CNR) (Italy)

Monika Ritsch-Marte, Medizinische Universität Innsbruck (Austria)
Christoph K. Hitzenberger, Medizinische Universität Wien (Austria)

Conference Program Committee

Luigi Ambrosio, CNR (Italy)

Giuseppe Chirico, Universitá degli Studi di Milano-Bicocca (Italy)

Jonathan M. Cooper, University of Glasgow (United Kingdom)

Diego di Bernardo, Telethon Institute of Genetics and Medicine (Italy)

Alberto Diaspro, Istituto Italiano di Tecnologia (Italy)

Frank Dubois, Université Libre de Bruxelles (Belgium)

Wolfgang A. Ertmer, Leibniz Universität Hannover (Germany)

Roger Groves, Technische Universiteit Delft (Netherlands)

Jochen R. Guck, Technische Universität Dresden (Germany)

Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Fernando Mendoza Santoyo, Centro de Investigaciones en Óptica,
A.C. (Mexico)

Lisa Miccio, Institute of Applied Sciences and Intelligent Systems
(ISASI-CNR) (Italy)

Serge Monneret, Institut Fresnel (France)

Paolo A. Netti, Universitá degli Studi di Napoli Federico II (Italy)

Fiorenzo Gabriele Omenetto, Tufts University (United States)

Pablo D. Ruiz, Loughborough University (United Kingdom)

David D. Sampson, The University of Western Australia (Australia)

Natan Tzvi Shaked, Tel Aviv University (Israel)

Claudia Tortiglione, Institute of Applied Sciences and Intelligent
Systems (ISASI-CNR) (Italy)

Ruikang K. Wang, University of Washington (United States)

Zeev Zalevsky, Bar-Ilan University (Israel)

Session Chairs

- 1 Optical Imaging
Pietro Ferraro, Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy))
- 2 Digital Holography and Tomography
Aydogan Ozcan, University of California, Los Angeles (United States)
- 3 Adaptive Optics
Giuseppe Chirico, Universitá degli Studi di Milano-Bicocca (Italy)
- 4 Interferometry
Monika Ritsch-Marte, Medizinische Universität Innsbruck (Austria)
- 5 Optical Microscopy I
Björn Kemper, Westfälische Wilhelms-Universität Münster (Germany)
- 6 Optical Microscopy II
Pasquale Memmolo, Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy))
- 7 Interference and Speckle
Monika Ritsch-Marte, Medizinische Universität Innsbruck (Austria)
- 8 Optical Coherence Tomography
Pietro Ferraro, Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy))
- 9 Sensing and Detection
Francesco Merola, Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy))
- 10 Optical Methods
Pascal Picart, Université du Maine (France)
- 11 Spectroscopy and Scattering
Monika Ritsch-Marte, Medizinische Universität Innsbruck (Austria)