

PROCEEDINGS OF SPIE

Optics, Photonics and Digital Technologies for Imaging Applications IV

**Peter Schelkens
Touradj Ebrahimi
Gabriel Cristóbal
Frédéric Truchetet
Pasi Saarikko**
Editors

**5–6 April 2016
Brussels, Belgium**

Sponsored by
SPIE

Cosponsored by
B-PHOT—Brussels Photonics Team (Belgium) • Research Foundation Flanders (Belgium)
Visit Brussels (Belgium)

Cooperating Organisations
Photonics 21 (Germany) • EOS—European Optical Society (Germany)
KTN—the Knowledge Transfer Network (United Kingdom) • Graphene Flagship (Belgium)
Photonics Public Private Partnership (Belgium)

Published by
SPIE

Volume 9896

Proceedings of SPIE 0277-786X, V. 9896

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

Optics, Photonics and Digital Technologies for Imaging Applications IV, edited by Peter Schelkens,
Touradj Ebrahimi, Gabriel Cristóbal, Frédéric Truchetet, Pasi Saarikko, Proc. of SPIE Vol. 9896,
989601 · © 2016 SPIE · CCC code: 0277-786X/16/\$18 · doi: 10.1117/12.2244219

Proc. of SPIE Vol. 9896 989601-1

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 *Optics, Photonics and Digital Technologies for Imaging Applications IV*, edited by Peter Schelkens, Touradj Ebrahimi, Gabriel Cristóbal, Frédéric Truchetet, Pasi Saarikko, Proceedings of SPIE Vol. 9896 (SPIE, Bellingham, WA, 2016) Six-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)
ISBN: 9781510601413

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 © 2016, 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/16/\$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 six-digit CID article numbering system structured as follows:

- 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.

Contents

| | |
|-----|-----------------------------|
| vii | <i>Authors</i> |
| ix | <i>Conference Committee</i> |

SESSION 1 DISPLAYS

- 9896 05 **Polychromatic see-through near-eye display design with two waveguides and a large field-of-view** [9896-4]
- 9896 06 **LED-based projection source based on luminescent concentration** [9896-5]

SESSION 2 COMPUTATIONAL IMAGING

- 9896 08 **Compensating for colour artefacts in the design of technical kaleidoscopes** [9896-7]
- 9896 09 **Sensorless adaptive optics system based on image second moment measurements** [9896-8]
- 9896 0A **Coded access optical sensor (CAOS) imager and applications** [9896-9]
- 9896 0B **Agile wavefront splitting interferometry and imaging using a digital micromirror device** [9896-10]

SESSION 3 HOLOGRAPHY

- 9896 0C **Slightly off-axis holography with partially coherent illumination implemented into a standard microscope** [9896-11]
- 9896 0E **Superresolution imaging system by color-coded tilted-beam illumination in digital in-line holographic microscopy** [9896-13]
- 9896 0F **Speckle noise reduction for computer generated holograms of objects with diffuse surfaces (Best Student Paper)** [9896-14]
- 9896 0G **Sparsity assisted phase retrieval of complex valued objects** [9896-15]

SESSION 4 3D IMAGING BY NONCONVENTIONAL METHODS I

- 9896 0I **3D digitization methods based on laser excitation and active triangulation: a comparison** [9896-17]
- 9896 0J **A fiber-compatible spectrally encoded imaging system using a 45° tilted fiber grating** [9896-18]

9896 OK **3D transient temperature measurement in homogeneous solid material with THz waves** [9896-19]

9896 OL **Measurement of 3D displacement fields from few tomographic projections** [9896-20]

SESSION 5 3D IMAGING BY NONCONVENTIONAL METHODS II

9896 OM **3D high- and isotropic resolution in tomographic diffractive microscopy by illumination angular scanning, specimen rotation and improved data recombination** [9896-21]

9896 ON **Motionless active depth from defocus system using smart optics for camera autofocus applications** [9896-22]

9896 OO **An evaluation of computational radiometric and spectral sensor calibration techniques** [9896-23]

9896 OP **Short review of polarimetric imaging based method for 3D measurements** [9896-24]

SESSION 6 TESTING AND IMAGE QUALITY ASSESSMENT

9896 OQ **Presence capture cameras: a new challenge to the image quality** [9896-25]

9896 OR **Speckle perception and disturbance limit in laser based projectors** [9896-26]

9896 OS **Image quality metrics applied to digital pathology** [9896-27]

9896 OT **Feedforward operation of a lens setup for large defocus and astigmatism correction** [9896-28]

SESSION 7 IMAGE ANALYSIS AND TRANSFORMATIONS

9896 OU **An active contour framework based on the Hermite transform for shape segmentation of cardiac MR images** [9896-29]

9896 OV **Local retrodiction models for photon-noise-limited images** [9896-30]

9896 OY **A current-assisted CMOS photonic sampler with two taps for fluorescence lifetime sensing** [9896-33]

9896 OZ **Non-diffracting super-airy beam with intensified main lobe** [9896-34]

POSTER SESSION

9896 IO **Performance prediction of optical image stabilizer using SVM for shaker-free production line** [9896-35]

- 9896 11 **High-speed digital color fringe projection technique for three-dimensional facial measurements** [9896-36]
- 9896 12 **Efficient detection and recognition algorithm of reference points in photogrammetry** [9896-38]
- 9896 13 **Products recognition on shop-racks from local scale-invariant features** [9896-39]
- 9896 14 **3D phase stepping optical profilometry using a fiber optic Lloyd's mirror** [9896-40]
- 9896 15 **Influence of array photodetectors characteristics on the accuracy of the optical-electronic system with optical equisignal zone** [9896-42]
- 9896 16 **Deformably registering and annotating whole CLARITY brains to an atlas via masked LDDMM** [9896-43]
- 9896 17 **Long-distance eye-safe laser TOF camera design** [9896-44]
- 9896 18 **Robust Bessel beam scanning without mechanical movement** [9896-45]
- 9896 19 **Sparsity metrics for autofocus in digital holographic microscopy** [9896-46]
- 9896 1A **The rejection of vibrations in adaptive optics systems using a DFT-based estimation method** [9896-47]
- 9896 1B **Singlet oxygen detection in water by means of digital holography and digital holographic tomography** [9896-48]
- 9896 1C **Optical-electronic system for real-time structural health monitoring of roofs** [9896-49]
- 9896 1D **Robust object tracking techniques for vision-based 3D motion analysis applications** [9896-50]
- 9896 1F **High resolution spectroscopic mapping imaging applied in situ to multilayer structures for stratigraphic identification of painted art objects** [9896-52]
- 9896 1G **Shape extraction in fetal ultrasound images using a Hermite-based filtering approach and a point distribution model** [9896-53]
- 9896 1H **Position estimation for fiducial marks based on high intensity retroreflective tape** [9896-54]
- 9896 1I **Accurate and high-performance 3D position measurement of fiducial marks by stereoscopic system for railway track inspection** [9896-55]
- 9896 1J **Simulator of human visual perception** [9896-56]
- 9896 1K **Texel-based image classification with orthogonal bases** [9896-57]
- 9896 1L **Perspective projection for variance pose face recognition from camera calibration** [9896-58]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four 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.

Agbana, Temitope E., 09
Ahar, Ayyoub, 0F
Almasian, Mltra, 0T
Amin, M. Junaid, 0B, 0N
Arámbula Cosío, Fernando, 1G
Arie, Ady, 0Z
Aubretton, Olivier, 0I, 0P
Bailleul, Jonathan, 0M
Barba-J, Leiner, 0U
Barnett, Stephen M., 0V
Barsukov, Oleg A., 1C
Batsale, J.-C., 0K
Belashenkov, Nickolai R., 1J
Belashov, A. V., 1B
Bezzubik, Vitalii V., 1J
Bilderbeek, Rolf, 0T
Bittner, Jiří, 08
Blinder, David, 0F
Borboa, Héctor, 1G
Borkowski, Józef, 1A
Bruls, Dominique, 06
Buchenkov, Vyacheslav A., 17
Bueno, Gloria, 0S
Camargo Marín, Lisbeth, 1G
Čáp, Jiří, 08
Carbajal-Degante, Erik, 1K
Chambers, J. A., 1L
Chang, Li-Jen, 11
Charon, Nicolas, 16
Colicchio, Bruno, 0M
Conway, Catherine, 0S
Cristóbal, Gabriel, 0S
de Boer, Dick K. G., 06
Debailleul, Matthieu, 0M
Deisseroth, Karl, 16
Déniz, Oscar, 0S
Dlay, S. S., 1L
Escalante-Ramírez, Boris, 0U, 1G, 1K
Faber, Dirk J., 0T
Fakhir, M. M., 1L
Fan, Xin, 19
Ferreira, Carlos, 0C, 0E
Fontaine, Joël, 05
Garbat, Piotr, 13
García, Javier, 0C, 0E
Gaur, Charu, 0G
Gérard, Philippe, 05
Gorbachev, Alexey A., 11
Granero, L., 0E
Guanshen, Yan, 19
Gusarov, Vadim F., 15
Guzmán Huerta, Mario, 1G
Haeberlé, Olivier, 0M
Havran, Vlastimil, 08
Healy, John J., 19
Hennelly, Bryan M., 19
Hild, François, 0L
Hoelen, Christoph, 06
Hošek, Jan, 08
Hyun, JinWook, 10
Inci, M. Naci, 14
Ingelberts, H., 0Y
Jacobs, An, 0R
Jagt, Henri, 06
Jailin, Clément, 0L
Janssens, Peter, 0R
Jeffers, John, 0V
Jiménez, Ana, 0S
Kalkman, Jeroen, 0T
Kania, Dariusz, 1A
Karagiannis, Georgios Th., 1F
Khare, Kedar, 0G
Kilpi, Katriina, 0R
Kim, GyuYeol, 10
Kim, HyungKwan, 10
Klimov, Aleksandr A., 15
Knyaz, Vladimir A., 1D
Konyakhin, Igor A., 1C
Kosoglu, Gulsen, 14
Kovalev, Anton V., 17
Kuijk, M., 0Y
Kurzejamski, Grzegorz, 13
Kuttan, Kwame S., 16
Kybic, Jan, 1K
La Torre, Juan Pablo, 0B
Lee, JungHyun, 10
Li, Weimin, 12
Li, Xiaofeng, 12
Lievens, Bram, 0R
Lim, Haekeun, 10
Liu, Cheng-Yang, 11
Liu, Gang, 12
Manakov, Alkhazur, 0O
Maraev, Anton A., 15
Mériaudeau, Fabrice, 0I
Meuret, Youri, 0R
Micó, Vicente, 0C, 0E
Mikheev, Sergey V., 1C

Miller, Michael I., 16
 Moon, HyukSoo, 10
 Munteanu, Adrian, 0F
 Naruniec, Jacek, 13
 Nava, Rodrigo, 1K
 Němcová, Šárka, 08
 Olveres, Jimena, 1K
 Pantyushin, Anton, 1H
 Pantyushina, Ekaterina N., 1I
 Peltoketo, Veli-Tapani, 0Q
 Petrov, N. V., 1B
 Picazo-Bueno, José Angel, 0C
 Polyakov, Vadim M., 17
 Pozzi, Paolo, 0T
 Pradere, C., 0K
 Remez, Roei, 0Z
 Riza, Nabeel A., 0A, 0B, 0N
 Roelandt, Stijn, 0R
 Romano, M., 0K
 Roux, Stéphane, 0L
 Saloma, Caesar A., 18
 Schelkens, Peter, 0F
 Schretter, Colas, 0F
 Semenova, I. V., 1B
 Serikova, Mariya G., 1H, 1I
 Shan, Siyu, 12
 Simon, Bertrand, 0M
 Singh, Brijesh Kumar, 0Z
 Soloviev, Oleg, 09
 Sommier, A., 0K
 Sonnleitner, Matthias, 0V
 Stolz, Christophe, 0P
 Symeonidou, Athanasia, 0F
 Taillandier-Thomas, Thibault, 0L
 Tapang, Giovanni A., 18
 Thienpont, Hugo, 0R
 Timofeev, Aleksandr N., 15
 Toomey, David, 0S
 Truchetet, Frédéric, 0I
 Trushkina, Anna, 1H
 Tsur, Yuval, 0Z
 Twardowski, Patrice, 05
 Van den Broeck, Wendy, 0R
 Vargas-Quintero, Lorena, 1G
 Vasyutinskii, O. S., 1B
 Vdovin, Gleb, 09
 Ventura, María Eloisa M., 18
 Verhaegen, Michel, 09, 0T
 Verschaffelt, Guy, 0R
 Verstraete, Hans R. G. W., 0T
 Vishnyakov, Boris V., 1D
 Vogelstein, Joshua T., 16
 Volkova, Daria A., 1I
 Wang, Chao, 0J
 Wang, Chung-Yi, 11
 Wang, Guoqing, 0J
 Woo, W. L., 1L
 Yan, Zhijun, 0J
 Yang, Huizhen, 09
 Yang, Jianming, 05
 Ye, Li, 16
 Yuksel, Heba, 14
 Zalevsky, Zeev, 0C, 0E
 Zanzouri Kechiche, Abir, 0P
 Zawistowski, Jacek, 13
 Zhang, Lin, 0J
 Zhang, Yuhai, 12
 Zheltov, Sergey Yu., 1D
 Zhu, Lichun, 12

Conference Committee

Symposium Chairs

Francis Berghmans, Vrije Universiteit Brussel (Belgium)
Jürgen Popp, Institut für Photonische Technologien e.V.
(Germany)
Ronan Burgess, European Commission Photonics Unit (Belgium)
Peter Hartmann, SCHOTT, AG (Germany)

Honorary Symposium Chair

Hugo Thienpont, Vrije Universiteit Brussel (Belgium)

Conference Chairs

Peter Schelkens, Vrije Universiteit Brussel (Belgium)
Touradj Ebrahimi, Ecole Polytechnique Fédérale de Lausanne
(Switzerland)
Gabriel Cristóbal, Consejo Superior de Investigaciones Científicas
(Spain)
Frédéric Truchetet, Université de Bourgogne (France)
Pasi Saarikko, Oculus VR, LLC (United States)

Conference Programme Committee

Jan T. Bosiers, Teledyne DALSA (Netherlands)
Jana Dittmann, Otto-von-Guericke-Universität Magdeburg
(Germany)
Marek Domanski, University of Poznan (Poland)
Boris Escalante-Ramírez, Universidad Nacional Autónoma de México
(Mexico)
Pascuala García-Martínez, Universitat de València (Spain)
Laurent Jacques, Universiteit Catholique de Louvain (Belgium)
Tom R. L. Kimpe, Barco N.V. (Belgium)
Dragan Kukolj, RT-RK Institute for Computer Based Systems (Serbia)
Jukka-Tapani Mäkinen, VTT Technical Research Center of Finland
(Finland)
María S. Millán García-Varela, Universitat Politècnica de Catalunya
(Spain)
Stuart W. Perry, Canon Information Systems Research (Australia)
Martin Schrader, Nokia Research Center (Finland)
Lea Skorin-Kapov, University of Zagreb (Croatia)
Colin James Richard Sheppard, National University of Singapore
(Singapore)

Athanassios N. Skodras, University of Patras (Greece)
Andrew G. Tescher, AGT Associates (United States)
Gerald Zauner, FH OÖ Forschungs & Entwicklungs GmbH (Austria)

Session Chairs

- 1 Displays
Peter Schelkens, Vrije Universiteit Brussel (Belgium)
- 2 Computational Imaging
Vicente Micó Serrano, Universitat de València (Spain)
- 3 Holography
Colas Schretter, Vrije Universiteit Brussel (Belgium)
- 4 3D Imaging by Nonconventional Methods I
Olivier Aubreton, Université de Bourgogne (France)
Christophe Stolz, Université de Bourgogne (France)
- 5 3D Imaging by Nonconventional Methods II
Christophe Stolz, Université de Bourgogne (France)
Olivier Aubreton, Université de Bourgogne (France)
- 6 Testing and Image Quality Assessment
Tim Bruylants, Ecole Polytechnique Fédérale de Lausanne
(Switzerland)
- 7 Image Analysis and Transformations
Olivier Aubreton, Vrije Universiteit Brussel (Belgium)