

PROCEEDINGS OF SPIE

Speckle 2018: VII International Conference on Speckle Metrology

**Malgorzata Kujawińska
Leszek R. Jaroszewicz**
Editors

**10–12 September 2018
Janów Podlaski, Poland**

Organized by
Warsaw University of Technology (Poland)
Photonics Society of Poland
Polish Technology Platform of Photonics
Polish Academy of Sciences

Published by
SPIE

Volume 10834

Proceedings of SPIE 0277-786X, V. 10834

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

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 SPIDigitalLibrary.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 *Speckle 2018: VII International Conference on Speckle Metrology*, edited by Malgorzata Kujawińska, Leszek R. Jaroszewicz, Proceedings of SPIE Vol. 10834 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510622975

ISBN: 9781510622982 (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 © 2018, 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/18/\$18.00.

Printed in the United States of America Vm7 i ffUb '5gg: WJUH' q' bWZi bXYf' JW bgY Zc'a 'GD-9.

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

SPIE. DIGITAL LIBRARY

SPIDigitalLibrary.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

ix	<i>Authors</i>
xiii	<i>Conference Committee</i>
xv	<i>Introduction</i>

SESSION 1

10834 02	Optical metrology: the long and unstoppable way to become an outstanding measuring tool (Invited Paper) [10834-130]
10834 03	Noise-inspired research: a journey through speckle-driven years (Invited Paper) [10834-53]
10834 04	Adaptive information retrieval in automated fringe based full-field optical metrology (Invited Paper) [10834-103]
10834 08	Propagation of the measurement uncertainty for the numerical reconstruction of holograms in Fresnel approximation [10834-26]
10834 09	Digital simulation of speckle patterns [10834-23]
10834 0A	Metrics and appraisal for noise reduction in holographic data processing (Invited Paper) [10834-121]
10834 0B	Instantaneous speckle reduction? Yes, but there is no free lunch! [10834-9]
10834 0C	Investigation of de-noising processing on the contrast transfer function in digital holographic imaging [10834-16]
10834 0D	Shot noise vs fixed pattern noise: what has higher effect on digital hologram quality? [10834-88]
10834 0E	Complex amplitude and phase control of light using metasurface holograms: the challenges, opportunities and perspectives (Invited Paper) [10834-123]
10834 0F	Light with finite rotation: an attempt for a theoretical description [10834-114]

- 10834 OG **Nonlinear mechano-optical effects and speckle fringe patterns exhibited by gold-platinum nanoparticles in cells** [10834-8]
- 10834 OH **Single-pixel camera with complex-amplitude representation** [10834-31]

SESSION 2

- 10834 OI **Hyperspectral digital holographic microscopy approach for reduction of coherence induced disturbances in quantitative phase imaging of biological specimens** [10834-49]
- 10834 OJ **Qualitative characterization of collagen hydrogel membranes using digital holographic microscopy and SHG microscopy** [10834-62]
- 10834 OK **Generation and spatio-temporal evolution of polarization speckle (Invited Paper)** [10834-118]
- 10834 OL **Modulation of depolarization analyzed by interferometry setup** [10834-89]
- 10834 OM **MOEMS-based imaging probe with integrated Mirau micro-interferometer and MEMS microscanner for swept-source OCT endomicroscopy** [10834-47]
- 10834 ON **Holography and tomography with compact EUV and SXR sources** [10834-85]
- 10834 OO **Learning-based signal retrieval from scattering media (Invited Paper)** [10834-133]
- 10834 OP **Measurement of selective species concentration using spectroscopic holography** [10834-58]
- 10834 OQ **Detection and sorting of microplastics in marine environment by new imaging tools** [10834-60]

SESSION 3

- 10834 OR **Study of transparent media using a simple digital holographic interferometer configuration (Invited Paper)** [10834-21]
- 10834 OS **Applications of optical coherence in interferometric metrology** [10834-48]
- 10834 OT **Recent developments in high speed imaging and applications in speckle light** [10834-36]
- 10834 OU **A single shot shearography device for simultaneous measurement in three shearing directions** [10834-39]
- 10834 OV **Mechanical deformations of space mirrors under thermal stress and their effect on wavefront errors: measurements by ESPI and comparison with multiphysics modeling** [10834-73]
- 10834 OW **Defect detection during laser welding by laser speckle photometry** [10834-13]

- 10834 0X **EXTREME shearography: development of a high-speed shearography instrument for measurements of the surface strain components during an impact event** [10834-34]
- 10834 0Y **Source coding of holographic data: challenges, algorithms and standardization efforts (Invited Paper)** [10834-132]
- 10834 0Z **Full and horizontal parallax Fourier holography with laser capture and LED display (Invited Paper)** [10834-124]
- 10834 10 **Speckle suppression method for infrared digital holograms based on sparse object representation and noise diversity** [10834-55]
- 10834 11 **An airborne, scanning, digital holography system** [10834-56]

POSTER SESSION

- 10834 12 **Deformation measurements in cortical bone-miniscrew interface in human maxilla by using digital speckle pattern interferometry** [10834-6]
- 10834 13 **Wavefront reconstruction from two lateral shearing interferograms with Hilbert–Huang transform in monitoring of high power laser beam quality** [10834-11]
- 10834 14 **Holographic optical element based digital speckle pattern shearing interferometer** [10834-12]
- 10834 15 **Laser speckle photometry: an advanced method for defect detection in ceramics** [10834-15]
- 10834 16 **Quantitative analysis of the agreement between scalar finite element simulation and pulsed TV-holography detection of the scattering of Rayleigh-Lamb waves in plates** [10834-22]
- 10834 17 **Study of the cortical bone strength affection due dehydration** [10834-24]
- 10834 18 **Inspection of micrometric size semitransparent biological samples using a transmission digital holographic interferometer** [10834-25]
- 10834 19 **Comparison between LED and LD as a light source for near-eye holographic display** [10834-27]
- 10834 1A **Integration of relay optics in LED-based reflective off-axis digital holographic microscopy** [10834-28]
- 10834 1B **Controlled compression test applied to composite materials reinforced with particles to predict fracture formation** [10834-29]
- 10834 1C **Speckle imaging for monitoring the growth kinetics of *Bacillus thuringiensis*** [10834-30]
- 10834 1D **Using spatial light modulator for correction of wavefront reflected from optically rough surface (Invited Paper)** [10834-38]
- 10834 1E **A multidirectional system for shape measurement of a human body in motion** [10834-41]

- 10834 1F **Wavefront complex modulation of semiconductor light sources via digital micromirror devices** [10834-42]
- 10834 1G **Autofocusing method for holographic tomography of 3D samples with large axial thickness** [10834-46]
- 10834 1H **Analysis of computerized aided designed and manufactured dental occlusal ceramics with multi-wavelength digital holography** [10834-50]
- 10834 1I **Enhancing spatial resolution of two-wavelength digital holographic microscopy using speckle patterns generated from ring-slit apertures** [10834-51]
- 10834 1J **Wavefront division off-axis digital holography microscopy on chip** [10834-54]
- 10834 1K **Comparison between process simulation and deformation measured by defocused speckle photography** [10834-57]
- 10834 1L **Tyres shoulder section characterization by means of ESPI** [10834-59]
- 10834 1M **Combined optical coherence tomography and spectral technique for detection of changes in eggshells caused by *Mycoplasma synoviae*** [10834-61]
- 10834 1N **Quantitative analysis of elasticity changes in UV radiated skin** [10834-63]
- 10834 1O **Preprocessing of raw data for quality enhancement of the pointwise dynamic speckle analysis** [10834-65]
- 10834 1P **Feasibility study of investigation of skin at cellular level by digital holographic microscopy** [10834-69]
- 10834 1Q **Sinogram cleaning procedure for optical diffraction tomography** [10834-70]
- 10834 1R **Characterization of 3D phantom for holographic tomography produced by two-photon polymerization** [10834-71]
- 10834 1S **Investigation of temporal response in finger blood flow and concentration change in occlusion test on human arm using bio-speckle patterns** [10834-74]
- 10834 1T **Optical vortex application for a secure optical system** [10834-75]
- 10834 1U **Redundant Haar wavelet regularization in sparse-view optical diffraction tomography of microbiological structures** [10834-76]
- 10834 1V **Multi-modal quantitative analysis of HeLa cells using digital holographic microscopy and confocal laser scanning microscopy** [10834-77]
- 10834 1W **Tomographic flow cytometry of circulating human breast adenocarcinoma cells** [10834-79]
- 10834 1X **Processing of binary fringe patterns obtained by phase-shifting time-averaged shearography on vibrating objects** [10834-80]

- 10834 1Y **Multimodal DIC-thermovision investigations of polymer structural sandwich composites exposed to high energy laser beam** [10834-83]
- 10834 1Z **Speckle suppression and error reduction by synthesis and display of multiple kinoforms with sparsed image implementing dummy-area technique** [10834-84]
- 10834 20 **Imaging through turbid media with wavefront modulated illumination full-field optical coherence microscopy** [10834-86]
- 10834 21 **Scanning errors in holographic tomography** [10834-90]
- 10834 22 **Modified variational image decomposition algorithm aided by the Hilbert transform as an alternative to 2D Hilbert-Huang transform for fringe pattern phase retrieval** [10834-93]
- 10834 23 **Depth-of-field characteristic analysis of the imaging system with scattering medium** [10834-94]
- 10834 24 **Height reconstruction algorithm for multi-incidence digital holography** [10834-95]
- 10834 25 **The method of acquiring and processing 3D data from drones** [10834-97]
- 10834 26 **Grating (moiré) interferometry with decreased sensitivity** [10834-100]
- 10834 27 **Dynamic speckle interferometry of technical and thin biological objects** [10834-101]
- 10834 28 **Imaging dynamic objects hidden behind scattering medium by retrieving the point spread function** [10834-102]
- 10834 29 **Histogram based hologram binarization for DMD application** [10834-104]
- 10834 2A **Numerical model of diffraction effects of pixelated phase-only spatial light modulators** [10834-106]
- 10834 2B **Extensive microstructural quality control inside a machine tool using multiwavelength digital holography** [10834-107]
- 10834 2C **Phase shift strategies in phase shifting time averaging interferometry for harmonic motion measurements** [10834-110]
- 10834 2D **The dynamic speckle-based wavemeter** [10834-115]
- 10834 2E **Multiwavelength digital holography: height measurements on linearly moving and rotating objects** [10834-119]
- 10834 2F **Inspection of mechanical surfaces with polarized structured light** [10834-128]
- 10834 2G **An adaptive optics 3D STED microscope for super-resolution imaging of thick samples with background noise suppression using digital image processing** [10834-134]

SPECKLE 2018 LATE PUBLISHED PAPERS

- 10834 2U **Study of the degradation process of glass-ionomer cements by analysis of speckle field dynamics** [10834-35]
- 10834 2V **Monitoring the hardening kinetics of glass-ionomer cements using temporal correlation of speckle patterns** [10834-32]