OPTICAL METROLOGY

The premier European meeting for the latest research in measurement systems, modeling, videometrics, and inspection.

24–27 June 2019
Internationales Congress Center
Munich, Germany

ADVANCE TECHNICAL PROGRAMME
PROGRAMME CURRENT AS OF 7 MARCH 2019

Co-located with
SPIE DIGITAL OPTICAL TECHNOLOGIES

spie.org/om19programme

- Optical Measurement Systems for Industrial Inspection
- Modeling Aspects in Optical Metrology
- O3A: Optics for Arts, Architecture, and Archaeology
- Multimodal Sensing and Artificial Intelligence: Technologies and Applications
- Optical Methods for Inspection, Characterization and Imaging of Biomaterials
- Automated Visual Inspection and Machine Vision

JUNE 23–27, 2019, MESSE MÜNCHEN
24th International Congress on Photonics in Europe—collocated with LASER World of PHOTONICS 2019

WORLD OF PHOTONICS CONGRESS
www.photonics-congress.com
Take this opportunity to share your research at SPIE Optical Metrology 2019. Come to Munich to meet with users and researchers to discuss the latest inventions and applications in the field of optical metrology. The symposium will highlight new optical principles and systems for metrology, multimodal sensing, artificial intelligence, and machine vision with applications in industrial design, production engineering, process monitoring, maintenance support, biotechnology, vehicle navigation, multimedia technology, architecture, archaeology, and arts. Special emphasis is directed to model-based, remote and active approaches, sensor fusion, robot guidance, image sequence processing and scene modelling, and biomaterials characterization, as well as to the preservation of our shared cultural heritage.

We invite engineers, scientists, researchers, trustees, and managers to attend this year’s meeting.

Co-located with Laser 2019 in Munich, Germany, this symposium will address the role of optics and lasers in the following areas:

• Optical Measurement Systems for Industrial Inspection
• Modeling Aspects in Optical Metrology
• Optical Methods for Inspection, Characterization and Imaging of Biomaterials
• Multimodal Sensing and Artificial Intelligence: Technologies and Applications
• Automated Visual Inspection and Machine Vision
• Optics for Arts, Architecture, and Archaeology

Take advantage of this unique opportunity to hear about the latest solutions to practical problems in industrial design and production engineering. Learn about recent advances in using optical technologies to preserve our shared cultural heritage. Find out about new approaches that push optical principles of measurement and testing at the macro, micro- and nanoscales to the forefront of metrology. Exchange new ideas, address your shared concerns, and get access to information not yet published in the mentioned topical areas. Share your research with other engineers, scientists, researchers, and managers. Presentations will be permanently archived in the SPIE Digital Library, and made available to others in the international scientific community who seek to learn, make discoveries, and innovate.

We invite you to join your colleagues and share the most recent developments and applications at SPIE Optical Metrology 2019.

Symposium Chairs
Marc P. Georges
Univ. de Liège (Belgium)
Jörg Seewig
Technische Univ. Kaiserslautern (Germany)

Honorary Chair:
Wolfgang Osten
Univ. Stuttgart (Germany)
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Technical Committee

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Jürgen Beyerer, Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (Germany)
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## DAILY EVENT SCHEDULE

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### COURSES

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PLENARY EVENTS

WORLD OF PHOTONICS CONGRESS-WIDE PLENARY SESSION
Monday 24 June 2019 · 10:00 - 11:00
Listening to the universe with gravitational waves

Karsten Danzmann
Max Planck Institute for Gravitational Physics and Leibnitz Univ. Hannover (Germany)

Biography: Prof. Karsten Danzmann is director at Max Planck Institute for Gravitational Physics (Albert Einstein Institute) and head of the division Laser Interferometry and Gravitational Wave Astronomy. He is Director of the Institute of Gravitation Physics at Leibniz Universität Hannover.

Prof. Danzmann is one of the most important scientists in the study of gravitational waves: His groundbreaking work has enabled the direct detection of gravitational waves, thus ushering in a new era of astrophysical research. For his merits he was honoured with the Edison Volta Prize of the European Physical Society and the Stern-Gerlach Medal of the German Physical Society (DPG) in 2018. Karsten Danzmann has already been presented with the Fritz Behrens Foundation Science Prize 2016, the Lower Saxony Science Award 2016, the Körber European Science Prize 2017, and the Otto Hahn Prize 2017. As a member of the LIGO Scientific Collaboration he was awarded the Special Breakthrough Prize in Fundamental Physics, the Gruber Cosmology Prize, and the Princess of Asturias Award.

SPIE. DIGITAL OPTICAL TECHNOLOGIES
CO-LOCATED: DIGITAL OPTICAL TECHNOLOGIES PLENARY SESSION
Monday 24 June 2019 · 13:00 - 14:00

Co-located Event with Optical Metrology

13:00 to 13:15
Welcome and Introduction
Bernard C. Kress, Microsoft Corp. (USA)
Peter Schelkens, Vrije Univ. Brussel (Belgium)

13:15 to 14:00
Light field image processing: overview and research problems
Christine Guillemot
INRIA, France

Light field imaging is becoming increasingly popular thanks to recent advances in acquisition devices. By capturing light rays emitted along different directions, light fields yield a rich description of the scene, enabling post-capture processing capabilities that can be appealing for a variety of applications. However, the huge volume of high-dimensional light field data is an obvious issue for storage, transmission but also for fast processing. In addition, acquisition devices designed so far to capture light fields come with some technological limitations that translate into trade-offs between angular and spatial resolution. This talk will review fundamentals in light field imaging, the main capturing devices and will present fundamental problems in light field image processing.

Biography: Christine Guillemot is currently Director of Research at INRIA (Institut National de Recherche en Informatique et Automatique) in France. She holds a PhD degree from ENST (Ecole Nationale Supérieure des Télécommunications) Paris (1992). From 1985 to 1997, she has been with France Telecom working in the areas of image and video compression for multimedia and digital television. From 1990 to mid 1991, she has worked as visiting scientist at Bellcore Bell Communication research) in the USA. Her research interests are signal and image processing, and in particular 2D and 3D image and video processing for various problems (compression, super-resolution, inpainting, classification). She has co-authored 25 patents, has published 80 journal publications and 190 publications in peer reviewed international conferences. She received an ERC advanced grant for a project on computational imaging (2016-2021).

She has served in both the IEEE MMSP technical committee (2005-2008), and the IEEE IVMS technical committee (2013-2016). She has been Associate Editor for IEEE Trans. on Image Processing (from 2000 to 2003 and from 2014 to 2016), for IEEE Trans. on Circuits and Systems for Video Technology (2004-2006), IEEE Trans. on Signal Processing (2007-2009), for the Eurasip journal on image communication (2010-2016), and member of the IEEE journal on selected topics in signal processing (2013-2016). She is currently senior area editor for IEEE Trans. on Image Processing and senior member of the steering committee of IEEE Trans. on Multimedia. She is IEEE fellow since January 2015.

World of Photonics Congress-wide Nobel Plenary Session
Monday 24 June 2019 · 18:00 - 19:00
Passion for Extreme Light
Gerard Mourou
Ecole Polytechnique (France); 2018 Physics Nobel Prize Laureate

Extreme-light laser is a universal source providing a vast range of high energy radiations and particles along with the highest field, highest pressure, temperature and acceleration. It offers the possibility to shed light on some of the remaining unanswered questions in fundamental physics like the genesis of cosmic rays with energies in excess of 10^20 eV or the loss of information in black-holes. Using wake-field acceleration some of these fundamental questions could be studied in the laboratory. In addition extreme-light makes possible the study of the structure of vacuum and particle production in “empty” space which is one of the field’s ultimate goal, reaching into the fundamental QED and possibly QCD regimes.

Looking beyond today’s intensity horizon, we will introduce a new concept that could make possible the generation of attosecond-zeptosecond high energy coherent pulse, de facto in x-ray domain, opening at the Schwinger level, the zettawatt, and PeV regime: the next chapter of laser-matter interaction.
metrological characteristics – instrument parameters that can be determined with a suitable material measure and procedure, and the resulting parameter values can then be propagated through a measurement model to give an estimate of measurement uncertainty. The framework only applies if certain well-defined assumptions about the measurement scenario are adhered to, but it is a solid start and will significantly enhance the kudos of optical instruments in manufacturing industry.

In the world of optical coordinate measurement, for example with laser triangulation or fringe projection systems, there is work in the standards committees to bring optical instruments into the performance verification framework that has been developed for contact coordinate measuring systems. However, with the exception again of the optics industry, there seems to be little research into how to apply the same equivalence to calibration of such instruments – calibration of optical coordinate measuring systems is not currently being addressed in the standardisation committees but is clearly needed in manufacturing industry. In the contact coordinate measuring system world, substitution can be applied in simple cases and virtual instruments can be used in more complex measurement scenarios, but such virtual instrument models are not widely available for optical instruments nor is it completely obvious how to develop them. The presentation will discuss the philosophy and positive advances that have been made in the development of a metrological characteristics framework for surface texture measuring instruments, research work to plug the gaps in situations when the usual assumptions do not apply and will take a forward look at how the framework might be applied to optical coordinate measuring systems. As Professor Wolfgang Osten once said: “…the transfer of technologies from the laboratory to the industrial environment is often an adventure” – I hope I can present a new chapter in this adventure and give some useful hints about the content of the chapters to come.

**Biography:** Professor Richard Leach currently holds the Chair in Metrology in the Faculty of Engineering at the University of Nottingham where he has established The Manufacturing Metrology Team to investigate information-rich metrology of surfaces, to support next-generation manufacturing technologies. Drawing on concepts such as machine learning and sensor fusion, his research is changing the approach to quality control in manufacturing.

Prior to his current position, he spent 25 years at the National Physical Laboratory and led a team in surface and nanometrology. He is an internationally recognised researcher in the field of surface topography measurement, particularly in the area of traceability for areal surface metrology, including optical instruments. Richard has developed a wide range of instruments over his 30 years of metrology research, including both theory and practical developments. Some instruments developed include Fizeau, Michelson, Twymann-Green, homodyne and low coherence interferometers; fringe projection, photogrammetry, and contact stylus systems; and co-ordinate measuring machine probes.

He has over 400 publications, including five textbooks. He is the European Editor-in-Chief for Precision Engineering journal. He is a Fellow of the Institute of Physics, the Institution of Engineering & Technology, the Institute of Measurement & Control, the International Society of Nanomanufacturing, a Sustained Member of the American Society of Precision Engineering and a Council Member of the European Society of Precision Engineering & Nanotechnology. Richard is a visiting professor at Loughborough University and the Harbin Institute of Technology.
SPECIAL EVENTS

Students and SPIE Fellows Luncheon
Monday 24 June 2019 · 12:30 - 14:00
Students: Advance sign-up required onsite; seating is limited. Student conference attendees and SPIE Fellows are invited to this engaging networking opportunity. This event gives students an opportunity to network with SPIE Fellows who will share their insights into career paths in optics and photonics. Lunch is complimentary but students must sign up at the SPIE registration desk onsite.

Bier & Brezel Reception
Monday 24 June 2019 · 19:00 - 21:00
SPIE invites all attendees to a Bier & Brezel reception. All registered congress attendees are welcome; please remember to wear your conference registration badges. Dress is casual.

Optical Metrology and Digital Optical Technologies Welcome Reception
Wednesday 26 June 2019 · 19:00 - 21:30
All attendees are invited to relax, socialise, and enjoy light refreshments. Please remember to wear your conference registration badges. Dress is casual.

SPIE Optical Metrology and SPIE Digital Optical Technologies Joint Poster Sessions
Tuesday - Thursday 25 - 27 June 2019 · 12:00 - 12:40
All symposium attendees are invited to attend Digital Optical Technologies and Optical Metrology Joint Poster Sessions provided as an opportunity to enjoy networking while reviewing poster papers. Please note that the Digital Optical Technologies Conference Poster Session (Conf. 10355) has been scheduled as part of the Wednesday Poster Session 2, and will run from 13:00 to 14:00 hrs.

TUESDAY POSTER SESSION 1: Conf. 11056, 11058, 11060 (Optical Metrology)
WEDNESDAY POSTER SESSION 2: Conf. 11057, 11059 (Optical Metrology), 11062 (Digital Optical Technologies)
THURSDAY POSTER SESSION 3: Conf. 11061 (Optical Metrology)

Attendees are encouraged to review the high-quality papers and interact with the poster authors. Poster authors must be present at their posters at the Poster Session times designated for their conference to answer questions and interact with the poster session audience. Attendees are requested to wear their conference registration badges to the poster sessions.

Please see below for specific conference poster session timing.
Tuesday 25 June - Poster Session 1
Optical Metrology, Conf. 11056 (Opt. Measurement Systems-Industrial Inspection): 13:00 to 14:20
Optical Metrology, Conf. 11058 (Optics for Arts, Architecture, and Archaeology): 12:30 to 13:10

Wednesday 26 June - Poster Session 2
Digital Optical Technologies, Conf. 11062: 13:00 to 14:00
Optical Metrology, Conf. 11057 (Modeling Aspects in OM): 11:30 to 12:40
Optical Metrology, Conf. 11059 (Multimodal Sensing and Artificial Intelligence: Technologies and Applications): 11:30 to 12:40

Thursday 27 June - Poster Session 3

Poster Authors, please note the following:
Set up and removal times for each of the Poster Session days.
Your poster may be displayed any time after setup time and must be removed by the break-down time noted below.
Tuesday 27 June - Conf. 11056, 11058, 11060
Setup—Monday, 13:00 hrs; Break-down—Tuesday, 17:00 hrs

Wednesday 28 June - Conf. 11057, 11059, 11062
Setup—Wednesday, 10:00 hrs; Break-down—Wednesday, 17:00 hrs

Thursday 29 June - Conf. 10334
Setup—Thursday, 9:30 hrs; Break-down—Thursday, 16:30 hrs
Poster presenters may post their poster papers starting at the announced times for each conference, and present them during their respective conference Poster Session. Any papers left on the boards following the poster removal time will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of the Poster Session. Poster authors should be at their papers during their assigned times to answer questions from attendees.

AR VR MR Headset Demos
Try out the latest virtual reality hardware while at the conference.
Monday 24 June 2019 · 10:00 - 17:00
Tuesday 25 June 2019 · 9:00 - 17:00
Wednesday 26 June 2019 · 9:00 - 17:00
Learn more online under Special Events!
Get focused, effective training that you can apply directly to your work.

TO REGISTER FOR COURSES

Registration for these Courses is being done through SPIE Digital Optical Technologies, also taking place at World of Photonics Congress.
To register for these courses, please visit the website and separate from your Optical Metrology registration, please register for the “course only” option through SPIE Digital Optical Technologies.

COURSE INSTRUCTOR SPOTLIGHT

Bernard Kress
Over the past two decades Bernard Kress has made significant scientific contributions as an engineer, researcher, associate professor, consultant, instructor, and author. He has been instrumental in developing numerous optical sub-systems for consumer electronics and industrial products, generating IP, teaching and transferring technological solutions to industry.

What attendees have said about his courses:
- The instructor is very knowledgeable in AR/VR and presented an extremely interesting course.
- Excellent course. Bernard has a lot of energy and enthusiasm!!
- Excellent presentation. Very thorough and generous at answering questions.

Optical Technologies and Architectures for Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) Head-Mounted Displays (HMDs)

SC1218

Course Level: Intermediate
CEU: 0.4  €280 Members | €165 Student Members | €330 Non-Members
Sunday 8:30 to 12:30

The course provides an extensive overview of the current product offerings as well as the various optical architectures, as in:
- Smart Glasses and Digital Eyewear
- Augmented Reality (AR) and Mixed Reality (MR) headsets
- Virtual Reality (VR) and Merged Reality headsets

The course describes the optical backbone of existing systems, as well as the various optical building blocks, as in:
- Display engines including microdisplay panel architectures, scanner based light engines and phase panels
- Optical combiners integrated either in free space or waveguide platforms
- Depth mapping sensors either through structured illumination or time of flight
- Head tracking, gaze tracking and gesture sensors

Emphasis is set on the design and fabrication techniques to provide the best display immersion and comfort:
- Wearable comfort (size/ weight, CG)
- Visual comfort (eye box size and IPD coverage, angular resolution, FOV, distortion, dynamic range, contrast,...)
- Passive and active foveated rendering and peripheral displays
- VAC (Vergence Accommodation Conflict) mitigation through varifocal, multifocal, spatial and temporal light fields and per pixel depth holographic displays.

The features and limitations of current optical technologies addressing such specifications are reviewed.
In order to design next generation head worn systems, one needs to fully understand the specific requirements and limitations of the human visual system, and design the optics and the optical architecture around such. Challenges for next generation systems are reviewed, where immersion and comfort need to be addressed along with consumer level costs requirements.

Finally, the course reviews market analysts’ expectations, projected over the next 5 to 10 years, and lists the main actors (major product design companies, start-ups and optical building block vendors, and current investment rounds in such). Demonstration of some of the state of the art AR, MR and VR headsets will be offered to attendees at the end of the course.

LEARNING OUTCOMES
This course will enable you to:
- Identify the various consumer and enterprise head worn systems available in industry today, defined as smart glasses, digital eyewear, AR, MR and VR HMDs, and understand their fundamental differences and specifics.
- Explain the current optical technologies and sub-systems, their advantages and limitations.
- Describe the relations and implications between FOV, resolution, MTF, eyebox size, effective IPD coverage, screen door effects, pupil swim, vergence/accommodation disparity, foveated rendering, peripheral displays, the human visual system, its specifics and limitations.
- Identify the limitations of current optical architectures and how some can be overcome by designing the optics around the human visual system.
- Describe the feature and functionality requirement for next generation systems, and review the key enabling technologies.
- Examine the current AR/VR market status as well as the upcoming market expectations for each field (smart glasses, AR and VR).

INTENDED AUDIENCE
Optical, mechanical and electrical engineers involved in the design and development of Enterprise and Consumer HMDs in all their declination. Project and product managers involved in defining current and next generation HMD products, technology product roadmaps and next generation optical sub-systems.

INSTRUCTOR
Bernard Kress
Over the past two decades, Bernard Kress has made significant scientific contributions as an engineer, researcher, associate professor, consultant, instructor, and author. He has been instrumental in developing numerous optical sub-systems for consumer and industrial products, generating IP, teaching and transferring technological solutions to industry. Application sectors include laser materials processing, optical anti-counterfeiting, biotech sensors, optical telecom devices, optical data storage, optical computing, optical motion sensors, digital displays systems, and eventually HUD and HMD displays (smart glasses, AR/VR/MR). Bernard has been specifically involved in the field of micro-optics, wafer scale optics, holography and nano-photonics. He has published half a dozen books and has more than 35 patents granted. He is a short course instructor for the SPIE and has been chair of various SPIE conferences. He is an SPIE fellow since 2013 and has been elected to the board of Directors of SPIE (2017-19). Bernard has joined Google [X] Labs. in 2011 as the Principal Optical Architect on the Google Glass project, and is since 2015 the Partner Optical Architect at Microsoft Corp. on the Hololens project.

Design, modeling and fabrication techniques for micro-optics: applications to display, imaging, sensing, and metrology

SC1217
Course Level: Intermediate
CEU: 0.4 €280 Members | €165 Student Members | €330 Non-Members
Sunday 13:30 to 17:30

This course provides an overview of the various design and fabrication techniques available to the optical engineer for micro / nano optics, diffractive optics and holographic optics. Emphasis is put on DFM (Design For Manufacturing) for wafer scale fabrication, Diamond Turning Machining (DTM) and holographic exposure. The course shows how design techniques can be tailored to address specific fabrication techniques’ requirements and production equipment constraints. The course will also address various current application fields such as display, imaging, sensing and metrology.

The course is built around 4 points: (1) design, (2) modeling, (3) fabrication/mass production and (4) application fields.

We will also review in details the basic micro-optics building blocks and the overall architecture of the iPhone X IR human face sensor.

1) The course will review various design techniques used in standard optical CAD tools such as Zemax and CodeV to design Diffractive Optical Elements (DOEs), Micro-Lens Arrays (MLAs), hybrid optics and refractive micro-optics, Holographic Optical Element (HOE), as well as the various numerical design techniques for Computer Generated Holograms (CGHs).

2) Modeling single micro optics or complex micro-optical systems including MLAs, DOEs, HOEs, CGHs, and other hybrid elements can be a difficult or nearly impossible task when using classical ray tracing algorithms. We will review techniques using physical optics propagation to model not only multiple diffraction effects and their interferences, but also systematic and random fabrication errors, multi-order propagation and other effects which cannot be modeled accurately through ray tracing.

3) Following the design (1) and modeling tasks (2), the optical engineer usually needs to perform a DFM process so that his/her design can be fabricated by the target manufacturing partner/vendor on specific equipment. We will review such DFM for wafer fab via optical lithography (tape-out process), single point diamond turning (SPDT), or holographic optics recording specification. The course also reviews fracturing techniques to produce GDsII layout files for specific lithographic fabrication techniques and manufacturing equipment.

4) In order to point out the potential of such micro-optics for consumer products, this section reviews current application fields for which such elements are providing an especially good match, impossible to implement with traditional optics, such as deep mapping sensing (structured illumination based sensor) and augmented reality display (waveguide grating combiner optics). We will also review applications in high resolution incremental/absolute optical encoders. Design and modeling techniques will be described for such applications fields, and optical hardware sub-system implementations and micro-optics elements will be shown and detailed.
LEARNING OUTCOMES
This course will enable you to:

• review the various micro-optics / diffractive optics design techniques used today in popular optical design software such as Zemax and CodeV
• decide which design software would be best suited for a particular micro-optics design task
• evaluate the various constraints linked to either ray tracing or physical optics propagation techniques, and develop custom numerical propagation algorithms
• model systematic and random fabrication errors, especially for lithographic fabrication
• compare the various constraints linked to mask layout generation for lithographic fabrication (GDSII)
• review the different GDSII fabrication layout file architectures, and how to adapt them to various lithographic fabrication techniques such as the ones described in SC454
• discuss current application fields and products using such optics, as in Augmented and Mixed Reality headsets, and high resolution hybrid incremental/absolute diffractive optical encoders.

INTENDED AUDIENCE
Scientists, engineers, technicians, or managers who wish to learn more about how to design, model, fabricate and test micro-optics, diffractive optics and hybrid micro-optics, and how such optics can be integrated effectively in consumer products. Basic knowledge in optics is assumed.

INSTRUCTOR
Bernard Kress
Over the past two decades, Bernard Kress has made significant scientific contributions as an engineer, researcher, associate professor, consultant, instructor, and author. He has been instrumental in developing numerous optical sub-systems for consumer and industrial products, generating IP, teaching and transferring technological solutions to industry. Application sectors include laser materials processing, optical anti-counterfeiting, biotech sensors, optical telecom devices, optical data storage, optical computing, optical motion sensors, digital displays systems, and eventually HUD and HMD displays (smart glasses, AR/MR/VR). Bernard has been specifically involved in the field of micro-optics, wafer scale optics, holography and nanophotonics. He has published half a dozen books and has more than 35 patents granted. He is a short course instructor for the SPIE and has been chair of various SPIE conferences. He is an SPIE fellow since 2013 and has been elected to the board of Directors of SPIE (2017-19). Bernard has joined Google [X] Labs. in 2011 as the Principal Optical Architect on the Google Glass project, and is since 2015 the Partner Optical Architect at Microsoft Corp. on the Hololens project.

An Introduction to Deep Learning

SC1275

Course Level: Introductory
CEU: 0.4  €280 Members | €165 Student Members | €330 Non-Members
Sunday 13:30 to 17:30

This course explains basic principles and applications of deep learning. In the first half the principles and history of deep learning and neural networks are explained, followed by many examples of applications of deep neural networks from image classification to deep fakes. In the second half of the course we will build our own basic networks using Google Collaboratory notebooks and will examine some more advanced options such as data augmentation and transfer learning. Anyone who wants to learn more about what deep learning is and how it can be used will benefit from this course.

LEARNING OUTCOMES
This course will enable you to:

• list the basic types of deep learning networks
• list the basic uses that deep networks are currently used for
• list the advantages and disadvantages of using neural networks
• construct a simple neural network using python
• use data augmentation to decrease the amount of data needed for training a neural network
• use transfer learning to make use of pre trained models to train on less data

INTENDED AUDIENCE
Scientists, engineers, technicians, or managers who wish to learn more about deep learning and its applications. Undergraduate training in engineering or science is assumed. To join in the second half of the course a laptop with Chrome browser, a Google account, and some rudimentary python knowledge is needed.

INSTRUCTOR
Maarten Kruithof
has worked at TNO in the computer vision group since 2008 and primarily in neural networks and deep learning since 2015. He currently leads a group that applies deep neural network technology to real world problems such as transport and mobility, health care, and industrial and infrastructure inspection. Together with his colleagues, he developed an introductory course on deep learning to teach the basic principles of deep neural networks to new employees, and teaches this course in and outside of TNO. Attendees will need their laptop with Chrome browser and a Google account.
Optical Measurement Systems for Industrial Inspection XI

Conference Chair: Peter Lehmann, Univ. Kassel (Germany)
Conference Co-Chairs: Wolfgang Osten, Univ. Stuttgart (Germany); Armando Albertazzi Gonçalves Jr., Univ. Federal de Santa Catarina (Brazil)
Programme Committee: Oleg V. Angelsky, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine); Anand Krishna Asundi, Nanyang Technological Univ. (Singapore); Partha P. Banerjee, Univ. of Dayton (USA); Ralf B. Bergmann, Bremer Institut für angewandte Strahltechnik GmbH (Germany); Harald Boss, Physikalisch-Technische Bundesanstalt (Germany); Jan Burke, Fraunhofer-Institut für Opttronik, Systemtechnik und Bildauswertung (Germany); Chau-Jern Cheng, National Taiwan Normal Univ. (Taiwan); Jürgen W. Czarske, Technische Univ. Dresden (Germany); Peter J. de Groot, Zygo Corporation (USA); Chris J. Evans, The Univ. of North Carolina at Charlotte (USA); Pietro Ferraro, CNR-Institute of Applied Sciences and Intelligent Systems “Eduardo Caianiello” (Italy); Andreas Fischer, Bremer Institut für Messtechnik, Automatisierung und Qualitätswissenschaft (BIMAQ) (Germany); Cosme Furlong, Worcester Polytechnic Institute (USA); Marc P. Georges, Univ. de Liège (Belgium); Christoph Gerecki, FEMTO-ST (France); Sen Han, Univ. of Shanghai for Science and Technology (China); Yoshio Hayasaki, Utsunomiya Univ. (Japan); Xiangqian Jiang, Univ. of Dayton (USA); Tomasz Kozacki, Warsaw Univ. of Technology (Poland); Richard K. Leach, The Univ. of Nottingham (United Kingdom); Eberhard Manske, Technische Univ. Ilmenau (Germany); Andrew John Moore, Heriot-Watt Univ. (United Kingdom); Gunther Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Yukitoshi Otani, Utsunomiya Univ. (Japan); Xiang Peng, Shenzhen Univ. (China); Pascal Picart, Univ. du Maine (France); Christian Rembe, TU Clausthal (Germany); Robert Schmitt, RWTH (Germany); Jörg Seewig, Technische Univ. Kaiserslautern (Germany); Cristina Trillo, Univ. de Vigo (Spain); Rainer Tutsch, Technische Univ. Braunschweig (Germany); Eriko Watanabe, The Univ. of Electro-Communications (Japan); Toyohiko Yatagai, Utsunomiya Univ. (Japan); Changhe Zhou, Shanghai Institute of Optics and Fine Mechanics (China)

Monday June 24

SESSION 1: MON 8:30 TO 10:00

Interferometry I

TBA1 (Invited Paper), Peter J. de Groot, Zygo Corporation (USA) ........... [11056-1]
Bessel fringes modulation determination by directional spatial carrier phase shifting, Adam R. Styk, Helena Dziubeka, Warsaw Univ. of Technology (Poland) ....................... [11056-2]
Comparison of algorithms determining sign of Bessel function in time averaging interferometry, Helena Dziubeka, Adam R. Styk, Institute of Micromechanics and Photonics, Warsaw Univ. of Technology (Poland) ..................... [11056-3]
Analysis of measurement error caused by swing motion for determining physical thickness and group refractive index of large glass panels, Jonghan Jin, Korea Research Institute of Standards and Science (Korea), Republic of, and Univ. of Science and Technology (Korea, Republic of); Jaeseok Bae, Univ. of Science and Technology (Korea, Republic of); Jungmin Kang, Takao Kitayama, Ryo Kozaki, Yu Toyosh, Kota Hashimoto, Osaka Univ. (Japan); Agustinus Winarno, Kyosh Takaamasu, The Univ. of Tokyo (Japan); Kazuya Yamamura, Endo Katsuyoshi, Osaka Univ. (Japan) ........... [11056-4]

PLENARY SESSION: MON 10:00 TO 11:00

World of Photonics Congress-wide Plenary Session

Karsten Danzmann, Max Planck Institute for Gravitational Physics and Leibniz Univ. Hannover (Germany)

SESSION 2: MON 11:20 TO 12:40

Digital Holography

Digital holographic imaging for optical inspection in learning-based pattern classification, Han-Yen Tu, Kuang-Chieh Chang Chien, Chinese Culture Univ. (Taiwan); Chau-Jerm Cheng, National Taiwan Normal Univ. (Taiwan) ............ [11056-5]
High NA lensless coherent imager as a building block for a synthetic aperture interferometry array, Jorge Garcia Armenta, Pablo D. Ruiz, Charles R. Coggins, Ian S. Park, Robert Middleton, Nikolay Nikolaev, Jeremy Coupland, Loughborough Univ. (United Kingdom) ................... [11056-6]
Compact dual-wavelength digital holography using VCSEL technology, Daniel Claus, Igor Alekseenko, Raimund Hibat, Institut für Lasertechnologie in der Medizin und Messtechnik, Univ. Ulm (Germany) ........ [11056-7]
Digital holography for quantification of semiconductor structures, Viamn Trivedi, Nimet Patel, HICS Co. (Korea, Republic of); Mugdha Joglekar, Vani Chharianwal, The Maharaja Sayajirao Univ. of Baroda (India); Seonho Lee, HICS Co. (Korea, Republic of); Arun Anand, The Maharaja Sayajirao Univ. of Baroda (India) ................................ [11056-8]
Lunch Break ................................. [11056-9]

SESSION 3: MON 13:45 TO 15:45

Interferometry II

Topography measurement of glass disk substrates with subnanometer resolution, Klaus Freischmidt, Chrs LCG (USA) .................... [11056-10]
Three-dimensional shape measurement of fine structure by detecting phase distribution of only zeroth order diffraction beam based on speckle interferometry, Yasuhiko Ara, Kansai Univ. (Japan) .... [11056-11]
Two-dimensional remote interferometric stage encoder through a single access port using range-resolved interferometry, Kieran B. Wiseman, Thomas Kissinger, Ralph P. Tatam, Cranfield Univ. (United Kingdom) ................................... [11056-12]
Absolute distance measurement of optical path length of non-contact three-dimensional profiler based on normal vector tracing method by tandem light interferometer, Jungmin Kang, Tako Kitayama, Ryo Kozaki, Yu Toyosh, Kota Hashimoto, Osaka Univ. (Japan); Agustinus Winarno, Kyosh Takaamasu, The Univ. of Tokyo (Japan); Kazuya Yamamura, Endo Katsuyoshi, Osaka Univ. (Japan) ........ [11056-13]
Highly accurate displacement measurements using virtually-balanced differential interferometry, Thomas K. Kissingler, Ralph P. Tatam, Cranfield Univ. (United Kingdom) .................... [11056-14]
Demodulation for sinusoidal frequency/phase modulation interferometer using artificial harmonic series signal and phase lock loop, Masato Aketagawa, Masato Higuchi, Dong Wei, Nagaoka Univ. of Technology (Japan) ................ [11056-15]

SESSION 4: MON 16:15 TO 17:55

Speckle and Shearing Interferometry

Thermography-inspired processing strategy applied on speckography towards nondestructive inspection of composites, Muriel Kirkove, Pascal Blain, Jean-François VandenBriel, Marc Georges, Liège Univ. (Belgium) .................. [11056-16]
Out-of-plane displacement measurements by an instantaneous and multidirectional shearing interferometry system, Estiven Sánchez Barrera, Univ. Federal de Santa Catarina (Brazil); Analucia Vieira Fantin, Daniel P. Willemsen, Univ. do Estado de Santa Catarina (Brazil); Mauro E. Benedet, Armando Albertazzi Gonçalves Jr., Univ. Federal de Santa Catarina (Brazil) ....... [11056-17]
Shearography inspection of monolithic CFRP composites: finite element modeling approach for assessing an adequate strategy of artificial defects representing delamination, Jean-François VandenBriel, Pascal Blain, Cl. Spatial de Liège (Belgium); Cedric Lequesne, Hu Xiong, Samtech (Belgium); Marc Georges, Cl. Spatial de Liège (Belgium) .................. [11056-18]
Extreme shearography: high-speed shearography instrument for in-plane surface strain measurements during an impact event, Andrei G. Anisimov, Roger M. Groves, Technische Univ. Delft (Netherlands) ................ [11056-19]
Absolute angle measurement using dual-wavelength laser speckle for robotic manufacturing, Sam J. Gibson, Thomas O. H. Chatterrell, Ralph P. Tatam, Cranfield Univ. (United Kingdom) ........ [11056-20]
World of Photonics Congress: Nobel Plenary Session
Passion for Extreme Light
Gerard Mourou, École Polytechnique (France);
2018 Physics Nobel Prize Laureate
See details page 4.

TUESDAY 25 JUNE
SESSION 5 ............................. TUE 8:30 TO 10:00
Topography Sensors and Measuring Systems
Scale scanning subnanometer metrology up to ten decades (Invited Paper), Eberhard Manske, Thomas Fröhlich, Roland Füssl, Rostyslaw Mastylo, Ulrike Blumröder, Technische Univ. Ilmenau (Germany); Paul Köchert, Physikalisch-Technische Bundesanstalt (Germany); Olli Birli, Ingo Ortepf, Technische Univ. Ilmenau (Germany); Christof Pruss, Univ. Stuttgart (Germany) [11056-20]
A highly miniaturized endoscopic point distance sensor, Korbinian Prause, Michael Layh, Hochschule Kempten (Germany); Alois Herkommer, Univ. Stuttgart (Germany); Bernd Pinzer, Hochschule Kempten (Germany) [11056-21]
Evaluation of the performance of a novel high speed focal distance-modulated fibre coupled confocal sensor, Andreas Grischk, Janik Schaudt, Tino Hausotte, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) [11056-22]
Roundness measurement by employing laser Doppler distance sensor and error separation techniques, Shengyu Shi, South China Univ. of Technology (China) and TU Dresden (Germany); Hao Zhang, TU Dresden (Germany); Jingping Qu, Gang Jin, South China Univ. of Technology (China); Robert Kuschmierz, Jürgen Czarske, TU Dresden (Germany) [11056-23]

SESSION 6 ............................ TUE 10:30 TO 12:00
Resolution Enhancement Techniques
Advanced methods for optical nanometry (Invited Paper), Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany). [11056-24]
Light-sample interaction in microscope enhanced 2D super-resolution imaging, Göran Mäconi, Anton Novik, Edward Häggström, Ivan Kassamakov, Göran Häggström, Univ. of Helsinki (Finland) [11056-25]
Microsphere-assisted imaging of subdiffraction-limited features, Stéphane Perrin, Sébastien Marbach, Paul Montgomery, Manuel Fluri, Sylvain Lecler, Lab. des sciences de l’Ingenieur, de l’Informatique et de l’Imagerie (France) [11056-26]
Label-free 3D super-resolution microscope, Ivan Kassamakov, Göran Mäconi, Edward Häggström, Ivan Kassamakov, Göran Häggström, Univ. of Helsinki (Finland) [11056-27]
Lunch Break ................................... Tue 12:00 to 13:00

POSTERS-TUESDAY .................... TUE 13:00 TO 14:20
Conference attendees are invited to attend the Optical Metrology Poster Session 1 on Tuesday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 13:00 through 14:20 hrs on Thursday. Poster authors, view poster presentation guidelines and set-up instructions on page 6, and at http://spie.org/sep513.xml. (Follow the Special Events link)
Wavelength-switchable Fizeau interferometry and its applications, Shijie Liu, Shanghai Institute of Optics and Fine Mechanics (China) [11056-75]
Light field three-dimensional measurement, Zewei Cai, Xiaoli Liu, Shenzhen Univ. (China); Giancarlo Pedrini, Wolfgang Osten, Univ. Stuttgart (Germany); Xiang Peng, Shenzhen Univ. (China) [11056-76]
Measurement of wavefront curvature using computer-generated Fourier holograms, George Krasin, Michael Kovalov, Sergey Odinokov, Nikita Stsepuro, Bauman Moscow State Technical Univ. (Russian Federation); Yury Glukhov, ELTA, Ltd. (Russian Federation). [11056-77]
Physical-optics investigation of light coupling into fiber and micro-optical sensors, Huying Zhang, Friedrich-Schiller-Univ. Jena (Germany); Zhiyong Zheng, LightTrans International UK (Germany); Wenxun Wang, Friedrich-Schiller-Univ. Jena (Germany); Christian Heilmann, Wyrowski Photonics UK (Germany); Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany) [11056-78]
Design and analysis of stress relieving and metrology support system for TMT primary mirror segments, Alikhan Basheer, S. Samim, Indian Institute of Astrophysics (India); Virendra Vignesh, Indian Institute of Astrophysics (India) and CHRIST (Deemed to be Univ.) (India); Janani Varadachari, Viswanatha Narasimha, G.C. Anupama, Indian Institute of Astrophysics (India) [11056-79]
Surface roughness measurement accuracy analysis of grinded silicon wafer by white light scanning interferometry (WLSI), Linjie Zhao, Ping Zhou, Ying Yan, Qian Bai, YiQI Wang, Dongming Guo, Dalian Univ. of Technology (China) [11056-80]
Nondestructive and real-time optical inspection for lens size using swept source optical coherence topography, Pingsing Jia, Xi’an Jiaotong Univ. (China) [11056-81]
Stability-enhanced dual-wavelength demodulation for MEMS-based FP interferometric acoustics sensors, Xi Xia, National Univ. of Singapore (Singapore); Yu Xin, National Univ. of Defense Technology (China) [11056-82]
Optical form measurement system using a line-scan interferometer and distance measuring interferometers for run-out compensation of the rotational object stage, Joerg Riebelung, Univ. Kassel (Germany); Gerd Ehret, Physikalisch-Technische Bundesanstalt (Germany); Peter Lehmann, Univ. Kassel (Germany) [11056-83]
Dynamic speckle inspection with raw data compression, Elena V. Stoykova, Branimir Ivanov, Institute of Optical Materials and Technologies (Bulgaria); Kwan-Jung Oh, Joong Ki Park, Electronics and Telecommunications Research Institute (Korea, Republic of) [11056-84]
Study of the errors of stochastic optical-electronic system for railroad track position, Ngoc Tuan Trinh, Ivan S. Nekrylov, Alexander Timofeev, ITMO Univ. (Russian Federation) [11056-85]
Motionless and fast measurement technique for obtaining the diffraction efficiencies of a grating, Shenghao Wang, Shijie Liu, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China) [11056-86]
Influence of test bench parameters on determination of CMOS-cameras features, Ba Minh Dinh, Valery V. Korolet, Sergey N. Yarshhev, Anton A. Maravea, Ivan S. Nekrylov, ITMO Univ. (Russian Federation) [11056-87]
Near-real-time digital holographic imaging on conventional central processing unit, Vira R. Besaga, Anton V. Saelchlikov, Nils C. Gerhardt, Andreas Oestendorf, Martin R. Hofmann, Phys. Universit (Germany) [11056-88]
Optic-electronic multimatrix system for measuring the positions of the reflecting panels on the main mirror of the large radio telescope, Igor A. Konakhin, Minhye Hong, ITMO Univ. (Russian Federation) [11056-89]
Design and fabrication of opto-mechanical micropolymeric cantilever-based optical fiber sensor, Omid Reza Ranjbar Naeini, Ali Barandak, Mohammad Reza Salehi Moghadam, Hamid Latifi, Shahid Beheshti Univ. (Iran, Islamic Republic of) [11056-90]
Investigation of the device for limiting the turn of the converter case, Alexander Semenov, ITMO Univ. (Russian Federation) [11056-91]
Bright high harmonic generation around 30 nm and 10 nm for seeding full-aperture XFEL. V. E. Galaktionov, Univ. of Science and Tech Mechanics (China) [11056-92]
Impact damage segmentation in CFRP plates using PCA and MEEMD methods in active lock-in thermography phase images, Bernardo Cassimiro Fonseca de Oliveira, Herbet Satchile Barbosa, Ernesto Fonseca de Oliveira, Armando Albertazzi Gonçalves Jr., Univ. Federal de Santa Catarina (Brazil); Robert H. Schmitt, RWTH Aachen Univ. (Germany) [11056-93]
Turning a machine vision camera into a high precision position and angle encoder: nanoGPS-Oxy, Oliver Acher, Than Liem Nguyen, HORIBA FRANCE SAS (France) [11056-94]
Improving the accuracy of detail positioning using machine vision methods and the use of preprocessing algorithms, Evgeny A. Semenishchev, Vlachaslov Voronin, Moscow State Univ. of Technology "Stankin“ (Russian Federation); Soa Agaian, College of State Island, The City Univ. of New York (USA) [11056-95]
Nonlinear noise analysis in a long-haul fiber-optic sensing system, Chunyan Cao, Hu Chen, National Univ. of Defense Technology (China); Zaibo Liu, Sichuan Univ. (China); Qiayang Tang, Shuidong Xiong, Weihua Zhang, Changxiang Linghu, National Univ. of Defense Technology (China) [11056-96]
Wafer-level inspection platform on high-volume photonic integrated circuits for drastic reduction of testing time, Toru Miura, NTT Device Technology Labs. (Japan); Yoshio Maeda, Shinji Matsuo, Hiroki Fukuda, Nippon Telegraph and Telephone Corp. (Japan) [11056-97]
A signal detection method with large dynamic range based on combined 3-D fiber interferometer, Shugong Xiao, Xiujian Wang, Qingkai Cao, Qiong Yao, Yongming Hu, Shuidong Xiong, National Univ. of Defense Technology (China) [11056-98]
Accounting for multiple scattering in holographic tomography by applying propagation algorithm based on high-order Born approach, Juliana Winnik, Tomasz Kozacki, Warsaw Univ. of Technology (Poland) [11056-99]
Multispectral image fusion methods for three-dimensional object reconstruction, Guilherme Canarin Marcellino, Bernardo Cassimiro Fonseca de Oliveira, Tiago Rezende da Costa, Nataly de Carvalho Gonçalves Jr., Univ. Federal de Santa Catarina (Brazil) ........... [11056-100]

Study of the non-uniformity of sensitivity distributed over photomultiplier active area influence on the operation of the photometric module for separate X-ray luminous diamond, Sergey V. Mednikov, Valery V. Korotayev, Timofeev N. Alexander, ITMO Univ. (Russian Federation) .......... [11056-101]

Optimization of a geometrical calibration procedure for stereoscopic endoscopy systems, Alexander S. Machikhin, Alexey Gorevoy, Demid Khokhlov, Alexander Naumov, Scientific and Technological Ctr. of Unique Instrumentation RAS (Russian Federation) ........... [11056-102]

Opto-electronic system for measurement the positions of Millimeter’s space telescope segments of main mirror, Gleb Vasilev, Igor A. Konyakin, ITMO Univ. (Russian Federation). ................ [11056-103]

Measurement and calculation of solid-state matrix photomultiplier’s polarization parameters, Daria Drozdova, Anastasiya Lobanova, Victoria Rydova, ITMO Univ. (Russian Federation). ................ [11056-104]

Optical laser reflection borometry, Jan Hošek, Czech Technical Univ. in Prague (Czech Republic). ................ [11056-105]

Simultaneous 3D displacements measurement using an integrated dual-observation digital speckle pattern interferometer, Guoqing Gu, Chengchun Gu, Fei Zhang, Bing Xu, Yancheng Institute of Technology (China) [11056-106]


Spectrally-resolved white light phase-shifted interferometry for 3D measurements of multilayer films, Young-Sik Chin, Korea Research Institute of Standards and Science (Korea, Republic of). ................ [11056-108]

Optical methods of diagnostics of processes of the nickel alloy powder consolidation in the layer-by-layer laser melting technology, Yuri N. Zavalov, Alexander V. Dubrov, Vladimir D. Dubrov, Institute of Laser and Information Technologies of the RAS (Russian Federation) ........... [11056-109]

Optical method of on-line temperature monitoring on the melt surface in laser metal deposition technology, Yuri N. Zavalov, Alexander V. Dubrov, Vladimir D. Dubrov, Institute of Laser and Information Technologies of the RAS (Russian Federation) ........... [11056-110]

Optical diagnostics of paraxial focal length of lens using Strehl definition, Mourad Tounsi, Abdelkrim Nassim, Univ. Chouaïb Doukkali (Morocco); Fernando Mendoza-Santoyo, Jurgen Schäfer, Technische Univ. München (Germany) ................ [11056-111]

3D shape measurement of specular objects by phase measurement deflectometry with polarizers, Juan Zhao, Zhan Song, Felfu Gu, Shenzhen Institutes of Advanced Technology (China). ................ [11056-112]

Original methods of aberration correction in optical systems of autocollimators, Dmitrii I. Egovor, ITMO Univ. (Russian Federation)[11056-113]

Micro- and nano-fabrication technologies using the NPMMP, Laura Weidenfeller, Johannes Kirchner, Martin R. Hofmann, Shadritha Supreeta, Ivo W. Rangelow, Stefan Sinzinger, Eberhard Manske, Technische Univ. Ilmenau (Germany). ................ [11056-114]

Removal of monotonically increasing or decreasing phase ambiguity in retrieved phase obtained by Riesz transform method in digital interferometric techniques, Manoj Kumar, Kobe Univ. (Japan); Yassine Tounsi, Abdekkrim Nassim, Univ. Chouaib Doukkali (Morocco); Fernando Mendoza-Santoyo, Centro de Investigaciones en Optica, A.C. (Mexico). ................ [11056-115]

Near-field light source calibration method for aircraft engine blade 3D measurement application, Long Ma, Civil Aviation Univ. of China (China). ................ [11056-116]

Optoelectronic autocollimator as a tool for monitoring load carrying structure, Anton A. Nogin, Igor A. Konyakin, Aigamyn M. Sakhariyanova, Institute of Laser and Technical Physics of the RAS (Russian Federation) ........... [11056-117]

Automatic control system of combustion processes based on the methods of contactless optical spectroscopy, Mikhail A. Vaganov, Vasily I. Kazakov, Oleg D. Moskalev, Small-angle Scattering Division, Russian State Hydrometeorological Institution (Russian Federation) .......... [11056-118]

High-accuracy piston error measurement with a large capture range based on coherent diffraction, Weirui Zhao, Lu Zhang, Yuejin Zhao, Liquan Dong, Weichao Xia, Shanghai Institute of Optics and Fine Mechanics (China). ................ [11056-119]

Analysis of the method errors of monitoring the parameters of the sub monuments layer roughness of an optical component’s surface based on scattered laser radiation measurement, Dmitry Denisov, Bauman Moscow State Technical Univ. (Russian Federation); Magomed A. Abdulkadyrov, Peter Luy, “Lytkarino Optical Glass Factory”, JSC (Russian Federation); Nikolay Baryshnikov, Tamara Kuznetsova, Bauman Moscow State Technical Univ., (Russian Federation) ........... [11056-120]

Adaptive optics test bench for predictive wavefront correction, Lidia A. Bobasova, V. E. Zuev Institute of Atmospheric Optics (Russian Federation); Aleksey N. Gritsuta, V. P. Baranauski, National Academy of Sciences of Belarus (Belarus); Tomask State Univ. (Russian Federation); Vitaly V. Lavrinov, Vladimir P. Lukin, Anton A. Selin, Egor L. Soin, V. E. Zuev Institute of Atmospheric Optics (Russian Federation) ........... [11056-121]

Reliability results of a fully automated robust x-y stage measurement unit for precise light distribution measurements, Stefan Reichel, Daniel Aichert, Thomas Schaeuffele, (Germany); Harum, Hamza Soeemelmez, Daniel Stadler, Hochschule Pforzheim (Germany). ................ [11056-122]

Noise reduction of digital holography using speckle correlation properties in longitudinal direction, Hideki Funamizu, Muroran Institute of Technology (Japan); Jun Uozumi, Hokkai-Gakuen Univ. (Japan); Yoshihisa Azu, Muroran Institute of Technology (Japan) ........... [11056-123]

Characterization of thermal absorption and nonlinear absorption in KDGP crystals with different orientations, Xiaocang Peng, Yuan’an Zhao, Dawei Li, Guohang Hu, Xiaofeng Liu, Ziyuan Xu, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China). ................ [11056-124]

High-resolution 3D topography sensors in a multisensor measuring setup, Sebastian Hagemeier, Peter Lehmann, Univ. Kassel (Germany) ........... [11056-125]

Measurement of the refractive index of a transparent film using interferometry, Hyo Jin Lee, Seung Ho Han, Seung Yup An, KMAC (Korea, Republic of) ................ [11056-126]

Multi degree-of-freedom position sensing by combination of laser speckle correlation and range-relationship interferometry, Young-Sik Chin, Daria Drozdova, Anastasiya Lobanova, Victoria Rydova, ITMO Univ. (Russian Federation) ........... [11056-127]

Measuring method and standard system for retroreflective traffic marking’s photometric characteristic, Huayang He, Yishu Zhou, Jinning Zhang, Jinjin Cao, Zhehai Li, Wenyi Xu, Research Institute of Highway Ministry of Transport (China) ................ [11056-128]

Automatic and accurate full-view registration method for 3D scanning system, Pei Xu, Guilin Univ. of Electronic Technology (China); Felfui Gu, Zhan Song, Yuan Zhao, Shenzhen Institutes of Advanced Technology (China); Jun Li, School of Electronic Engineering and Automation (China) ........... [11056-129]

3D shape measurement in the presence interferences by light stripe triangulation with additional geometric constraints, Yang Xu, Huijie Zhao, Hongzhi Jiang, Yunlan Wang, Xudong Li, Belang Univ. (China). ................ [11056-130]

Analysis of subpixel laser spot detection in laser triangulation systems, Patrick Kienle, Elif Nallar, Michael H. Köhler, Martin Jakobi, Alexander W. Koch, Technische Univ. München (Germany) ........... [11056-131]

Digital holographic microscopy for thickness characterization using synthesized partially coherent holograms, Marta Mikula, Juan Martinez-Caravaca, Juliariki Wenz, Tomasz Kozat, Warsaw Univ. of Technology (Poland) .... [11056-132]

Nonlocal means variants filtering methods for speckle noise reduction in digital speckle pattern interferometric fringes, Yassine Tounsi, Univ. Chouaib Doukkali (Morocco); Manoj Kumar, Kobe Univ. (Japan); Abdelkrim Nassim, Univ. Chouaib Doukkali (Morocco); Fernando Mendoza-Santoyo, Centro de Investigaciones en Optica, A.C. (Mexico). ................ [11056-133]

Polarization analysis of the object wave using FMCW digital holography, Masayuki Yokota, Shimane Univ. (Japan) ........... [11056-134]

A hybrid method for velocity field of fluid flow estimation based on optical flow, Grzegorz Gliomb, Grzegorz Swinicka, Wroclaw Univ. of Science and Technology (Poland) ........... [11056-135]

Interferometer for large convex optical aspheric surfaces testing, Alexandra E. Gavina, Scientific and Technological Ctr. for Unique Instrumentation (Russian Federation); Vladislav I. Batabei, Scientific and Technological Ctr. of Unique Instrumentation RAS (Russian Federation) and Bauman Moscow State Technical Univ. (Russian Federation); Denis A. Novikov, All-Russian Scientific Research Institute for Optical & Physical Measurements (Russian Federation); Maria V. Sergeeva, Scientific and Technological Ctr. of Unique Instrumentation RAS (Russian Federation) ........... [11056-136]

A demodulation method with enhanced stability for phase-generated carrier modulated interferometric optical fiber acoustic sensors, Qingkai Hou, Fuyin Wang, Qiong Yao, Shuqiong Xiong, National Univ. of Defense Technology (China) ........... [11056-137]

Determination of paraxial focal length of lens using Streifh definition measurement, Antonin Mikic, Jiri Novak, Pavel Novak, Petr Pokorny, Filip Smekal, Czech Technical Univ. in Prague (Czech Republic) ........... [11056-138]

Contactless optical spectroscopy methods in the tasks of monitoring physical and technological processes in extreme conditions, Vasily I. Kazakov, Mikhail A. Vaganov, Saint-Petersburg State Univ. of Aerospace Instrumentation (Russian Federation) ........... [11056-139]

Measurement of the refractive index of a transparent film using interferometry, Gueorgui Stefanov, Iana Kirilova, IASIS Ltd., Bulgaria. ................ [11056-140]
Experimental light scattering by optical fibers: system design and testing.
Grzegorz Swiniak, Grzegorz Giomb, Wroclaw University of Science and Technology (Poland); 
[11056-150]

Alignment analysis and verification plan of freeform mirrors in linear
astigmatism-free three-mirror system (LAF-TMS).
Yunjun Kim, Jiun Kim, Jeong-Yeo Han, Korea Astronomy and Space Science Institute (Korea, Republic of); Woonjoon Park, Kyung Hee University (Korea, Republic of); Seunghyuk Chang, C. Tr. for Integrated Smart Sensors (Korea, Republic of); Byungjoon Jeong, Hwan-Jun Choi, Geon-Hee Kim, Korea Basic Science Institute (Korea, Republic of).
[11056-142]

Direct monochromatic optical control system of the thickness of thin-film interference coatings applied in vacuum.
Vladislav Druzhin, Bauman Moscow State Technical University (Russian Federation); Oleg Prosovsky, Aleksandr Budnevich, Technologiya (Russian Federation).
[11056-143]

Development of absolute angular encoder design on coordinate
photon-detector sensor.
R. S. Povarov, Sergey Mitrofanov, ITMM (Russian Federation).
[11056-144]

Adaptive windowed Fourier transform filtering method for speckle fringe patterns.
Jing Liu, Weinan Normal University (China).
[11056-145]

Coordinate mapping of the primary mirror vertex in a space telescope by
using a CGH and theodolites.
Hagyong Khim, Ho-Soon Yang, Ji-Won Kang, Korea Research Institute of Standards and Science (Korea, Republic of).
[11056-146]

A new method for measuring target reflectivity.
Hongfei Wu, Huazhong University of Science and Technology (China).
[11056-147]

Highly repetitive low-coherence interferometry with time-stretch
technique.
Masaharu Hoshikawa, The Graduate School for the Creation of New Photonics Industries (Japan).
[11056-148]

Contrast determination in phase-shifting algorithms for interferograms
with arbitrary steps and additive noise.
Gaston A. Ayubi, Universidad de la Republica Uruguay (Uruguay).
[11056-149]

Environmental impact analysis on accuracy of reflector photometric
performance measurement.
Yishu Zhou, Jinming Zhang, Huayang He, Jinjin Cao, Research Institute of Highway Ministry of Transport (China).
[11056-150]

Two-shot fringe pattern phase demodulation using the extreme value of
interference with Hilbert-Huang per-filtering.
Hangyang Zhang, Zixin Zhao, Hong Zhao, Xi’an Jiaotong University (China).
[11056-151]

High-resolution measurement of freeform wavefront by using self-imaging
based sensor.
Lalit Mohan Pant, Instrument Design and Development Center (India) and Indian Institute of Technology Delhi (India); Kamal K. Pant, Dale Ramu Burada, Instrument Design and Development Center (India); Amitava Ghosh, Instruments Research & Development Establishment (India); Gufran Saeed Khan, Chandra Shaliker, Instrument Design and Development Center (India).
[11056-152]

Development of an illumination module for stroboscopic phase-shift
interferometry on MEMS devices.
Luz Guilherme de Medeiros Ventura, Steffen Wolschke, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); Christoph Skupsch, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) and Robert Bosch Kft. (Hungary); Dirk Berndt, Fraunhofer-Institut für Photonische Mikrosysteme (Germany).
[11056-153]

Sensitivity of an image-plane digital holography interferometer for the
measurement of pile-up.
Matias R. Viotti, Armando Acucalves, Jucar, Universidade Federal de Santa Catarina (Brazil); Denis Boing, Rodrigo Bliodom, Centro Un. de Brusque - UNIFEBE (Brazil).
[11056-154]

Measurement system of characteristics of compensation devices by the
autocollimation method.
Valeria Portnova, ITMO University (Russian Federation).
[11056-155]

Freeform optics alignment strategy and its effect on development of
precision freeform optics.
Vinod Mishra, CSIR - Central Scientific Instruments Organisation (India); Dale Ramu Burada, Kamal K. Pant, Indian Institute of Technology Delhi (India); Vinod Karar, CSIR - Central Scientific Instruments Organisation (India); Sunil Jha, Gufran Saeed Khan, Indian Institute of Technology Delhi (India).
[11056-156]

On-machine measurement and evaluation of small scale waviness error
in aspheric parallel grinding.
Lian Zhou, Qiancai Wei, Xinhua Chen, Qinghua Zhang, Jian Wang, Qiao Xu, China Academy of Engineering Physics (China).
[11056-157]

Scale spanning subnanometer metrology up to ten decades.
Eberhard Manske, Thomas Fröhlich, Roland Füssli, Rostyslav Mastyljo, Ulrike Blumröder, Technische Universität, Ilmenau (Germany); Paul Köchert, Physikalisch-Technische Bundesanstalt (Germany); Oliver Birli, Ingo Ortleck, Technische Universität, Ilmenau (Germany); Christof Pruss, Universität Stuttgart (Germany).
[11056-158]

Interferometer for checking the wide-ranged shapes of large optical
components.
Vladislav Druzhin, Bauman Moscow State Technical University (Russian Federation); Vladiy Petrokeev, Lytkarino Optical Glass Factory, JSC (Russian Federation); Daniil T. Purysen, Bauman Moscow State Technical University (Russian Federation); Alexander P. Semenov, Lytkarino Optical Glass Factory, JSC (Russian Federation).
[11056-159]

Application of immersion method for measuring freeform surfaces.
Ksenia Lova, Bauman Moscow State Technical University (Russian Federation) and P. N. Lebedev Physical Institute of the RAS (Russian Federation); Victoria Kaidarakova, Bauman Moscow State Technical University (Russian Federation); Anastasia Perevoznikova, Bauman Moscow State Technical University (Russian Federation) and P. N. Lebedev Physical Institute of the RAS (Russian Federation); Vladislav Druzhin, Bauman Moscow State Technical University (Russian Federation).
[11056-160]

SESSION 7   ....................................... TUE 14:20 TO 15:20
High-speed Techniques

Double pulse LED illumination for phase detection in RGB interferometry.
Markus Schake, Peter Lehmann, Univ. Kassel (Germany).
[11056-28]

Full-field, high-frequency, heterodyne interferometry for dynamic
metrology based on phase detection using a modified time-of-flight
camera (Tatam, B. M. Instrument Design and Development Ctr. (United Kingdom) and Glyndwr Innovations Ltd. (United Kingdom)).
[11056-29]

GPU-based digital image correlation system for real-time strain-controlled
fatigue and strain field measurement.
Andreas Blug, Fraunhofer-Institut für Physikalische Messtechnik (Germany); David J. Regina, Stefan Eckmann, Melanine Stenn, Fraunhofer-Institut für Werkstoffmechanik (Germany); Alexander Berts, Daniel Carl, Fraunhofer-Institut für Physikalische Messtechnik (Germany); Chris Eberl, Fraunhofer-Institut für Werkstoffmechanik (Germany).
[11056-30]

SESSION 8   ....................................... WED 10:00 TO 11:00

3D Microscopy

Active illumination focus variation.
Roger Artigas, Carlos Bermudez, Cristina Caveda, Pol Martínez, Sensof-Tech, S.L. (Spain).
[11056-31]

Optical measurement of ground cylinder lead angle.
Peter J. de Groot, Leslie L. Deck, Michael Schmidt, Zygo Corporation (USA).
[11056-32]

User-oriented evaluation of the metrological characteristics of areal
surface topography measuring instruments.
Matthias Eller, Felix Ströer, Julian Hering, Jörg Seewig, Georg von Freudemann, Technische Universität Kaiserslautern (Germany).
[11056-33]

Correction of surface error occurring in microreliefs characterization
performed with optical profilors.
Jeremy Bigueul, SUSS MicroOptics SA (Switzerland).
[11056-34]

The use of parabolic mirrors in combined low-coherence and confocal
refractive index measurement.
Daniel Francis, Jonathan M. Hallam, Helen D. Ford, Ralph P. Tatam, Cranfield University (United Kingdom).
[11056-35]

Novel quantitative chromatic confocal differential interference contrast
prototype.
Johannes Bektner, National Taiwan Univ. (Taiwan) and Technische Universität Ilmenau (Germany); Hsue-Wen Liu, National Taiwan Univ. (Taiwan); Eberhard Manske, Technische Universität Ilmenau (Germany); Liang-Chia Chen, National Taiwan Univ. (Taiwan).
[11056-36]

SESSION 9   ....................................... WED 08:30 TO 10:00

Structured Illumination Techniques I

Deflectometry (Invited Paper).
Jan Burke, Fraunhofer-Institut für Optonik, Systemtechnik und Bionik, Gomaringen (Germany).
[11056-37]

Hybrid telecentric triangulation sensor system with real-time field-
dependent deconvolution.
Andreas Faulhaber, Univ. Stuttgart (Germany); Marc Grone, Tobias Haist, Wolfgang Osten, Institut für Technische Optik, Univ. Stuttgart (Germany); Yousef Baroud, Sven Simon, Univ. Stuttgart (Germany).
[11056-38]

Structured light sensor with telecentric stereo camera pair for
measurements through vacuum window.
Rüdiger Beermann, Lorenz Quentin, Markus Kämär, Eduard Reithmeier, Institut für Mess- und Regelungstechnik, Leibniz Univ. Hannover (Germany).
[11056-39]

3D shape from thermal patterns: optimization of projection parameters
in simulation and experiment.
Martin Landmann, Stefan Heist, Institut für Angewandte Physik, Friedrich-Schiller-Universität Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany); Peter Kühnstedt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany); Gunther Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany) and Technische Universität Ilmenau (Germany).
[11056-40]

WEDNESDAY 26 JUNE
SESSON 10 ............................ WED 11:30 TO 12:50
Structured Illumination Techniques II
Automatic 2D image calibration of a multisensor fringe measurement system using hexapod positioning, Sebastian Metzner, Tino Hausotte, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) .............................................. [11056-41]
Extrinsic calibration of a 3D sensor based on an array projector and a single camera, Eugene Wong, Institut für Angewandte Physik, Friedrich-Schiller-Univ. Jena (Germany); Stefan Heist, Christian Bräuer-Burchardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany); Holger Babovsky, Richard Kowarschik, Institut für Angewandte Physik, Friedrich-Schiller-Univ. Jena (Germany) .............................................. [11056-42]
3D multispectral imaging system for contamination detection, Chen Zhang, Maik Rosenberger, Technische Univ. Ilmenau (Germany); Gunther Nohra, Technische Univ. Ilmenau (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany) ....................... [11056-43]
Full-field deflectometry for optical characterisation of high-precision mirrors, Philippe Antoine, Arno Bouwer, Luc Boussenairre, LAMBEA-X sa (Belgium); Vincent Moreau, Benoît Borguet, Ksenia Sharshavina, AMOS Ltd. (Belgium) .............................................. [11056-44]
Lunch Break .............................................. Wed 12:50 to 13:50
SESSON 11 ............................ WED 13:50 TO 15:30
Light Scattering Techniques
Heterodyne detection system for coherent Fourier backscattering, Dmytro Kolenov, Roland C. Horsten, Silvania F. Pereira, Technische Univ. Delft (Netherlands). .......................................................... [11056-45]
Determination of optical fiber layer parameters by inverse evaluation of lateral scattering patterns, Gunnar Clausen, Werner Blohnn, Jade Hochschule (Germany) ......................................................... [11056-46]
High-resolution Czerny-Turner scatterometer for BRDF measurements, Felix Koch, Tilman Glaser, Mike Schnabel, Carl Zeiss Jena GmbH (Germany) .......................................................... [11056-47]
Recent development in BSDF metrology on large-scale Lambertian-like diffusers, application to on-board calibration units in space instrumentation, Emmanuel Mazy, Céline Michel, Sara Marcotte, Lionel like diffusers, application to on-board calibration units in space instrumentation, Emmanuel Mazy, Céline Michel, Sara Marcotte, Lionel (Belgium); Vincent Moreau, Benoît Borguet, Ksenia Sharshavina, AMOS Ltd. (Belgium) .............................................. [11056-44]
Lunch Break .............................................. Wed 12:50 to 13:50
SESSON 12 ............................. WED 16:00 TO 18:05
Measurement of Optical Components I: Asphere and Freeform Measurement
Joint Session with EOS
Detailed schedule will be available in late March.
Grazing incidence interferometry for testing rough aspheres, Sergej Rothau, Johannes Schwider, Norbert Lindlein, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Klaus Mantel, Max-Planck-Institut für die Physik des Lichts (Germany) ......................................................... [11056-50]
Tilted wave interferometer in common path configuration: challenges and realization, Rolf Beisswanger, Institut für Technische Optik, Univ. Stuttgart (Germany); Christian Schöber, TU Dresden (Germany); Christof Pruss, Wolfgang Osten, Antonia Harisch, Institut für Technische Optik, Univ. Stuttgart (Germany) ......................................................... [11056-51]
Measurement of mid-spatial frequency errors on freeform optics using deflectometry, Todd F. Blalock, Optimax Systems, Inc. (USA) ......................................................... [11056-52]
Innovative system for automated measurement of the distribution of the length of natural fibres, Stefan J. Rinner, Michael Kahl, NTB Interstaatliche Hochschule für Technik Buchs (Switzerland); Hubert Schmid, IST AG (Switzerland); Carsten Ziolek, NTB Interstaatliche Hochschule für Technik Buchs (Switzerland). ........................................... [11056-67]

Imaging detection and classification of particulate contamination on structured surfaces, Jan Schütz, Alexander Blättermann, Peter Kozlowski, Albrecht Brandenburg, Fraunhofer-Institut für Physikalische Messtechnik (Germany). ........................................... [11056-68]

SESSION 16 ........................... THU 16:00 TO 18:00

Nondestructive Testing and Fault Detection

Development of an experimental setup and a study for the comparison between optical properties and the subjective perception of the quality of display surfaces, Theresia Puder, Fraunhofer-Institut für Werkstoff- und Strahntechnik (Germany); Florian Rudek, Fraunhofer-Institut für Werkstoff- und Strahntechnik (Germany) and Westsächsische Hochschule Zwickau (Germany); Christopher Taudt, Alexander Kabardiadi-Virkovski, Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer-Institut für Werkstoff- und Strahntechnik (Germany). ................. [11056-69]

Diameter quantification of through holes in pipelines hidden by protective layers of composite materials using instantaneous shearography simultaneously in three shearing directions, Armando Albertazzi Gonçalves Jr., Tiago Bortoli, Analucia V. Fantin, Daniel P. Willemann, Mauro E. Benedet, Univ. Federal de Santa Catarina (Brazil). ......................... [11056-70]

Photoacoustic inspection of CFRP using an optical microphone, Janez Rus, Ctr. Baustoffe und Materialprüfung, Technische Univ. München (Germany); Balthasar Fischer, XARION Laser Acoustics GmbH (Austria); Christian U. Grosse, Ctr. Baustoffe und Materialprüfung, Technische Univ. München (Germany). ........................................... [11056-71]

Development of a convolutional autoencoder using deep neuronal networks for defect detection and generating ideal references for cutting edges, Abdullah Karatas, Samuel Schmidt, Dorothea Kölsch, Matthias Eifler, Jörg Seewig, Technische Univ. Kaiserslautern (Germany). ........ [11056-72]

SS-OCT for automated composite manufacturing quality control, Guy Lamouche, National Research Council Canada (Canada); Gil Lund, Fives Lund LLC (USA); Steven Roy, Bruno Gauthier, Marc Palardy-Sim, Maxime Rivard, Christian P adioletou, Jihua Chen, Jean-Pierre Monchalin, Ali Yousefpoor, National Research Council Canada (Canada). ......................... [11056-73]

An automatic visual inspection system to scan outer lenses of automotive rear lamps, Tommaso Fontanot, Univ. degli Studi di Trieste (Italy) and Automotive Lighting Rear Lamps Italia (Italy); Denis Ermacora, Giulio Simonetti, Sebastian Raducci, DataMind S.r.l. (Italy); Erik Vesselli, Univ. degli Studi di Trieste (Italy) and Istituto Officina dei Materiali (Italy); Sara Paroni, Automotive Lighting Rear Lamps Italia (Italy). ........................................... [11056-74]

Modeling Aspects in Optical Metrology VII

Conference Chair: Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany)

Conference Co-Chairs: Karsten Frenner, Institut für Technische Optik (Germany); Richard M. Silver, National Institute of Standards and Technology (USA)

Programme Committee: Markus Bär, Physikalisch-Technische Bundesanstalt (Germany); Jörg Bischoff, Osiris Optical Engineering (Germany); Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik (Germany); Peter Evanschitzky, Fraunhofer-Institut für Integrierte Systeme und Bauelementetektronik IISB (Germany); Liwei Fu, Univ. Stuttgart (Germany); Wolfgang Holzapfel, DR. JOHANNES HEIDENHAIN GmbH (Germany); Norbert Kerwien, Carl Zeiss AG (Germany); Rainer König, Physikalisch-Technische Bundesanstalt (Germany); Stefanie Kroker, Physikalisch-Technische Bundesanstalt (Germany); Johannes Ruoff, Carl Zeiss SMT GmbH (Germany); Thomas Siekue, Physikalisch-Technische Bundesanstalt (Germany); Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany)

MONDAY 24 JUNE

PLENARY SESSION ................ MON 10:00 TO 11:00
World of Photonics Congress-wide Plenary Session
Listening to the universe with gravitational waves
Karsten Danzmann, Max Planck Institute for Gravitational Physics and Leibnitz Univ. Hannover (Germany)
See details page 4.

JOINT SESSION ........................ MON 11:15 TO 12:45
SPIE Optical Metrology-EQEC 2019
Joint Session with CLEO EQEC 2019
Numerical optimization of resonant photonic devices (Invited Paper), Martin Hammerschmidt, Lin Zschiedrich, Philipp Schneider, Felix Binkowski, Sven Burger, Zuse Institute Berlin (Germany) .................. [11057-101]
Lensless metrology for semiconductor lithography at EUV (Invited Paper), Iacopo Mochi, Paul Scherrer Institute (Switzerland) .................. [11057-102]
Metrology for and with nanoopitcs (Invited Paper), Thomas Pertsch, Friedrich Schiller Univ., Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Max Planck School of Photonics (Germany) .................. [11057-103]
Lunch Break ................................. Mon 12:45 to 13:50

WELCOME AND INTRODUCTION ........ 13:50 TO 14:00

SESSION 1 ............................ MON 14:00 TO 15:50
Interferometry I
Modeling the misalignment error in a solar system simulator for rotationally shearing interferometer (Invited Paper), Marija Strojinik Scholl, Centro de Investigaciones en Optica, A.C. (Mexico) ............ [11057-1]
Fractional Fourier ridges for demodulation of interferograms with quadratic phase, Jinmin Wu, Mingfeng Lu, Chenchen Ji, Pei-Hang Li, Feng Zhang, Ran Tao, Beijing Institute of Technology (China) ............ [11057-2]
Suppression of nonlinear optical frequency sweeping in frequency-scaning interferometry for absolute distance measurement, Zhongwen Deng, Zhigang Liu, Wen Deng, Xingyu Jia, Xin Jiaotong Univ. (China) ......... [11057-3]
Intrinsic surface feature-based subaperture stitching of freeform wavefront, Kamal K. Pant, Instruments Research & Development Establishment (India); Daili R. Burada, Indian Institute of Technology Delhi (India); Vinod Mishra, CSIR - Central Scientific Instruments Organisation (India); Amilta Gosh, Instruments Research & Development Establishment (India); Gufran S. Khan, Chandra Shakker, Indian Institute of Technology Delhi (India) .......... [11057-4]
Adjustable accurate phase shifter for phase-shifting interferometry, Cruz Menezes-Fabian, Benemérita Univ. Autónoma de Puebla (Mexico); Rosaura Kantun-Montiel, Gildardo Pablo Lemus-Alonso, Univ. de Monterrey (Mexico) ................ [11057-5]

SESSION 2 .............................. MON 16:20 TO 18:10
Optical Materials/Imaging and Microscopy
Modeling of bulk materials and nanostructures for applications in high-precision optical metrology (Invited Paper), Stefanie Kroker, Physikalisch-Technische Bundesanstalt (Germany) and Technische Univ. Braunschweig (Germany); Florian Bruns, Johannes Dickmann, Physikalisch-Technische Bundesanstalt (Germany); Walter Dickmann, Jan Meyer, Technische Univ. Braunschweig (Germany); Carol B. Rojas Hurtado, Physikalisch-Technische Bundesanstalt (Germany) .................. [11057-6]
Modeling aspects for high-precision absorption measurements, Walter Dickmann, Technische Univ. Braunschweig (Germany); Johannes Dickmann, Florian Bruns, Stefanie Kroker, Physikalisch-Technische Bundesanstalt (Germany) .................. [11057-7]
Large area metasurface lenses in the NIR region, Mitchell Kenney, James Grant, Univ. of Glasgow (United Kingdom); Kevin Docherty, Kelvin Nanotechnology Ltd. (United Kingdom); David Heny, UK Astronomy Technology Ctr. (United Kingdom); Peter MacKay, Gooch & Housego PLC (United Kingdom); Robert Lamb, Leonardo MW Ltd. (United Kingdom); David Cumming, Univ. of Glasgow (United Kingdom) .................. [11057-8]
Systematic approach on illustrating the challenges represented by optical bidirectional measurements using rigorous simulations, Jan Krüger, Rainer König, Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany) ........ [11057-9]
Model-based confocal fluorescence microscopy measurements of submerged micro geometries, Merlin Mikulewitsch, Axel von Freyberg, Andreas Fischer, Univ. Bremen (Germany) .................. [11057-10]

TUESDAY 25 JUNE

NOBEL PLENARY SESSION ............ MON 18:00 TO 19:00
World of Photonics Congress: Nobel Plenary Session
Passion for Extreme Light
Gerard Mourou, École Polytechnique (France); 2018 Physics Nobel Prize Laureate
See details page 4.

SESSION 3 ........................... TUE 08:30 TO 10:00
3D and Shape Metrology
Model based laser focus scanning: the path towards improved lateral resolution (Invited Paper), Jörg Bischoff, Rostyslaw Mastylko, Eberhard Manske, Technische Univ. Ilmenau (Germany) .................. [11057-11]
Characterization of the topography fidelity of 3D optical microscopy, Sai Gao, Physikalisch-Technische Bundesanstalt (Germany) .................. [11057-12]
Simulation of 3D laser scanning with phase-based EDM for the prediction of systematic deviations, Sukant Chaudhry, David Salido-Monzú, Andreas Wieser, ETH Zurich (Switzerland) .................. [11057-13]
Design of a null-screen for a compact corneal topographer, Manuel Campos-Garcia, Daniel Aguirre-Aguirre, José Rufino Diaz-Uribe, José Antonio Lechuga-Núñez, Jesús Alberto Aguirre-Caro, Andrés Peña-Conzuelo, Univ. Nacional Autónoma de México (Mexico) .................. [11057-14]
SESSION 4 .......................... TUE 10:30 TO 12:30

Scatterometry

Efficient global sensitivity analysis for silicon line gratings using polynomial chaos (Invited Paper), Nando Farchmin, Sebastian Heidenreich, Anna Andrei, Victor Soltwisch, Markus Bär, Physikalisch-Technische Bundesanstalt (Germany); Martin Hammerschmidt, Philipp-Immanuel Schneider, JCMwave GmbH (Germany) and Zuse Institute Berlin (Germany) .................................................. [11057-15]

Supplementing rigorous electromagnetic modeling with atomistic simulations for optical-based metrology (Invited Paper), Bryan M. Barnes, Hui Zhou, Richard M. Silver, Mark-Alexander Herrn, National Institute of Standards and Technology (USA) .................................................. [11057-16]

Benchmarking global optimization and machine learning methods for parameter reconstruction, Philipp-Immanuel Schneider, Martin Hammerschmidt, Lin Zschiedrich, Sven Burger, JCMwave GmbH (Germany) .................................................. [11057-17]

Reference-free GIXRF of nanostructures for element sensitive profile reconstruction, Anna Andrei, Victor Soltwisch, Philipp Hönicke, Yves Kayser, Burkhard Beckhoff, Physikalisch-Technische Bundesanstalt (Germany); Philipp-Immanuel Schneider, Martin Hammerschmidt, JCMwave GmbH (Germany); Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany); Frank Scholze, Physikalisch-Technische Bundesanstalt (Germany) .................................................. [11057-18]

Accurate and robust characterization of volume scattering materials using the intensity-based inverse adding-doubling method, Antoine Correa, Peter Hanselaer, Youji Meuret, KU Leuven (Belgium) ................................. [11057-19]

Lunch Break .......................... Tue 12:30 to 13:30

SESSION 5 .......................... TUE 13:30 TO 15:40

Mueller Matrix, Ellipsometry and Polarimetry

Tomographic Mueller-matrix scatterometry for nanostructure metrology: principle and opportunities (Invited Paper), Xiuguo Chen, Shiyuan Liu, Huazhong Univ. of Science and Technology (China) .............................. [11057-20]

Polarization metrology for high numerical aperture DUV objectives, Robert D. Grejda, Duncan C. Spaulding, Paul F. Michalski, Robert L. Michaels, Stephen K. Mack, Paul G. Dewa, David L. Aronstein, Corning Tropel Corp. (USA) .................................................. [11057-21]

Vectorial modeling for the image formation of a high-numerical-aperture Mueller-matrix ellipsimeter, Cai Wang, Xiuguo Chen, Chao Chen, Shiyuan Liu, Huazhong Univ. of Science and Technology (China) .............................. [11057-22]

Mueller matrix ellipsometry for enhanced optical form metrology of sub-lamba structures, Tim Käseberg, Johannes Dickmann, Physikalisch-Technische Bundesanstalt (Germany); Thomas Siefke, Friedrich-Schiller-Universität Jena (Germany) and Physikalisch-Technische Bundesanstalt (Germany); Matthias Wurm, Physikalisch-Technische Bundesanstalt (Germany); Stefanie Kroker, Physikalisch-Technische Bundesanstalt (Germany) and Physikalisch-Technische Bundesanstalt (Germany); Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany) .............................. [11057-23]

An improved method to derive best-fit parameters and their uncertainties from depolarizing Mueller-matrices, Tobias Grunewald, Physikalisch-Technische Bundesanstalt (Germany); Matthias Wurm, Sven Teichert, Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany); Johanna Reck, Uwe Richter, SENGTECH Instruments GmbH (Germany) .............................. [11057-24]

Fast compressed channeled spectropolarimetry for full Stokes vector measurement, Guodong Zhou, Yangli Li, Jianhui Li, Jiazhi Wang, Beijing Institute of Technology (China) .............................. [11057-25]

POSTERS-WEDNESDAY ................ WED 11:30 TO 12:30

Conference attendees are invited to attend the Optical Metrology Poster Session 2 on Wednesday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 11:30 through 12:30 hrs on Wednesday. Poster authors, view poster presentation guidelines and set-up instructions on page 6, and at http://spie.org/e6513.xml. (Follow the Special Events link)

Determination of the reference length to increase the accuracy of measuring the optical thickness of the layers during the production of interference coatings, Thai Phi Ngo, Lyudmila Aleksandrovna Gubanova, ITMO Univ. (Russian Federation) .............................. [11057-42]

Modeling of direct laser writing in multilayer absorbing medium, Anton V. Saetchnikov, Ruhr-Universität Bochum (Germany); Elina Tcherniaevskaya, Vladimir Saetchnikov, Belarussian State Univ. (Belarus); Andreas Ostendorf, Ruhr-Universität Bochum (Germany) .............................. [11057-43]

Development of a measuring system based on the principles of stereo vision, Ksenia Ezhova, Duy Hung Nguyen, ITMO Univ. (Russian Federation) .............................. [11057-44]

Phase dispersion measurement on laser mirrors using fringe-free spectral interferometry, Kulish, Mikhail Melnechenko, Oleg Vygodov, GosNIIAS (Russian Federation) .............................. [11057-45]

Enhancing detail of 3D terrain models using GAN, Vladimir S. Gorbatsevich, Mikhail Melnechenko, Oleg Vygodov, GosNIIAS (Russian Federation) .............................. [11057-46]

Modelling of spectroradiometric error due to unoptimized choice of array photodetector for integrated photosynthetically active radiation spectroradiometer, Sergei S. Baev, Ivan S. Nekrylov, Valery V. Korotaev, ITMO Univ. (Russian Federation); Konstantin A. Tomsik, Vladimir N. Kuzmin, TQA Scientific Instruments (Russian Federation) .............................. [11057-47]

Optical attachment for spatial conversion shape and divergence of UV laser output beam, Alekseandr S. Grishkanich, Aleksandr Zhevlakov, ITMO Univ. (Russian Federation) .............................. [11057-48]

SESSION 6 .......................... TUE 16:10 TO 17:50

Interferometry II

An improved control structure for the tracking of sine command in a motion simulator, Bernard Vau, IXBlue SAS (France); Damien Ponceau, IXBlue Motion Systems (France); Mehdi Bussutti, Guillaume Vallee, IXBlue SAS (France) .................................................. [11057-26]

Physical optics modeling of interferometer-based metrology systems, Sifei Wang, LightTrans International (GmbH); Huayong Zhong, Rui Shi, Friedrich-Schiller-Universität Jena (Germany); Christian Hellmann, Wyrowski Photonics UG (Germany); Frank Wyrowski, Friedrich-Schiller-Universität Jena (Germany) .............................. [11057-27]

Modeling of vignetting in an adaptive optics system with Shack-Hartmann wavefront sensor, Vitaly V. Lavrino, Lidia N. Lavrino, V. E. Zuev Institute of Atmospheric Optics (Russian Federation) .............................. [11057-28]

Extending wavefront sensing range of phase diversity, Zhao-jun Yan, Shanghai Astronomical Observatory (China); Pengjian Yang, Shanghai Institute of Optics and Fine Mechanics (China); Feng Zhang, Ran Tao, Beijing Institute of Technology (China) .............................. [11057-29]

Faster region-based convolutional neural network method for estimating parameters from Newton’s rings, Chenchen Ji, Mingfeng Lu, Jinmin Wu, Zhen Guo, Feng Zhang, Ran Tao, Beijing Institute of Technology (China) .............................. [11057-30]
Error estimation due to approximations in Shack-Hartmann sensor based measurement of high slope freeform wavefront, Ashish Dwivedi, Kamal K. Das, R. Burada, Gufran S. Khan, Anurag Sharma, Indian Institute of Technology Delhi (India) .......................... [11057-52]

Development of the device for positioning control mirrors, Igor V. Lapkaev, Anastasiya D. Kozhina, Vassilisa V. Ezhova, Zobin A. Dmitriy, Dmitry D. Zarhov, ITMO Univ. (Russian Federation) .......................... [11057-53]

Calculation of intensity distribution from a wavefront using ray-counting method, Manuel Campos-Garcia, Univ. Nacional Autónoma de México (Mexico); Angel Eugenio Martinez-Rodriguez, Fyrmín Salomon Granados-Agustín, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) .......................... [11057-54]

A method for improving the accuracy of an extinction coefficient measurement of weakly absorbing interference layers, Van Ba Nguyen, Lyudmila Aleksandrovna Gubanova, ITMO Univ. (Russian Federation); Dinh Bao D. B. Bui, Le Quy Don Technical Univ. (Viet Nam) .......................... [11057-55]

Evaluation of the aberrations of a PDMS lens, Manuel Campos-Garcia, Oliver Huerta-Carranza, Celestino Vargas-Alfredo, Univ. Nacional Autónoma de México (Mexico); Angel Eugenio Martinez-Rodriguez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Agustín Santiago-Alvarado, Univ. Tecnológica de la Mixteca (Mexico); Víctor Iván Moreno-Oliva, Univ. del Istmo (Mexico) .......................... [11057-56]

Modelling and tolerance analysis of volume-phase gratings in complex dispersive units, Andrey Melnikov, OJSC “Scientific and Production Association State Institute of Applied Optics” (Russian Federation); Maxim Bakshaev, Kazan National Research Technical Univ. A.N. Tupoleva - KAI (Russian Federation); Eduard R. Muslimov, Lab. d'ASTrophysique de Marseille (France) and Kazan National Research Technical Univ. A.N. Tupoleva - KAI (Russian Federation); Ilya Gusakov, Kazan National Research Technical Univ. A.N. Tupoleva - KAI (Russian Federation) .......................... [11057-57]

A fully coupled diffusional-mechanical formulation for growth kinetics of precipitates in laser powder bed fusion process using a phase field approach, Fikret K. Mizrade, Institute of Laser and Information Technologies of the Russian Federation (Russia) .......................... [11057-58]

On modeling of heat transfer and molten pool behavior in multilayer and multitrack laser additive manufacturing process, Alexander V. Dubrov, Fikret K. Mizrade, Institute of Laser and Information Technologies of the RAS (Russian Federation) .......................... [11057-59]

A flexible and simplified calibration procedure for fringe projection profilometry, Raúl Vargas, Andrés Marshu, Lenry Romero, Jesús Pineda, Univ. Tecnológica de Bolívar (Colombia) .......................... [11057-60]

Measurement of errors by axial misalignment and tilt of the null screen used in experimental arrangements by deflectometry, Diana Nalley Castán-Ricaño, Fermín S. Granados-Agustín, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Andrea F. Muñoz-Potosi, Gabriel Valdivieso-González, Univ. de Investigación y Desarrollo (Colombia); María Elizabeth Percino-Zacarías, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Maximino Avendaño-Alejo, Univ. Nacional Autónoma de México (Mexico); Alejandro Cornejo-Rodríguez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) .......................... [11057-61]

Design of a two-mirror telescope using a free-form surface for the primary mirror, J. J. Álvarez Martínez, F. Granados Agustín, S. Vázquez Y Montiel, M. E. Percino Zacarías, A. Cornejo Rodriguez, Instituto Nacional de Astrofísica, Óptica y Electrónica y Univ. Interserrana del estado de Puebla-Ahuacatlan (Mexico) .......................... [11057-62]

Lunch Break .......................... Wed 12:30 to 13:40

SESSION 8 ............................ WED 16:00 TO 18:00

Optical Systems

Three-dimensional modelling of coherence scanning interferometry for complex surfaces based on a boundary element method, Matthew Thomas, Rong Su, The Univ. of Nottingham (United Kingdom); Nikolai Nikolaev, Jeremy M. Coupland, Loughborough Univ. (United Kingdom); Richard Leach, The Univ. of Nottingham (United Kingdom) .......................... [11057-36]

Optical time domain reflectometer for precision measurement of signal delay in optical fiber, Sergey S. Donchenko, Oleg Kolmogorov, Dmitriy Prokhorov, Ekaterina Chemesova, VNIIITRI (Russian Federation) .......................... [11057-37]

ELT-HIRES the high-resolution spectrograph for the ELT: simulation results of polarimetric aberrations for the polarimetric module, Igor Di Varano, Manfred Woche, Michael Weber, Klaus G. Strassmeier, Leibniz-Institut für Astrophysik Potsdam (Germany); Shu Yuan, Yunnan Astronomical Observatories (China) .......................... [11057-38]

Estimation of reflectance factors and their uncertainties from multiple measurements, Matti A. Eskelinen, Univ. of Jyväskylä (Finland); John Lu, National Institute of Standards and Technology (USA) .......................... [11057-39]

Superaccurate camera calibration via inverse rendering, Morten Hannenmose, Jakob Wilm, Jesper Revall Friisvad, Technical Univ. of Denmark (Denmark) .......................... [11057-40]

Research on the application of absolute reverse reflection measurement model, Jinming Zhang, Yishu Zhou, Huayang He, Jinjin Cao, Research Institute of Highway Ministry of Transport (China) .......................... [11057-41]

CLOSING REMARKS .......................... 18:00 TO 18:30

Fight Bias, Embrace Diversity

SPIE seeks to cultivate a culture of openness and inclusivity. Help us eradicate bias and make the world of optics and photonics a shining example of all minds coming together to innovate regardless of gender, race, nationality, culture, educational background, politics, sexuality, body-type and age, for the betterment of life.

Educate yourself on the issues faced by a diverse workforce, challenge your own assumptions, and tap into the rich pool of talent, perspectives, and ideas offered by people different from you.
MONDAY 24 JUNE

SESSION 1 ............................ MON 8:30 TO 10:00
3D Tomography: Applications

Nondestructive observation of multilayered modern paintings by electromagnetic waves (Invited Paper), Kaori Fukunaga, National Institute of Information and Communications Technology (Japan); Yoshini Ueno, CRS Corp. (Japan); Yasunobu Ito, IKE Museum of 20th Century Art (Japan) .................................................. [11058-1]

A noninvasive investigation of Limoges enamels using both optical coherence tomography (OCT) and spectral imaging, Margaret Read, Nottingham Trent Univ. (United Kingdom) and The British Museum (United Kingdom); Chi Shing Cheung, Haida Liang, Nottingham Trent Univ. (United Kingdom); Denise Ling, Capucine Korent, The British Museum (United Kingdom) .......................................................... [11058-2]

Nd:YAG vs Er:YAG: a comparative study of laser varnish removal on easel paintings, Maxime Lopez, Ctr. de Recherche et de Restauration des Musées de France (France); Xueyhi Bai, Ctr. de Recherche et de Restauration des Musées de France (France) and Ctr. de Recherche sur la Conservation (France); Corinna Koch-Dandolo, Ctr. de Recherche et de Restauration des Musées de France (France) and Fondation des Sciences du Patrimoine (France); Stéphane Serfaty, Nicolas Wilke-Chancellor, Univ. de Cergy-Pontoise (France); Vincent Detatte, Ctr. de Recherche et de Restauration des Musées de France (France) .......................................................... [11058-3]

An exploratory study for the noninvasive detection of metal soaps in paintings through optical coherence tomography, Alessandra Vichi, Chi Shing Cheung, Haida Liang, Nottingham Trent Univ. (United Kingdom); Daniela Cornelli, Alessia Artesani, Gianluca Valentini, Politecnico di Milano (Italy); Austin Nevin, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Anna Piccirillo, Fondazione Centro Conservazione e Restauro dei Beni Culturali La Venaria Reale (Italy); Tommaso Poli, Univ. degli Studi di Torino (Italy); Paola Croveri, Univ. degli Studi di Torino (Italy) and Fondazione Centro Conservazione e Restauro dei Beni Culturali La Venaria Reale (Italy) .......................................................... [11058-4]

SESSION 2 ............................ MON 11:20 TO 13:10
Light-Matter Interaction and Nonlinear Optics

The study of the degradation of cadmium yellow paints through their photoluminescence emission from trap states (Invited Paper), Daniela Cornelli, Marta Ghirardello, Gianluca Valentini, Politecnico di Milano (Italy); Austin Nevin, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Dougas MacLennan, Alan Phenix, Catherine Schmidt Patterson, Herant Khajian, Karen Trentelman, The Getty Conservation Institute (USA); Lucia Toniolo, Politecnico di Milano (Italy); Alessandra Vichi, Politecnico di Milano (Italy); Corrado Spigarelli, Courtauld Institute of Art (United Kingdom); Markus Gross, Fondation Beyeler (Switzerland) .................................................. [11058-5]


CONFERENCE 11058

Optics for Arts, Architecture, and Archaeology VII

Conference Chairs: Haidia Liang, Nottingham Trent Univ. (United Kingdom); Roger Groves, Technische Univ. Delft (Netherlands)

Conference Co-Chair: Piotr Targowski, Nicolaus Copernicus Univ. (Poland)

Programme Committee: Dario Ambrosini, Univ. degli Studi dell’Aquila (Italy); Marta Castillejo, Consejo Superior de Investigaciones Científicas (Spain); Daniela Comelli, Politecnico di Milano (Italy); Claudia Dafni, Univ. degli Studi di Verona (Italy); Vincent Detatte, Centre de Recherche et de Restauration des Musées de France (C2RMF) (France); John K. Delaney, National Gallery of Art (USA); Martin C. Fischer, Duke Univ. (USA); Raffaella E. M. Fontana, Istituto Nazionale di Ottica (Italy); Igor P. Gurov, ITMO Univ. (Russian Federation); Alexander J. Kossolapov, State Hermitage Museum (Russian Federation); Gaël Latour, Univ. Paris-Sud (France); Nicola Masini, Consiglio Nazionale delle Ricerche (Italy); Luca Pezzati, Istituto Nazionale di Ottica-CNR (Italy); David R. Saunders, International Institute for Conservation (United Kingdom); Robert Sitnik, Warsaw Univ. of Technology (Poland); Vivi Tornari, Foundation for Research and Technology-Hellas (Greece)

Determination of thresholds for safe analyses of acrylic paintings by nonlinear optical microscopy, Mikel Sanz, Mohamed Ouja, Consejo Superior de Investigaciones Científicas (Spain); Raffaella E. M. Fontana, Riccardo Cicchi, Alice Dal Fovo, Sara Mattana, Consiglio Nazionale delle Ricerche, Istituto Nazionale di Ottica (Italy); Marco Marchetti, LENS - Lab. d’Optique et Biosciences (France); Laurianne Robinet, Ctr. de Recherche sur la Conservation (France) and Muséum national d’Histoire naturelle, Ctr. de Recherche sur la Conservation (France); Sylvie Thao, Ctr. de Recherche sur la Conservation (France); Claire Teuton, Guillaume Ducourtial, Marie-Claire Schanne-Klein, Lab. d’Optique et Biosciences (France); Gaël Latour, Imagery et Modélisation en Neurobiologie et Cancérologie (France) and Univ. Paris-Sud (France) and Univ. Paris-Saclay (France) .......................................................... [11058-7]

The potential of nonlinear optical microscopy to noninvasively quantify the degradation state of historical parchments, Margaux Schnitzel, Lab. d’Optique et Biosciences (France); Laurianne Robinet, Ctr. de Recherche sur la Conservation (France) and Muséum national d’Histoire naturelle, Ctr. de Recherche sur la Conservation (France); Sylvie Thao, Ctr. de Recherche sur la Conservation (France); Claire Teuton, Guillaume Ducourtial, Marie-Claire Schanne-Klein, Lab. d’Optique et Biosciences (France); Gaël Latour, Imagery et Modélisation en Neurobiologie et Cancérologie (France) and Univ. Paris-Sud (France) and Univ. Paris-Saclay (France) .......................................................... [11058-8]

A study on the coloring mechanism of famous ancient Chinese ceramics, Weidong Li, Shanghai Institute of Ceramics (China) .......................................................... [11058-9]

Lunch Break ..................................... Mon 13:10 to 14:10

SESSION 3 ............................ MON 14:10 TO 15:50
Imaging and Spectroscopy for Material Analysis

A hyperspectral camera for conservation science, based on a birefringent ultrastable common path interferometer, Cristian Manzoni, CNR-IFN Padova (Italy) and Politecnico di Milano (Italy); Antonio Peri, Politecnico di Milano (Italy); Bárbara E. Nogueira de Faria, Daniela C. Teles Ferreira, Univ. Federal de Minas Gerais (Brazil); Dante Polli, Daniela Cornelli, Gianluca Valentini, Giulio N. Cerullo, Politecnico di Milano (Italy) .......................................................... [11058-10]

Maximizing the microscope: instrument design and data processing strategies for hyperspectral imaging of cross-sectional cultural heritage samples, Lindsay Oakley, Marc S. Walton, Northwestern Univ. (USA)[11058-11]

Methodological considerations regarding the problem of apparent versus intrinsic fluorescence properties of historical paint layers, Fabien Pottier, Anne Michelin, Christine Andraud, Ctr. de recherche sur la conservation des collections, Museum national d'Histoire naturelle (France); Fabrice Goubard, Univ. de Cergy-Pontoise (France); Bertrand Lavédrine, Ctr. de recherche sur la conservation des collections, Museum national d'Histoire naturelle (France) .......................................................... [11058-12]

Investigation of reflectance-based pigment classification in layered media, Lionel Fliske, Oliver Cossairt, Aggelos K. Katsaggelos, Marc S. Walton, Northwestern Univ. (USA) .................................................. [11058-13]

An auto-hyperspectral scanning system for techniques investigation of Chinese paintings, Guanghua Li Jr., Yao Chen Jr., The Palace Museum (China); Hongming Zhang Sr., Xuejian Sun Sr., Institute of Remote Sensing and Digital Earth, CAS (China); Yong Le, Sr., The Palace Museum (China)[11058-14]
SESSION 4 ............................ MON 16:15 TO 17:55
Structural Analysis
Deformation measurement of large buildings by holographic point replication, Flavio S. Guerra, Simon Hartlieb, Tobias Haist, Alexander Warsewa, Wolfgang Osten, Oliver Sadowy, Univ. Stuttgart (Germany) .......................... [11058-15]
Combined hardware and software approaches for infrared thermographic analysis of wall paintings, Kamel Mouhoubi, Jean Luc Bodnar, Univ. de Reims Champagne-Ardenne (France); Vincent Detaille, Ctr. de Recherche et de Restauration des Musées de France (France); Jean-Marc Valtat, Ctr. Interregional de Conservation et Restauration du Patrimoine (France)[11058-16]
Comparison of induced thermal change to climate chamber simulated environmental change in mosaic model by digital holographic speckle pattern interferometry (DHSPI), Antonina Chaban, Univ. degli Studi di Padova (Italy); Vivi Tornari, Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (Greece); Rita Deiana, Univ. degli Studi di Padova (Italy) .......................... [11058-17]
X-ray tomography and aggregated analysis for Bavay treasure bronze statuettes analysis, Cloidilde Boust, Elsa Lambert, Charlotte Hochart, Benoît Milhe, Ctr. de Recherche et de Restauration des Musées de France (France) .......................... [11058-18]
Use of 3D laser scanning for documentation, digital reconstruction and physical replication of sculptural monuments, Vadim Partenov, Saint Petersburg Electrotechnical Univ. "LETI" (Russian Federation) .......................... [11058-19]

NOBEL PLENARY SESSION ........................ MON 18:00 TO 19:00
World of Photonics Congress:
Noel Plenary Session
Passion for Extreme Light
Gerard Mourou, École Polytechnique (France); 2018 Physics Nobel Prize Laureate
See details page 4.

TUESDAY 25 JUNE
SESSION 5 ............................ TUE 08:10 TO 10:00
Optical Coherence Tomography: Instruments and Methods
Multiscale optical coherence tomography imaging of "The girl with a pearl earring" (Invited Paper), Jeroen Kalkman, Joris Dik, Tom Callewaert, Technische Univ. Delft (Netherlands) .......................... [11058-20]
High-penetration high-resolution time domain optical coherence tomography for cultural heritage applications, Bingjie Xu, Kuan He, Jian Gao, Florian Williomitzer, Angelos K. Katsaggelos, John E. Tumbill, Oliver Cossart, Marc S. Walton, Northwestern Univ. (USA) .......................... [11058-21]
Multimodal mid-infrared optical coherence tomography for art diagnosis, Ivan Zorin, RECENDT (Austria) .......................... [11058-22]
Simultaneous measurement of refractive index and dispersion using optical coherence tomography in the analysis of plastic sculptures, Mixon Faluweki, Haida Liang, Chi Shing Cheung, Nottingham Trent Univ. (United Kingdom) .......................... [11058-23]
Noninvasive depth-resolved material characterisation using OCT and spectral imaging, Patrick S. Atkinson, Chi Shing Cheung, Haida Liang, Nottingham Trent Univ. (United Kingdom); Catherine Higgitt, Marika Spring, The National Gallery (United Kingdom) .......................... [11058-24]

SESSION 6 ............................ TUE 10:30 TO 11:30
Advanced Image Processing
A novel methodology for the automatic analysis of large collections of paintings, Sotiria Kogou, Nottingham Trent Univ. (United Kingdom); Lynn Lee, The Getty Conservation Institute (USA); Golnaz Shahihaensazbehti, Haida Liang, Nottingham Trent Univ. (United Kingdom) .......................... [11058-25]
MID-FTIR macro mapping and clustering-based automatic brushing: an advanced diagnostic tool for in situ investigations of artworks, Emilio Catelli, Giorgia Sciuotto, Silvia Prati, Univ. degli Studi di Bologna (Italy); Paolo Oliveri, Univ. degli Studi di Genova (Italy); Stijn Legrand, Koen Janssens, Univ. Antwerpen (Belgium); Rocco Mazzeo, Univ. degli Studi di Bologna (Italy) .......................... [11058-26]

CONFERENCE 11058
Unbending light: new computational methods for the correction of 3D effects in scanning XRF, Monica Gario, The Getty Conservation Institute (USA); Stephen Parsons, Seth Parker, Univ. of Kentucky (USA); Marie Svoboda, J. Paul Getty Museum (USA); Brent Seales, Univ. of Kentucky (USA); Catherine Schmidt Patterson, The Getty Conservation Institute (USA) .......................... [11058-27]
SESSION 7 ............................ TUE 11:30 TO 12:30
Poster Pitch Presentations
Three-minute oral presentations (poster pitch presentations) will take place in the conference room. Each brief poster overview will consist of three-minute talk including no more than three slides (powerpoint presentation) as part of this presentation. Poster Pitch Session will be followed by the official conference Poster Session 12:30 to 13:10 hrs in the designated area in Hall B1 with all posters on display and authors present at their posters.
The metallography and corrosion of an ancient Chinese bimetallic bronze sword ............................................. [11058-1]
Analytical characterization of gold leaves of forth (innermost) shrine of the King Tut Ankh Amun ............................................. [11058-2]
Fluorescence lifetime imaging a good approach to revealed gilded and polychromed surface under black encrustation of marble object ............................................. [11058-3]
Colour and spectral characterisation of the particulate matter deposited on the mosaic at the house of Hippolytus in Complutum (Spain) ............................................. [11058-5]
Follow up of restoration of works of art of the patrimony by infrared thermography ............................................. [11058-15]
High-resolution visible and infrared imaging for large paintings: a case study in Israel on Egypt by Poynter ............................................. [11058-17]
Tattoo Wall®: study of the stability of an innovative decorative technique through hyperspectral imaging and possible application in the mural painting’s restoration ............................................. [11058-18]
In situ nondestructive detection and analysis of the structure of clay statue cultural heritage ............................................. [11058-21]
Stimulated IRT for detection of bacterial biofilm on building limestones ............................................. [11058-28]
Evaluation methods of effect of cleaning techniques on library collagen materials ............................................. [11058-37]
A method for the analysis of spectral Imaging data from Tang tomb murals ............................................. [11058-41]
Smartphone diagnostics for cultural heritage ............................................. [11058-46]
Scanning the Celts: evaluation of 2D and 3D techniques in protohistoric archaeology ............................................. [11058-47]
Development of a hyperspectral imaging setup for the noninvasive identification and mapping of unstable corrosion products in ancient bronze ............................................. [11058-49]
Machine learning analysis of illuminated Southeast Asian manuscripts using complementary noninvasive Imaging techniques ............................................. [11058-51]
Comprehensive study of the fresco of Raphael's workshop "Venus Tying a Sandal" from the State Hermitage Museum's collection ............................................. [11058-54]
Non-artistic materials in artistic works by David Lynch. Multidisciplinary approach ............................................. [11058-60]
Incrustation of ancient Saka scabbard. Materials studies by Raman and FTIR spectroscopy ............................................. [11058-62]
Development of a drone-based spectral imaging system for archaeological applications ............................................. [11058-63]

POSTERS TUESDAY ................................ TUE 12:30 TO 13:10
Conference attendees are invited to attend the Digital Optical Technologies Poster Session 1 on Tuesday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 12:30 through 13:10 hrs on Tuesday. Poster authors, view poster presentation guidelines and set-up instructions on page 6, and at http:// spie.org/x6513.xml. (Follow the Special Events link)
The metallography and corrosion of an ancient Chinese bimetallic bronze sword ............................................. [11058-45]
Analytical characterization of gold leaves of forth (innermost) shrine of the King Tut Ankh Amun ............................................. [11058-46]
Fluorescence lifetime imaging a good approach to revealed gilded and polychromed surface under black encrustation of marble object, Eman Tah, The Grand Egyptian Museum (Egypt) ............................................. [11058-47]

SESSION 8 ............................. TUE 14:20 TO 15:30

Remote Imaging and Spectroscopy


Long-range remote spectroscopy for wall paintings and architectural interiors, Yu Li, Ching Shuen Cheung, Sotiria Kogou, Alex Hogg, Florence Liggins, Luke Butler, Haida Liang, Nottingham Trent Univ. (United Kingdom). [11058-29]

Palm-sized and tough two-dimensional spectral imaging: the so-called hyperspectral camera for visible and mid-infrared light, Ichiro Ishimaru, Hanyue Kang, Natsumi Kawashima, Tomoya Kitazaki, Juunya Iwaki, Satoshi Adachi, Sora Mitani, Kotone Yokoyama, Kajawa Univ. (Japan) .......... [11058-30]

SESSION 9 ............................. TUE 16:00 TO 17:50

Applications to Cultural Heritage


Novel imaging spectroscopy applications for the study of ancient and Byzantine Cypriot monumental paintings, Roxanne Radvany, Univ. of Calgary; K. Delaney, National Gallery of Art (USA); Ioanna Kakkouli, Univ. of California, Los Angeles (USA) .......... [11058-32]

Analysis of the physical characteristics and chemical composition of gold leaf in works of art by scanning macro X-ray fluorescence (MA-XRF) spectroscopy, Douglas MacLaennan, The Getty Conservation Institute (USA); Arlen Heginbotham, J. Paul Getty Museum (USA); Monica Ganio, The Getty Conservation Institute (USA); John K. Delaney, National Gallery of Art (USA); Lynn Lee, The Getty Conservation Institute (USA); Laura Llewellyn, J. Paul Getty Museum (USA); Karen Trentelman, The Getty Conservation Institute (USA) .......... [11058-33]

Physicochemical monitoring of conservation state of the 19th century glass beads, Dmitri V. Pankin, Saint Petersburg State Univ. (Russian Federation); Irina F. Kadikova, GosNIIR (Russian Federation); Ekaterina A. Kriuchkova, Institute for the History of Material Culture (Russian Federation); Maria V. Lukashova, TESCAN Ltd. (CIS) (Russian Federation); Anastasia Povolotckia, Saint Petersburg State Univ. (Russian Federation); Vladimir M. Yuryev, A.M. Prokhorov General Physics Institute of the RAS (Russian Federation) .......... [11058-34]

Multianalytical investigation of the ancient nomads polychromic belt buckles, Nikolai S. Kurganov, Saint Petersburg State Univ. (Russian Federation) and Institute for the History of Material Culture (Russian Federation); Sergey Khavin, The State Hermitage Museum (Russian Federation); Dmitri V. Pankin, Saint Petersburg State Univ. (Russian Federation); Irina A. Grigorieva, Ksenia Chugunova, The State Hermitage Museum (Russian Federation); Mariana Klunovskaya, Institute for the History of Material Culture (Russian Federation); Anastasia Povolotckia, Alexey Kurochkin, Saint Petersburg State Univ. (Russian Federation) .......... [11058-35]

WEDNESDAY 26 JUNE

SESSION 10 ..................................... WED 8:20 TO 10:00

3D Surface Analysis

Monitoring surface degradation process by 3D structured light scanning, Robert Slihik, Krysztof Lech, Warsaw Univ. of Technology (Poland); Eryk Bunsch, Willanow Palace Museum (Poland) .......... [11058-36]

Monitoring microcrinate-induced deformations by hyperscopic materials using conoscopic holography sensors, Giacomo Marchioro, Luca Perlini, Claudia Daffara, Univ. degli Studi di Verona (Italy) .......... [11058-37]

A new method to improve reconstruction and rendering of RTI images, Yuli Castro, Alain Mansouret, Gaetan Le Goic, Vincent Brost, Univ. de Bretagne Occidentale; John K. Delaney, National Gallery of Art (USA); Kathryn A. Dooley, National Gallery of Art (USA) .......... [11058-38]

Lights on the Dark Ages: multiscale 2D and 3D imagery for the study of medieval graffiti at the Chateau de Selles Cambrai, France, Nicolas Melard, Ctr. de Recherche et de Restauration des Musées de France .......... [11058-39]

FringeMatchNet: effective stereo matching onboard of mobile structured light 3D scanner, Vladimir V. Kniaz, GosNIIAS (Russian Federation) .......... [11058-40]
PLENARY SESSION ........................... WED 10:30 TO 11:25
SPIE Optimal Metrology Plenary Session
Towards a complete framework for calibration of optical surface and coordinate measuring instruments
Richard Leach, Univ. of Nottingham (United Kingdom)
For details, please see page 5.

SESSION 11 ........................... WED 11:30 TO 12:50
Multimodal Imaging and Spectroscopy
Merging of imaging techniques based on reflectance hyperspectral and neutron tomography for characterization of a modern replica of a 13th century knife from Croatia, Costanza Cucci, Andrea Casini, Lorenzo Stefani, Marcello Picollo, Consiglio Nazionale delle Ricerche, Istituto di Fisica Applicata “Nello Carrara” (Italy); Nikolay Kardjilov, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany); Adam Thiele, Budapest Univ. of Technology and Economics (Hungary); Jiri Hosek, Archeologický ústav AV CR, Praha, v.v.i. (Czech Republic); Francesco Grazzi, Consiglio Nazionale delle Ricerche, Istituto di Fisica Applicata “Nello Carrara” (Italy) ....... 11058-41
Terahertz time domain imaging and optical coherence tomography for the subsurface noninvasive inspection of a 21st Dynasty Egyptian coffin, Corinna Ludovica Koch Dandolo, Ctr. de Recherche et de Restauration des Musées de France (France); Lucie Brunel-Duverger, Ctr. de Recherche et de Restauration des Musées de France (France) and Univ. de Cergy-Pontoise (France); David Giovannacci, Lab. de Recherche des Monuments Historiques (France); Ruven Pillay, Ctr. de Recherche et de Restauration des Musées de France (France); Maxime Lopez, Ctr. de Recherche et de Restauration des Musées de France (France); Xueshi Bai, Ctr. de Recherche et de Restauration des Musées de France (France) and Muséum national d’Histoire naturelle, Ctr. de Recherche sur la Conservation (France); Sandrine Pagès-Camagna, Ctr. de Recherche et de Restauration des Musées de France (France); Nancy Brodie-Linder, Univ. de Cergy-Pontoise (France) and Lab. Léon Brillouin (France); Michel Menu, Vincent Detalle, Ctr. de Recherche et de Restauration des Musées de France (France). .............................. 11058-42
Integrating LIBS LIF Raman into one multispectroscopic mobile device for in situ cultural heritage analysis, Xueshi Bai, Ctr. de Recherche et de Restauration des Musées de France (France) and Ctr. de Recherche sur la Conservation (France); Mohamed Oujja, Mikel Sanz, Consejo Superior de Investigaciones Científicas (Spain); Maxime Lopez, Corinna Ludovica Koch Dandolo, Ctr. de Recherche et de Restauration des Musées de France (France) and Fondation des Sciences du Patrimoine (France); Marta Castillejo, Consejo Superior de Investigaciones Científicas (Spain); Vincent Detalle, Ctr. de Recherche et de Restauration des Musées de France (France). .... 11058-43
Micro-Raman spectroscopy and THz time domain spectroscopic imaging of ‘Pietra Dura’ marble inlay work resembling Taj Mahal architectural motifs, Amartya Sengupta, Indian Institute of Technology Delhi (India); Aparajita Bandopadhyay, Joint Advanced Technology Ctr., Indian Institute of Technology Delhi (India); Diksha Garg, Indian Institute of Technology Delhi (India). .............................. 11058-44
Multimodal Sensing and Artificial Intelligence: Technologies and Applications

Conference Chair: Ettore Stella, CNR (Italy)

Conference Co-Chairs: Shahriar Negahdaripour, Univ. of Miami (USA); Dariusz Ceglarek, The Univ. of Warwick (United Kingdom); Christian Möller, Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung (Germany)

Programme Committee: Andrei G. Anisimov, Technische Univ. Delft (Netherlands); Salah Bourennane, Institut Fresnel (France); Cosimo Distanti, Univ. del Salento (Italy); Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti "Eduardo Caianiello" (Italy); Marc P. Georges, Liège Univ. (Belgium); Antonio Lanzotti, Univ. degli Studi di Napoli Federico II (Italy); Luiz Marcos Garcia Gonçalves, UFRN (Brazil); Michele Meeo, Univ. of Bath (United Kingdom); Thomas B. Moeslund, Aalborg Univ. (Denmark); Nicola Mosca, CNR (Italy); Vito Pagliarulo, Istituto di Scienze Applicate e Sistemi Intelligenti "Eduardo Caianiello" (Italy); Clive Roberts, The Univ. of Birmingham (United Kingdom); Pierre R. Slangen, Mines Alès (France); Rocco Zito, Flinders Univ. (Australia)

WEDNESDAY 26 JUNE

SESSION 1 .......................... WED 8:10 TO 10:00
Multimodal Sensing for Surveillance

Session Chairs: Francesco Soldovieri, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Massimiliano Nolich, Univ. degli Studi di Trieste (Italy)

Multimodal surveillance systems for the continuous monitoring of heterogeneous environments and danger prevention, Massimiliano Nolich, Univ. degli Studi di Trieste (Italy) .......................................................... [11059-3]

Radar for indoor surveillance: state of art and perspectives (Invited Paper), Francesco Soldovieri, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy) .......................................................... [11059-4]

Microwave imaging through an unknown wall by a MIMO configuration and SVD approach, Raffaele Solimene, Tushar Rajvanshi, Giovanni Buonanno, Francesco Soldovieri, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Massimiliano Nolich, Univ. degli Studi di Trieste (Italy) .......................................................... [11059-5]

Radiometer effectiveness in real cases for disclosing stealth, Alexander G. Denisov, Harbin Institute of Technology (China) .......................................................... [11059-6]

Passive radar for measuring passive sensors: direct signal interference suppression on FPGA using orthogonal matching pursuit, Jean-Michel Denis, Institut Franche-Comté Electronique Mecanique Thermique et Optique (France); Weike Feng, Motoyuki Sato, Tohoku Univ. (Japan); Stephane Chretien, National Physical Lab. (United Kingdom); Ghenche Goveac, Institut Franche-Comté Electronique Mecanique Thermique et Optique (France) .......................................................... [11059-7]

SESSION 1 ..................................... WED 11:20 TO 13:10
SPIE Optimal Metrology Plenary Session

Towards a complete framework for calibration of optical surface and coordinate measuring instruments, Richard Leach, Univ. of Nottingham (United Kingdom) .......................................................... [11059-8]

POSTERS-WEDNESDAY ............... WED 13:30 TO 12:30

Conference attendees are invited to attend the Optical Metrology Poster Session 2 on Wednesday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 11:30 through 12:30 hrs on Wednesday. Poster authors, view poster presentation guidelines and set-up instructions on pages 6 and 6, at http://spie.org/v5613.xml (Follow the Special Events link).

Multibiometric systems in hospitality: methodologies and use cases in hotel scenarios, Massimiliano Nolich, Sara Cacciotti, Raoul Buicci, Walter Ukovich, Univ. degli Studi di Trieste (Italy); Francesco Soldovieri, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy) .......................................................... [11059-36]

Study of the 360° light field display, Chong Zeng, Longyan Univ. (China) .......................................................... [11059-37]

A full Stokes imaging polarimeter based on a consumer CMOS camera, Sara Pefu-Gutierrez, Santiago Royo, Univ. Politecnica de Catalunya (Spain) .......................................................... [11059-38]

Power law scaling of test error versus number of training images for deep convolutional neural networks, Vittorio Sala, IMAGE S S.p.A. (Italy) .......................................................... [11059-39]

Robot welding seam tracking system research based on image identification, Hongwei Sun, Peng Xu, Yu Han, Chao Liu, Jiangsu Automation Research Institute (China) .......................................................... [11059-40]

Research of spatial alignment techniques for multimodal image fusion, Aryan Akhmerov, Alexandr S. Vasiliev, ITMO Univ. (Russian Federation) .......................................................... [11059-41]

Predictive models for abundance estimation and distribution maps of the striped dolphin Stenella coeruleoalba and the bottlenose dolphin Tursiops truncatus in the Northern Ionian Sea (North-eastern Central Mediterranean), Vito Renò, Consiglio Nazionale delle Ricerche (Italy); Carmelo Fanizza, Jonian Dolphin Conservation (Italy); Giovanni Dimarou, Univ. degli Studi di Bari Aldo Moro (Italy); Vito Telesca, Univ. degli Studi della Basilicata (Italy); Pierluigi Dilibari, Genaro Gata, Univ. degli Studi di Bari Aldo Moro (Italy); Nicola Mosca, Consiglio Nazionale delle Ricerche (Italy); Giulia Cipriano, Roberto Carlucci, Univ. degli Studi di Bari Aldo Moro (Italy); Rosalba Muglia, Consiglio Nazionale delle Ricerche (Italy) .......................................................... [11059-42]

An electro-optical system for transverse displacement measurement with rotation parameters estimation of the measurement unit, Anh Phuong Hoang, Alexey Gorbachev, ITMO Univ. (Russian Federation) .......................................................... [11059-43]

A rapid nanotexturing of micronoeedle patch procedure for multimodal sensing and fabricating polymeric 3D arrays with biomaterials using hydrophobic elastomeric molds, Byungwon Hwang, Konkuk Univ. (Korea, Republic of) .......................................................... [11059-44]

Floor integrated optical fall detector for needy people, Ronny Maschke, Westsächsische Hochschule Zwickau (Germany) .......................................................... [11059-45]

Lunch Break .......................................................... Wed 12:30 to 13:40

JOINT SESSION ........................... WED 13:40 TO 15:30
Holography Technology

Session Chairs: Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti "Eduardo Caianiello" (Italy); Pierre R. Slangen, Mines Alès (France)

Joint Session Conference 11060

Time resolved digital holography applied to droplets fragmentation by shockwave (Invited Paper), Pierre Jaffrezic, Romain, Pierre Lauren, Zacaria Essaidi, Mines Alès (France) .......................................................... [11059-6]

Automated cell identification with 3D optical imaging (Keynote Presentation), Bahram Javid, Univ. of Connecticut (USA); Arun Anand, The Maharaja Sayajirao Univ. of Baroda (India); Timothy O’Connor, Univ. of Connecticut (USA); Inkyu Moon, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) .......................................................... [11060-38]

Imaging the competition between growth and production of self-assembled lipid droplets at the single-cell level (Invited Paper), Andreas V. Yaskevich, Hamdah Alanazi, Univ. of Idaho (USA); Andrew M. Silverman, Massachusetts Institute of Technology (USA); Amrath J. Canul, Univ. of Idaho (USA); Alice C. Dohnalkova, John B. Cliff, Pacific Northwest National Lab. (USA); Gregory Stephanopoulos, Massachusetts Institute of Technology (USA) .......................................................... [11060-39]

How holographic imaging can improve machine learning, Pasquale Memmolo, Vittorio Bianco, Pierluigi Caragni, Francesco Merola, Melanie Paturzo, Cosimo Distanti, Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti "Eduardo Caianiello" (Italy) .......................................................... [11059-7]
SESSION 2 ........................... WED 16:00 TO 18:10

Multiwavelength Light Technology

Session Chairs: Pasquale Franciosa, The Univ. of Warwick (United Kingdom); Darek J. Ceglarek, The Univ. of Warwick (United Kingdom)

Automated visual inspection of friction stir welds: a deep learning approach, Roman Hartl, Institut für Werkzeugmaschinen und Betriebssysteme, Technische Univ. München (Germany) .................................. [11059-8]

Multiwavelength light technology for multiscale closed-loop in-process quality control with application to remote laser welding (Invited Paper), Pasquale Franciosa, Darek Ceglarek, The Univ. of Warwick (United Kingdom); Salvatore Gerbino, Univ. degli Studi della Campania Luigi Vanvitelli (Italy); Antonio Lanzutti, Univ. degli Studi di Napoli Federico II (Italy) [11059-9]

Process parameter estimation for closed loop quality control of sheet metal assemblies using bayesian convolutional neural networks, Sumit Sinha, Emile Glorieux, Pasquale Franciosa, Dariusz Ceglarek, The Univ. of Warwick (United Kingdom) .................................................... [11059-10]

Model-based interfacing of large scale metrology instruments, Benjamin Montavon, Martin Peterek, Robert H. Schritt, RWTH Aachen Univ. (Germany) ................................................... [11059-11]

Concept, functionality and controller integration of a combined geometry-temperature sensor unit for the improvement of open die forging processes, Steffen Christoffersen, TU Delft (Netherlands) [11059-12]

Robust principal component analysis of ultrasonic sectorial scans for high probability of defect detection and low false alarm rate in weld inspection, Bryan Cassela, Li-Kwan Shark, Stephen Mein, Univ. of Central Lancashire (United Kingdom); Andrew Nixonn, Thomas Barber, Ray Turner, BAE Systems (United Kingdom) .................... [11059-13]

THURSDAY 25 JUNE

SESSION 3 ............................ THU 8:10 TO 10:00

Multimodal Sensing for Infrastructure Monitoring

Session Chairs: Ilaria Catapano, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Shubham Negahdaripour, Univ. of Miami (USA)

UAV radar imaging for target detection (Invited Paper), Ilaria Catapano, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Giancarmine Fasano, Alfredo Renga, Univ. degli Studi di Napoli Federico II (Italy); Giovanni Ludeno, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy) .......................................................... [11059-14]

Imaging capabilities of an airborne X-band SAR based on the FMCW technology, Antonio Natale, Carmine Esposito, Paolo Berardino, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Gianfranco Palmas, Elettra Microwave S.r.l. (Italy); Riccardo Lanari, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); Stefano Perna, Univ. degli Studi di Napoli Parthenope (Italy) ............ [11059-15]

Study of complementary multisensor data influence on infrared thermography measurements for in situ long-term monitoring, Thibaud Toullier, Institut National de Recherche en Informatique et en Automatique (France) and Institut Français des Sciences et Technologies des Transports de l’aménagement et des Reseaux (France); Jean Cuminou, Institut Français des Sciences et Technologies des Transports de l’aménagement et des Reseaux (France) and Institut National de Recherche en Informatique et en Automatique (France); Laurent Mevel, Institut de Recherche en Informatique et Systèmes Aléatoires (France) and Institut Français des Sciences et Technologies des Transports de l’aménagement et des Reseaux (France) ...................... [11059-16]

Automatic network level bridge monitoring by integration of InSAR and GIS catalogues, Luca Bianchini Ciampoli, Valerio Gagliardi, Alessandro Calvi, Fabrizio D’Amico, Univ. degli Studi di Roma ‘Tor Vergata’ (Italy); Fabio Testi, Univ. of West London (United Kingdom) .......................................... [11059-17]

Methodology for utilization of a generalised antenna in gprMax simulator, Sumona Chatterjee, Amitabha Bhattacharya, Indian Institute of Technology Kharagpur (India); Swati Duggal, Space Applications Ctr. (India) ........................................ [11059-18]

SESSION 4 ............................. THU 10:30 TO 12:10

Hyperspectral Imaging Applications

Session Chairs: Salah Bourennane, Ecole Centrale de Marseille (France); Nicola Mosca, Consiglio Nazionale delle Ricerche (Italy)

Palm-sized and tough two-dimensional spectroscopic image: the so-called hyperspectral camera for visible and mid-infrared light, Proposal of plant-species identification regardless of zenith and azimuth angles based on only two types of basic spectroscopic data (near-surface and internal reflectance), Hanyue Kang, Natsume Kawashima, Soras Mizutani, Tomoya Kizuki, Satoru Adachi, Jyunia Iwaya, Kotone Yokoyama, Ichiro Ishihara, Kagawa Univ. (Japan) .......................................................... [11059-31]

Unsupervised hyperspectral image classification based on band selection and 3D generative adversarial network, Qiaoqiao Sun, Salah Bourennane, Ecole Centrale de Marseille (France) ......................... [11059-32]

Target detection based on classification in shadow region of hyperspectral image, Xuefeng Liu, Congcong Wang, Qingdao Univ. of Science and Technology (China); Min Fu, Ocean Univ. of China (China); Salah Bourennane, Institut Fresnel (France) and Ecole Centrale de Marseille (France) .......................................................... [11059-33]

Overview of tensor-based processing methods to improve classification and detection results in hyperspectral images, including the case of signal dependent noise and small targets, Caroline Fossati, Salah Bourennane, Institut Fresnel (France) .................................................. [11059-34]

Hybrid spectroscopic microscopy for the characterization of dried DNA samples, Vassilis M. Papadakis, George Kenanakis, Foundation for Research and Technology-Hellas (Greece) ........................................ [11059-35]

Lunch Break

SESSION 5 ............................ THU 12:10 TO 13:20

Machine Learning Applications

Session Chairs: Cosimo Distante, Univ. del Salento (Italy); Luiz Marcos Garcia Goncalves, UFRN (Brazil)

Multimodal data fusion for object recognition, Vladimir A. Knyaz, GosNIIAS (Russian Federation) .......................................................... [11059-19]

Deep learning approaches to EEG feature extraction (Invited Paper), Francesco Carlo Morabito, Univ. Mediterranea di Reggio Calabria (Italy) ....................................................... [11059-20]

Challenges of hand recognition and interpretation for a manual assembly assistance system, Christian Jauch, Martin Root, Fraunhofer-Institut für Produktionstechnik und Automatisierung (Germany) ........................................ [11059-21]

Convolutional neural networks for recognition and segmentation of aluminum profiles, Pier Luigi Mazzeo, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy); Federico De Luca, Univ. del Salento (Italy); Arturo Argentieri, Paolo Spagnozzi, Marco Leo, Pierluigi Carcagni, Cosimo Distante, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy) .................................................. [11059-22]

Scene disparity estimation with convolutional neural networks, Essa Anas, Bogdan Matuszewski, Univ. of Central Lancashire (United Kingdom) [11059-23]

Image quality evaluation and CNN segmentation of thermal cutting edge using a mobile device, Omar De Miti, Univ. del Salento (Italy); Janek Stahl, Christian Jauch, Fraunhofer-Institut für Produktionstechnik und Automatisierung (Germany); Cosimo Distante, Univ. del Salento (Italy) ....................................................... [11059-24]

SESSION 6 ............................. THU 16:00 TO 18:30

Multimodal Sensing Applications

Session Chairs: Andrei G. Anisimov, Technische Univ. Delft (Netherlands); Michele Meo, Univ. of Bath (United Kingdom)

Hyperspectral image segmentation based on the estimation of the multispectral subspace dimension, Pierre Delmas, Caroline Fossati, Salah Bourennane, Ecole Centrale de Marseille (France) .................................................. [11059-25]

Multimodal nondestructive inspection of damage composites laminate: a case study to assess the damage volume (Invited Paper), Andrei G. Anisimov, Technische Univ. Delft (Netherlands); Mariya G. Serikova, NIKP Electron, Ltd. (Russian Federation); Nan Tao, Chirag Anand, Fardin Eslair, Christos Kassapoglou, Roger M. Groves, Technische Univ. Delft (Netherlands) ......................................................................... [11059-26]

Multimodal calibration of laser optics for sensor guided remote cutting, Daniel Valencia, Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung (Germany); Benjamin Schulze, Fraunhofer-Institut für Fertigungstechnik und Materialforschung (Germany); Jörg Wollnack, Technische Univ. Hamburg-Harburg (Germany) and Fraunhofer-Institut für Fertigungstechnik und Materialforschung (Germany) [11059-27]

An effective approach for 3D point cloud registration in railway contexts, Cosimo Patruno, Roberto Coletta, Massimiliano Nitti, Ettore Stella, Consiglio Nazionale delle Ricerche (Italy) .................................................. [11059-28]

Multiple honey bees tracking and trajectory modeling, Baptiste Magnier, Behrang Moradi, Pierre R. Stangen, Faysal Bougmann, Ellyouh Gabbay, Francois Pfister, Mines Alès (France) ........................................................................ [11059-29]

New applications of electronic speckle pattern interferometry in novel materials and structures, Vito Pagliarulo, Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy) .................. [11059-30]
Optical Methods for Inspection, Characterization, and Imaging of Biomaterials IV

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 Univ. Innsbruck (Austria); Christoph K. Hitzenberger, Medizinische Univ. Wien (Austria)

Programme Committee: Luigi Ambrosio, CNR (Italy); Giuseppe Chirico, Univ. degli Studi di Milano-Bicocca (Italy); Jonathan M. Cooper, Univ. of Glasgow (United Kingdom); Diego di Bernardo, Telethon Institute of Genetics and Medicine (Italy); Alberto Diaspro, Istituto Italiano di Tecnologia (Italy); Frank Dubois, Univ. Libre de Bruxelles (Belgium); Wolfgang A. Ertmer, Leibniz Univ. Hannover (Germany); Roger Groves, Technische Univ. Delft (Netherlands); Jochen R. Guck, Technische Univ. Dresden (Germany); Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Pasquale Memmolo, Istituto di Scienze Applicate e Sistemi Intelligenti (ISASI-CNR) (Italy); Fernando Mendoza Santojo, Ctr. 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, Univ. degli Studi di Napoli Federico II (Italy); Fiorenzo Gabriele Omenetto, TU Dresden (Germany); Pablo D. Ruiz, Loughborough Univ. (United Kingdom); David D. Sampson, The Univ. of Western Australia (Australia); Natan Tzi Shaked, Tel Aviv Univ. (Israel); Claudia Tortiglione, Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy); Ruikang K. Wang, Univ. of Washington (USA); Zeev Zalevsky, Bar-Ilan Univ. (Israel)

MONDAY 24 JUNE

SESSION 1 ............................ MON 8:30 TO 10:00
Advanced Microscopy Modalities
Session Chair: Lisa Miccio, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy)
Fluorescence and scattering, a tug of war towards multimessenger optical microscopy (Keynote Presentation), Alberto Diaspro, Istituto Italiano di Tecnologia (Italy) and Univ. degli Studi di Genova (Italy) ..................................................... [11060-1]
Design and implementation of a compact high-throughput eichelle spectrometer using off-the-shelf off-axis parabolic mirrors for analysis of biological samples by LBS, Hamed Abbasi, Georg Rauter, Rafaeul Guzman, Philippe C. Cattin, Azhar Zam, Univ. Basel (Switzerland) ........................................... [11060-2]
Video rate scanning endomicroscopy through a coherent fiber bundle using a galvo scanner, Elias Scharf, Robert Kuschmier, Jürgen W. Czarnecki, TU Dresden (Germany) ..................................................... [11060-3]

PLENARY SESSION ............................. MON 10:00 TO 11:00
World of Photonics Congress-wide Plenary Session
Listening to the universe with gravitational waves, Karsten Danzmann, Max Planck Institute for Gravitational Physics and Leibniz Univ. Hannover (Germany)
See details page xx.

SESSION 2 ............................ MON 11:20 TO 12:30
Advanced Diagnostics by Speckle Techniques
Session Chair: Aydogan Ozcan, Univ. of California, Los Angeles (USA)
Secondary speckle-based tomography and tissue probing (Keynote Presentation), Ariel Schwarz, Nisan Ozana, Ran Caflia, Amir Shemer, Hadar Genish, Zeev Zalevsky, Bar-Ilan Univ. (Israel) ..................................................... [11060-5]
Detection of self-propelling bacteria by speckle correlation assessment and applications to food industry, Vittorio Bianco, Biagio Mandracchia, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy); Filomena Nazzaro, Istituto di Scienze dell’Alimentazione (Italy); Romina Rega, Pietro Ferraro, Simonetta Grilli, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy) ..................................................... [11060-6]
In-plane deformation gradient measurement using common-path spatial phase shift shearing interferometry, Hela Hooshmand-Ziafi, Masoomeh Dashtdar, Shahid Beheshti Univ. (Iran, Islamic Republic of); Khosrow Hassanii, Univ. of Tehran (Iran, Islamic Republic of) ..................................................... [11060-7]

SESSION 3 ............................ MON 13:50 TO 15:50
Digital Holography
Session Chair: Pierre P. Marquet M.D., Ctr. de Recherche de l’Univ. Laval Robert-Giffard (Canada)
Digital holography in optogenetics: a new window to the brain (Invited Paper), Jürgen W. Czarnecki, TU Dresden (Germany) ..................................................... [11060-8]
A review on optical method to assess CAD/CAM occlusal ceramic reconstructions (Invited Paper), Pascal Picart, Lab. d’Acoustique de l’Univ. du Maine (France); Michel Fages, Univ. Montpellier (France); Pierre R. Rangin, Mines Alès (France); Hailing Xiu, Kunming Univ. of Science and Technology (China); Silvio Montrésor, Lab. d’Acoustique de l’Univ. du Maine (France); Rongxin Guo, Junchang Li, Kunming Univ. of Science and Technology (China); Osama Y. Solieman, Univ. Montpellier (France); Jean-Claude Durand, Univ. of Montpellier (France) ..................................................... [11060-9]
Morphometry and spatial refractive index distribution of the retina accessed by hyperspectral quantitative phase microscopy, Álvaro Barroso Peña, Steffi Ketelhut, Peter Hedinshka, Jürgen Schneckenburger, Björn Kemper, Westfälische Wilhelms-Universität (Germany) ..................................................... [11060-10]
Matched filter applied to discriminate particles with different sizes in biological flows, Marina Gómez Climente, Julia Lobera Salazar, Virginia Palero-Díaz, M. Pilar Arroyo de Grandes, Univ. de Zaragoza (Spain); rushbeard, Jürgen Schneckenburger, Björn Kemper, Westfälische Wilhelms-Universität (Germany) ..................................................... [11060-11]
Holographic compression for metrology of biological cells: a comparative study, Gili Dardikman, Natan T. Shaked, Tel Aviv Univ. (Israel) ..................................................... [11060-12]

SESSION 4 ............................ MON 16:15 TO 17:35
Learning Approaches in Microscopy I
Session Chair: Jürgen W. Czarnecki, TU Dresden (Germany)
Toward a thinking microscope: deep learning-enabled computational microscopy and sensing, Aydogan Ozcan, Univ. of California, Los Angeles (USA) ..................................................... [11060-13]
Applications of deep learning in computational imaging (Invited Paper), Guohai Situ, Hao Wang, Fei Wang, Shanghai Institute of Optics and Fine Mechanics (China) ..................................................... [11060-14]
Identification and classification of biological micro-organisms by holographic learning, Pasquale Memmolo, Vittorio Bianco, Pierluigi Carcagni, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy); Ando Douglas Goncalves da Silva Junior, Luiz Marcos Garcia Goncalves, Univ. Federal do Rio Grande do Norte (Brazil); Francesca Schiavoni, Melanina Pasturzo, Cosimo Distante, Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caianiello” (Italy) ..................................................... [11060-15]

Abstracts for this session are forthcoming.

Conference, Session, and Paper abstracts can be found on the SPIE website at spie.org/omprogramme.
**TUESDAY 25 JUNE**

**SESSION 5 ............................ TUE 10:00 TO 11:30**

**Understanding Biomechanics by Optical Methods II**
Session Chair: Christoph K. Hitzenberger, Medizinische Univ. Wien (Austria)

Dynamic optical coherence elastography for noninvasive quantification of tissue mechanical properties (Invited Paper), Cristian Goosens, Katharina Götze, Matthias Ugele, Technische Univ. München (Germany) .................................................. [11060-18]

Boosting accessibility of diagnostic tools for 3D printing, consumer electronics, digital imaging and open source software conversion (Invited Paper), Stefano Selleri, Univ. degli Studi di Milano (Italy) .................................................. [11060-21]

Analysis of retinal and choroidal images measured by laser Doppler holography (Invited Paper), Leo Puyo, Mathias Fink, Instytut Langevin Ondes et Images (France); Michel Pâques, José-Alain Sahel, Ctr. Hospitalier National d’Ophthalmologie des Quinze-Vingts (France); Michael Allan, Institut Langevin Ondes et Images (France) .................................................. [11060-22]

**SESSION 6 ............................ TUE 10:30 TO 12:00**

**Understanding Biomechanics by Optical Methods II**
Session Chair: Christof K. Hitzenberger, Medizinische Univ. Wien (Austria)

Dynamic optical coherence elastography for noninvasive quantification of tissue mechanical properties (Invited Paper), Cristian Goosens, Katharina Götze, Matthias Ugele, Technische Univ. München (Germany) .................................................. [11060-18]

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**Posters-Tuesday .......................... TUE 12:05 TO 12:40**

Conference attendees are invited to attend the Optical Metrology Poster Session 1 on Tuesday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 12:05 and lasting until 12:40 hrs on Tuesday. Poster authors, view poster presentation guidelines and set-up instructions on page 6, and at http://spie.org/x6513.xml. (Follow the Special Events link)

Estimation of concentration and particle size distribution in colloidal suspensions via spatially resolved near-field spectroscopy, Daria Stoliaraskia, Leo Luo, Y-Chih Chen, Univ. of Strathclyde (United Kingdom) .................................................. [11060-45]

Fast nonmechanical manipulating microobjects using optical tweezers based on acousto-optic deflector, Alexander S. Machikhin, Scientific and Technological Ctr. for Unique Instrumentation (Russian Federation); Vladislav I. Batshev, Bauman Moscow State Technical Univ. (Russian Federation); Yulia Pichugina, Alexey Kozlov, Scientific and Technological Ctr. for Unique Instrumentation (Russian Federation); Vitaliy E. Puzhar, Pavel A. Nosov, George Krasin, Bauman Moscow State Technical Univ. (Russian Federation) .................................................. [11060-46]

Effect of nanoparticle polyethylene glycol surface density for biomaterials: toward redesigning the PEG surface of nanocarriers, Sungwon Hwang, Konkuk Univ. (Korea, Republic of) .................................................. [11060-47]

Optical design of infrared endoscope systems for laparoscopic surgery, Alisa S. Ekimenkova, Anna O. Voznesenskaya, ITMO Univ. (Russian Federation) .................................................. [11060-48]

Metamaterial structure for potential image processing, Hongwei Sun, Jiangsu Automation Research Institute (China) .................................................. [11060-49]

Characterization of microplastics by holographic features for automatic detection in heterogeneous samples, Vittorio Bianco, Pasquale Mummolo, Francesco Merola, Pierlugi Carragni, Melania Patuzzo, Cosimo Dinstein, Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiñelio” (Italy) .................................................. [11060-50]

In vivo skin surface study by scattered ellipsometry method, Anastasia B. Bulykina, Victoria A. Ryzhova, Valery V. Korotaev, ITMO Univ. (Russian Federation) .................................................. [11060-51]

Methods and instruments for terahertz dielectroscopic measurement of liquids and biological tissues, Vladislav Ulitko, Bauman Moscow State Technical Univ. (Russian Federation); Anseriy A. Gadvush, Nikita V. Cheomydyr, A.M. Prokhorov General Physics Institute of the RAS (Russian Federation) and Bauman Moscow State Technical Univ. (Russian Federation); Guzel R Musina, Bauman Moscow State Technical Univ. (Russian Federation) and A.M. Prokhorov General Physics Institute of the RAS (Russian Federation); Gennady A. Komandir, A.M. Prokhorov General Physics Institute of the RAS (Russian Federation); Kirill I. Zaytsev, A.M. Prokhorov General Physics Institute of the RAS (Russian Federation) .................................................. [11060-52]

Intensity favored switching of nonlinear optical absoprtion mechanism in silver nanoparticles under nanosecond pulsed laser excitation, Sharafudeen Kanayarakkal Naval Vimalapalp, Kuwait College of Science and Technology (Kuwait); Shiju E., Department of Physics, National Institute of Technology Calicut (India); Siil Narendran N.K., T. K. Madhava Memorial College (India); Chandrasekharan Keloth, National Institute of Technology Calicut (India) .................................................. [11060-53]

Local orthostatic maneuver in the optical diagnosis of peripheral blood oxygenation, Sylvester Nowocin, Wroclaw Univ. of Science and Technology (Poland) .................................................. [11060-54]

Lunch Break .................................................. Tue 12:40 to 14:00

**SESSION 7 ............................ TUE 14:00 TO 15:30**

**Phase Contrast and 3D Imaging**
Session Chair: Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Quantifying myelination at the individual axon scale using color spatial light interference microscopy (cSLIM) (Keynote Presentation), Gabriel Popescu, Univ. of Illinois (USA) .................................................. [11060-24]

Phenotypical analysis of hematological disorders for advanced label-free detection and classification by holographic microscopy, Dominik Heim, Stefan Röhrli, Christian Klenk, Klaus Diepold, Katharina Götze, Oliver Hayden, Matthias Ugele, Technische Univ. München (Germany) .................................................. [11060-25]

Phase imaging of free-standing thin films for biomaterials engineering, Vincenzo Ferraro, Univ. degli Studi di Napoli Federico II (Italy); Zhe Wang, Bejing Univ. of Technology (China); Biagio Mandracci, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiñelio” (Italy); Ernesto Di Maio, Pier Luca Maffettone, Univ. degli Studi di Napoli Federico II (Italy) .................................................. [11060-26]

Automatic calibration of the spatial position and orientation for the tomographic digital holographic microscopy, Li-Chien Lin, Feng Chia Univ. (Taiwan); Chau-Jen Cheng, National Taiwan Normal Univ. (Taiwan); Yu-Chun Hu, Feng Chia Univ. (Taiwan) .................................................. [11060-27]

**SESSION 8 ............................ TUE 16:00 TO 17:30**

**Learning Approaches in Microscopy II**
Session Chair: Piero Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiñelio” (Italy)

Optical imaging using learning techniques (Keynote Presentation), Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) .................................................. [11060-28]

Deep learning for analysis and synthesis of dense and multicolor localization microscopy (Invited Paper), Elias Nehme, Eran Hershko, Lucien E. Weiss, Tomer Michaeli, Yoav Shechtman, Technion-Israel Institute of Technology (Israel) .................................................. [11060-29]
WEDNESDAY 26 JUNE

SESSION 9 .......................... WED 8:30 TO 10:00

Advanced Biosensors

Session Chair: Andreas E. Vasdekis, Pacific Northwest National Lab. (USA)

- **Ultralarge scale single-cell image-based biophysical phenotyping: opportunities and challenges (Keynote Presentation),** Kevin K. Tsia, The Univ. of Hong Kong (Hong Kong, China) ........................................... {11060-31}
- **Advanced label-free cellular identification in flow by collaborative coherent imaging techniques,** David Dannhäuser, Domenico Rossi, Istituto Italiano di Tecnologia (Italy); Maria Isabella Mareronti, Univ. degli Studi di Napoli Federico II (Italy) .................. {11060-32}
- **Optical lensless microscopy using vertical scanning,** Andreas E. Vasdekis, Pacific Northwest National Lab. (USA); Gregory Stephanopoulos, Massachusetts Institute of Technology (USA); Amirbahador Zeynali, Mines Alès (France) .................................................. {11060-39}

SESSION 10 .......................... WED 11:30 TO 12:40

Thermal Imaging for Medicine and Biotechnology

Session Chair: Giuseppe Chirico, Univ. degli Studi di Milano-Bicocca (Italy)

- **Photo-activated thermal imaging at subdiffraction resolution (Invited Paper),** Margaux Bouzin, Mario Marini, Amirbahador Zeynali, Univ. degli Studi di Milano Bicocca (Italy); Laura Sironi, Laura D’Alfonso, Francesca Mingozzi, Francesca Granucci, Giuseppe Chirico, Maddalena Collini, Univ. degli Studi di Milano-Bicocca (Italy) ........................................... {11060-35}
- **Sources of uncertainty in the evaluation of thermal images in medicine,** Kurt Ammer M.D., European Association of Thermology (Austria) ........................................... {11060-36}
- **Toward single cell thermal biology,** Guillaume Baffou, Institut Fresnel (France) ........................................... {11060-37}
- **Lunch Break ...........................................** Wed 12:40 to 13:40

SESSION 11 .................................. WED 16:00 TO 18:00

Phase Contrast Tomography: New Trends

Session Chair: Christoph K. Hüttenberger, Medizinische Univ. Wien (Austria)

- **Quantitative phase imaging and artificial intelligence (Keynote Presentation),** Geon Kim, KAIST (Korea, Republic of); Hyungjoo Cho, Tomocube, Inc. (Korea, Republic of); Donghun Ryu, KAIST (Korea, Republic of); Hyunsook Min, Tomocube, Inc. (Korea, Republic of); YongKeun Park, KAIST (Korea, Republic of) .......................... {11060-40}
- **Fast label-free optical diffraction tomography compatible with conventional wide-field microscopes (Invited Paper),** Jose A. Rodrguez, Juan M. Soto, Tatiana Alvea, Univ. Complutense de Madrid (Spain) .................. {11060-41}
- **Holographic processing pipeline for tomographic flow cytometry,** Francesco Merola, Pasquale Memmolo, Lisa Miccio, Martina Mugnano, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy); Massimiliano M. Villone, Pier Luca Maffettone, Univ. degli Studi di Napoli Federico II (Italy); Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy) .................. {11060-42}
- **Holographic imaging of erythrocytes in acoustofluidic platforms,** Teresa Cacace, Pasquale Memmolo, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy); Massimiliano M. Villone, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy); Massimiliano M. Villone, Pier Luca Maffettone, Univ. degli Studi di Napoli Federico II (Italy); Marco De Corato, Imperial College London (United Kingdom); Melanie Paturzo, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy); Pietro Ferraro, Istituto di Scienze Applicate e Sistemi Intelligenti “Eduardo Caiainello” (Italy) .................. {11060-43}
- **BM3D filtration in holographic tomography reconstruction,** Piotr Stepien, Michał Ziemczonok, Arkadiusz T. Kuś, Małgorzata Kujawinska, Warsaw Univ. of Technology (Poland) ........................................... {11060-44}

PLENARY SESSION ............. WED 10:30 TO 11:25

SPIE Optical Metrology Plenary Session

Towards a complete framework for calibration of optical surface and coordinate measuring instruments

Richard Leach, Univ. of Nottingham (United Kingdom)

For details, please see page 5.
CONFERENCE 11061
Thursday 27–27 June 2019 • Proceedings of SPIE Vol. 11061

Automated Visual Inspection and Machine Vision III

Conference Chairs: Jürgen Beyerer, Fraunhofer-Institut für Optonik, Systemtechnik und Bildauswertung IOSB (Germany); Karlsruher Institut für Technologie (Germany); Fernando Puente León, Karlsruher Institut für Technologie (Germany)

Programme Committee: Christian Frese, Fraunhofer-Institut für Optonik, Systemtechnik und Bildauswertung (Germany); Andreas Heinrich, Hochschule Aalen (Germany); Michael Heizmann, Karlsruher Institut für Technologie (Germany); Bernd Jähne, Ruprecht-Karls-Universität Heidelberg (Germany); Thomas Längle, Fraunhofer-Institut für Optonik, Systemtechnik und Bildauswertung (Germany); Markus Maurer, VITRONIC Dr.-Ing. Stein Bildverarbeitungssysteme GmbH (Germany); Wolfgang Osten, Universität Stuttgart (Germany); Felix Salazar, Universidade Politécnica de Madrid (Spain); Robert Schmitt, Fraunhofer-Institut für Produktions-technologie (Germany); Hugo Thiennout, Vrije Universiteit Brussel (Belgium); Stefan Welring, Duale Hochschule Baden-Württemberg (Germany); Ernst Wiedemann, Serious Enterprises (Germany); Volker Willert, Technische Universität Darmstadt (Germany)

THURSDAY 27 JUNE

SESSION 1 ............................... THU 10:30 TO 11:30
Image Acquisition
Session Chair: Jürgen Beyerer, Fraunhofer-Institut für Optonik, Systemtechnik und Bildauswertung (Germany)

A simulation framework for the design and evaluation of computational cameras, Thomas Nürnberg, Maximilian Schambach, David Uhlig, Fernando Puente León, Michael Heizmann, Karlsruher Institut für Technologie (Germany) ............................................. [11061-1]
Robust phase unwrapping based on non-coprime fringe pattern periods for defocometry measurements, Stephan Allgeier, Ulrich Gengenbach, Bernd Köhler, Klaus-Martin Reichert, Velt Hagenmeyer, Karlsruher Institut für Technologie (Germany) ............................................. [11061-2]
Coded aperture imaging of high-energy radiation: modeling and primary experimental research, Anna V. Vasiliev, Aleksandr S. Vasiliev, Victoria A. Rykova, ITMO University (Russia) ............................................. [11061-3]

POSTERS-THURSDAY.......................... THU 11:30 TO 12:30

Conference attendees are invited to attend the Optical Metrology Poster Session on Thursday. Come view the posters and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Posters will be available for viewing starting at 11:40 through 12:40 hrs on Thursday. Poster authors, view poster presentation guidelines and set-up instructions on page 6, and at http://spie.org/x6513.xml. (Follow the Special Events link)

Region of interest detection based on visual saliency analysis and iteratively clustering for remote sensing images, Yang Sun, Shuang Wang, Libao Zhang, Beijing Normal University (China) ............................................. [11061-8]
Region proposal-based semantic matcher, Vladimir S. Gorbatsevich, Boris V. Vishnyakov, Yuri Viziter, Anastasia Moiseenko, GosNIIAS (Russian Federation) ............................................. [11061-9]

THU 12:30 TO 13:40
Lunch Break ..................................... Thu 12:30 to 13:40

SESSION 2 ..................................... THU 13:40 TO 15:00
Inspection, Measurement, and Control
Session Chair: Fernando Puente León, Karlsruher Institut für Technologie (Germany)

On the use of stereovision system carried by UAV to obtain 3D measurements of spreading fires, Lucile L. Rossi, Vito Ciullo, Antoine Pieri, Univ. di Corsica Pasquale Paoli (France) ............................................. [11061-4]
An advanced method for matching partial 3D point clouds to freeform CAD models for in situ inspection and repair, Bilal Nasser, Rolls-Royce Power Engineering plc (United Kingdom) ............................................. [11061-5]

Optical inspection of noncooperative copper surface structures using multi- and hyperspectral acquisition systems, Markus Wrieden, Andreas Breitbarth, Technische Universität Ilmenau (Germany); Manuel Zimmermann, Jörg Schambach, GOPEL electronic GmbH (Germany); Maik Rosenberger, Technische Universität Ilmenau (Germany); Gunther Notni, Technische Universität Ilmenau (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany) ............................................. [11061-6]
Automated inspection of optical surface cleanliness, Daniel Kießhaber, Peter Würtz, Fabian Etzold, Willi Maurer, Jean-Michel Asfouri, Diopptic GmbH (Germany) ............................................. [11061-7]
GENERAL INFORMATION

Registration

Onsite Registration and Badge Pick-up Hours
ICM Foyer West
Sunday 23 June · 7:30 to 17:30 hrs.
Monday 24 June · 7:30 to 17:00 hrs.
Tuesday 25 June · 8:00 to 17:00 hrs.
Wednesday 26 June · 8:30 to 17:00 hrs.
Thursday 27 June · 8:30 to 16:00 hrs.

Conference Registration
Includes admission to all conference sessions, plenaries, panels, and poster sessions, admission to the AR/VR headset demonstrations, admission to the Laser World of Photonics Exhibition, Welcome Reception, coffee breaks, and a choice of online proceedings.

Early Registration Pricing and Dates
Conference registration prices increase by €90 after 3 June 2019. The online form will automatically display the increased prices.

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• SPIE Members receive conference registration discounts. Discounts are applied at the time of registration.
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Monday through Thursday · Open during registration hours

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All symposium attendees are invited to attend Digital Optical Technologies and Optical Metrology Joint Poster Sessions provided as an opportunity to enjoy networking while reviewing poster papers.

Please note that the Digital Optical Technologies Conference Poster Session (Conf. 10335) has been scheduled as part of the Wednesday Poster Session 2, and will run from 13:00 to 14:00 hrs.

**TUESDAY POSTER SESSION 1:** Conf. 11056, 11058, 11060 (Optical Metrology)

**WEDNESDAY POSTER SESSION 2:** Conf. 11057, 11059 (Optical Metrology), 11062 (Digital Optical Technologies)

**THURSDAY POSTER SESSION 3:** Conf. 11061 (Optical Metrology)

Attendees are encouraged to review the high-quality papers and interact with the poster authors. Poster authors must be present at their posters at the Poster Session times designated for their conference to answer questions and interact with the poster session audience. Attendees are requested to wear their conference registration badges to the poster sessions.

Please see below for specific conference poster session timing.

**Tuesday 25 June · Poster Session 1**
- Optical Metrology, Conf. 11056 (Opt. Measurement Systems-Industrial Inspection): 13:00 to 14:20
- Optical Metrology, Conf. 11058 (Optics for Arts, Architecture, and Archaeology): 12:30 to 13:10

**Wednesday 26 June · Poster Session 2**
- Digital Optical Technologies, Conf. 11062: 13:00 to 14:00
- Optical Metrology, Conf. 11057 (Modeling Aspects in OM): 11:30 to 12:40
- Optical Metrology, Conf. 11059 (Multimodal Sensing and Artificial Intelligence: Technologies and Applications): 11:30 to 12:40

**Thursday 27 June · Poster Session 3**

**Set up and removal times for each of the Poster Session days.**
Your poster may be displayed any time after setup time and must be removed by the break-down time noted below.

**Tuesday 27 June** - Conf. 11056, 11058, 11060
Setup—Monday, 13:00 hrs; Break-down—Tuesday, 17:00 hrs

**Wednesday 28 June** - Conf. 11057, 11059, 11062
Setup—Wednesday, 10:00 hrs; Break-down—Wednesday, 17:00 hrs

**Thursday 29 June** - Conf. 10334
Setup—Thursday, 9:30 hrs; Break-down—Thursday, 16:30 hrs

Poster presenters may post their poster papers starting at the announced times for each conference, and present them during their respective conference Poster Session. Any papers left on the boards following the poster removal time will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of the Poster Session. Poster authors should be at their papers during their assigned times to answer questions from attendees.

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Digital Optical Technologies

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                        Bernd Bodermann, Karsten Frenner, Richard M. Silver |
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                        Roger Groves, Haida Liang |
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                        Pietro Ferrara, Monika Ritsch-Marte, Simonetta Grilli,  
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                        Jürgen Beyener, Fernando Puente León |

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Personal belongings should not be left unattended in meeting rooms or public areas. Unattended items are subject to removal by security. SPIE is not responsible for items left unattended.

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At most events, SPIE provides wireless access for attendees. Properly secure your computer before accessing the public wireless network. SPIE is not responsible for computer viruses or other computer damage.

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Smoking, including e-cigarettes, is not permitted at any SPIE event.

Agreement to Hold Harmless

Attendee agrees to release and hold harmless SPIE from any and all claims, demands, and causes of action arising out of or relating to your participation in the event you are registering to participate in and use of any associated facilities or hotels.

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