

2017

OPTICAL METROLOGY CALL FOR PAPERS

Call for Papers

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**26-29 June 2017
Internationales Congress Center
Munich, Germany**

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

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Welcome to Munich!

Take this opportunity to share your research at SPIE Optical Metrology 2017. 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, videometrics, 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 modeling, 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 2017 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**
- **Videometrics, Range Imaging 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 2017.

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Abstracts Due:

19 DECEMBER 2016

Author Notification:

18 FEBRUARY 2017

Manuscripts Due:

15 APRIL 2017

Post-meeting Manuscripts Due:

27 MAY 2017

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PLEASE NOTE:

Authors are encouraged to include figures and diagrams in a supplemental file to illustrate the concepts outlined in the abstract.

If submitting abstract with figures and graphs in the supplemental file format, please be aware that this submission is optional and needs to be made IN ADDITION to the plain-text only abstract and following the online instructions at the time of submission.

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Optical Measurement Systems for Industrial Inspection (OM101)

Conference Chairs: **Peter Lehmann**, Univ. Kassel (Germany)

Conference Co-Chairs: **Wolfgang Osten**, Univ. Stuttgart (Germany); **Armando Albertazzi Gonçalves Jr.**, Univ. Federal de Santa Catarina (Brazil)

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This conference addresses optical metrology methods and their application to solve measurement problems in industrial design, production engineering, and process monitoring. Relevant applications range from the optical inspection of large scale industrial components to the investigation of microsystems and nanostructures involving both, optical and technical surfaces. Special emphasis shall be placed on the implementation of new methods, algorithms and sensor components into complete measurement systems. The design and implementation of powerful and robust optical systems close-to-production is of general interest. Furthermore, new approaches related to resolution enhancement and uncertainty reduction of optical measurement systems, as well as their implementation and application are in the focus of this conference. Scientific contributions concerning one of the following topics are greatly appreciated.

The Conference intends to organize a joint session dedicated to the metrology of advanced optical components and systems together with the EOS Conference on Manufacturing and Testing of Optical Components.

GENERAL ITEMS

- optical metrology
- reliable and robust measurement systems
- process integrated and in-process measurement and inspection
- resolution enhancement
- metrology for efficient use of resources
- measurement uncertainty.

METHODOLOGY AND TECHNIQUES

- interferometry
- holographic and speckle techniques
- Moire and structured illumination techniques
- deflectometry
- 3D microscopy
- hyperspectral techniques
- confocal and focus scanning techniques
- coherence scanning, time-of-flight techniques

Continued

Optical Measurement Systems for Industrial Inspection *continued*

- Terahertz techniques
- light scattering techniques
- diffraction-based analysis
- reconstruction/retrieval algorithms and approaches
- advanced image and signal processing
- digital image correlation techniques
- fiber and micro-optical sensors
- smart sensors
- multisensor approaches and sensor fusion
- multimodal inspection and measurement techniques.
- measurement of precision components
- shape measurement/reverse engineering
- nondestructive testing and fault detection
- thickness measurement
- inspection of functional surfaces
- stress and vibration analysis
- inspection of components for renewable energy systems
- inspection of large-scale objects
- high-speed measurement/high volume production
- remote technologies
- determination of material properties and parameters.

APPLICATIONS

- micro-, nanostructure, and roughness measurement



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Modeling Aspects in Optical Metrology (OM102)

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Programme Committee: **Markus Bär**, Physikalisch-Technische Bundesanstalt (Germany); **Jörg Bischoff**, Osires Optical Engineering (Germany); **Harald Bosse**, Physikalisch-Technische Bundesanstalt (Germany); **Sven Burger**, Konrad-Zuse-Zentrum für Informationstechnik (Germany); **Peter Evanschitzky**, Fraunhofer-Institut für Integrierte Systeme und Bauelementetechnologie IISB (Germany); **Christian Hafner**, ETH Zürich (Switzerland); **Wolfgang Holzapfel**, DR. JOHANNES HEIDENHAIN GmbH (Germany); **Bernd H. Kleemann**, Carl Zeiss AG (Germany); **Wolfgang Osten**, Institut für Technische Optik (Germany); **Andreas Rathsfeld**, Weierstrass-Institut für Angewandte Analysis und Stochastik (Germany); **Thomas Scherübl**, Carl Zeiss SMS GmbH (Germany); **Patrick Schiavone**, Aselta Nanographics (France); **Irwan D. Setija**, ASML Netherlands B.V. (Netherlands); **Michael Totzeck**, Carl Zeiss AG (Germany); **Jari Turunen**, Univ. of Eastern Finland (Finland); **Frank Wyrowski**, Friedrich-Schiller-Univ. Jena (Germany)

This conference will focus on modelling aspects in optical metrology as a prerequisite for traceable and comparable measurements. One important topic is the development and verification of methods to describe the interaction of light with matter for quantitative characterization of micro- and nanostructures. The verification of these methods often relies on comparison measurements with independent metrology methods, thus so called cross-calibration techniques are of interest, too. Relevant applications range from optical metrology and inspection of nanostructures on masks and wafers in semiconductor and display production to the investigation of grating structures and grating-based devices. In most of the applications nanometer or sub-nanometer measurement uncertainties are required. Thus complex and increasingly challenging metrology applications emphasise even more the importance of error modelling for optical systems. Special emphasis shall be placed on the description and modelling of new methods, algorithms, components or complete measurement systems.

- optical metrology
- image modelling
- modelling of sensor response, parametric modelling
- modelling of optical metrology systems
- critical dimension (CD) metrology
- novel microscopy methods
- near-field modelling
- super-resolution
- reference metrology
- measurement uncertainty and error modelling in optical systems
- multiprobe characterization
- cross-calibration techniques

- hybrid metrology applications
- scatterometry (from IR, VIS and UV to X-Ray)
- ellipsometry and Mueller polarimetry
- inverse problems in optics
- Maxwell equation solving algorithms
- Maxwell solution databases and related stitching methods
- algorithms for real 3D simulations
- modelling of material properties in optics
- modelling of polarization effects
- optimization for diffractive optical elements
- determination of optical constants
- shape metrology of critical features
- placement and registration metrology
- alignment and overlay metrology
- metrology for multi patterning/exposure and EUV lithography
- metrology for lithographic masks
- modelling of line edge roughness
- phase metrology, phase retrieval techniques
- flatness metrology, deflectometry
- high-precision interferometry
- high-precision displacement metrology
- grating characterization and modelling
- optical scattering on nanoparticles
- time dependent phenomena
- modelling of ultrafast processes
- surface enhanced Raman scattering
- new materials, metamaterials, photonic crystals.

The Conference will organize a joint session together with the CLEO/Europe-EQEC Conference dedicated to modern approaches in computational photonics for metrology.

O3A: Optics for Arts, Architecture, and Archaeology (OM103)

Conference Chairs: **Luca Pezzati**, CNR–National Institute of Optics (Italy); **Piotr Targowski**, Nicolaus Copernicus Univ. (Poland)

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The SPIE optical metrology conference devoted to methods of examination of heritage objects – O3A: Optics for Arts, Architecture and Archaeology – is coming to its eight edition. O3A is an established event for discussing advanced methodologies and new instruments for the study, documentation, safeguarding, preservation and conservation of the heritage. The symposium will be an ideal place to introduce new applications, to exchange ideas and to discuss methods and best practices for optics applied to heritage science.

Submissions are expected to target new techniques, experimental applications and/or case-studies where the integration of concurrent diagnostic approaches plays a key role. We expect to discuss techniques, applications and studies of optical methods, such as: multi-photon microscopy; optical coherence tomography; imaging spectroscopy (multi-spectral and hyper-spectral imaging); terahertz imaging, time-resolved fluorescence imaging, 3D analyses (laser triangulation, time-of-flight, structured light and more image-based methods), spectroscopy (infrared, LIBS, LIF, Raman), holography, interferometry, colorimetry, laser cleaning methods and many more.

A special session of the conference will be devoted to presenting advanced methods, instruments and facilities to be used in the upcoming European Research Infrastructure for Heritage Science (www.e-rihs.eu).

Contributions are welcome and will be considered in all fields of research for cultural and natural heritage including the following areas of interest:

- surface examination and analysis
- structure and material analyses
- stratigraphic and depth-resolved methods
- multimodal analyses and imaging
- 3D imaging, scanning, topography and tomography
- image processing and digital data processing methods
- new portable instruments for in situ applications
- integrated techniques and case studies
- new methods and applications for restoration.

Videometrics, Range Imaging, and Applications (OM104)

Conference Chairs: **Fabio Remondino**, Fondazione Bruno Kessler (Italy); **Mark R. Shortis**, RMIT Univ. (Australia)

Programme Committee: **Jean-Angelo Beraldin**, National Research Council Canada (Canada); **Jan Boehm**, Univ. College London (United Kingdom); **Werner Boesemann**, AICON 3D Systems GmbH (Germany); **Simon Buckley**, Ctr. for Integrated Petroleum Research (Norway); **Takashi Fuse**, The Univ. of Tokyo (Japan); **Gabriele Guidi**, Politecnico di Milano (Italy); **Stephen A. Kyle**, University College London (United Kingdom); **Derek D. Lichti**, Univ. of Calgary (Canada); **Thomas Luhmann**, Jade Hochschule (Germany); **Jon P. Mills**, Newcastle Univ. (United Kingdom); **Norbert Pfeifer**, Technische Univ. Wien (Austria); **Stuart Robson**, Univ. College London (United Kingdom); **David Stoppa**, Fondazione Bruno Kessler (Italy); **Isabella Toschi**, Fondazione Bruno Kessler (Italy); **Patrick Westfeld**, TU Dresden (Germany); **Michael Yang**, Univ. Twente (Netherlands)

For more than two decades the Videometrics conference series has been providing a unique forum for photogrammetry, computer vision, 2D and 3D image analysis and vision metrology researchers, developers and practitioners to present the latest advances in precise 3D measurement and accurate modeling from imaging and range sensors. This conference was originally focused on the metric performance of sensors and algorithms to produce the most accurate and reliable geometric measurements and models. Topics such as sensor calibration, performance evaluation and accurate object reconstruction were dominant. For some years this has been expanded to encompass all phases of precise 3D optical and range imaging for the accurate and reliable modeling of real scenes, including the design of sensors and systems, automation of data collection and processing, improving the visual quality and realism, visualization, animation and data management for real-time manipulation. This is in response to the fast growing interest in processing and modeling technology and the increasing demands of accurate 3D models in applications such as industrial inspection, material and component testing, virtual museums, 3D documentation of cultural heritage scenarios, motion analysis, marketing and tourism, human body modeling, maritime sciences, medicine and the exploration of remote and hazardous sites, just to name a few.

We invite submission of original research contributions, as well as demonstrations of successful applications in, but not limited to, the following technical areas:

3D SENSING, CHARACTERISATION AND CALIBRATION

- 3D sensors and scanning devices (including both passive imaging and active range-imaging), sensor design, systems and methods
- mobile and handheld 3D devices and complementary 6DoF sensors
- advances in practical and automatic calibration and orientation techniques
- automatic data acquisition and strategies for next best view planning
- aerial, terrestrial and underwater, remote and autonomous, platforms
- sensor integration and data fusion
- accuracy and performance evaluation: test objects, methodologies, facilities and standards
- certification and acceptance of optical technologies.

3D PROCESSING AND MODELING

- precise object, site and complex environment 3D digitization
- image- and range-based 3D modeling
- fringe projection, coded light, white light scanning and phase shift techniques
- assessment of model quality (including view registration and surface modeling)
- automatic matching and segmentation of structured and unstructured scenes
- local, semi-global and global matching strategies
- multi-view registration and integration
- 3D model optimization
- modeling of deformable surfaces
- medical image analysis
- automation and process control
- deformation measurement and analysis.

Continued

Videometrics, Range Imaging, and Applications *continued*

MOTION CAPTURE AND ANIMATION

- capture, storing, archiving, analysis and display of image sequences
- automated systems and platforms for image capture
- image matching and tracking in motion analysis and surface deformation
- high speed imaging and real time analysis.

VISUALIZATION

- hybrid image- and model-based rendering
- multiresolution 3D representations
- texture acquisition and integration
- viewpoint/illumination dependent texture mapping
- realistic rendering representations and techniques
- remote rendering and web visualization of 3D models.

3D APPLICATIONS

- 3D applications of Videometrics and Range Imaging in engineering, cultural heritage, entertainment, geosciences, in the natural and built environment, and in medical and biological sciences, demonstrating the research, development and operation of the techniques are highly welcome.

The Programme Committee will accept both full papers for peer review and abstract submissions for professional papers (not peer reviewed).

PLEASE NOTE: Full papers must be no more than 8 pages in length and must adhere to the specified format for SPIE publications. Style templates are available here: <http://spie.org/x5258.xml>

Abstracts should be a minimum of 500 and a maximum of 1000 words (approximately 1-2 pages of single-spaced 12 point font). Authors are encouraged to include figures and diagrams in a supplemental file to illustrate the concepts outlined in the abstract.

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Optical Methods for Inspection, Characterization, and Imaging of Biomaterials (OM105)

Conference Chairs: **Pietro Ferraro**, CNR-Institute of Applied Sciences and Intelligent Systems “Eduardo Caianiello” (Italy); **Simonetta Grilli**, CNR-Institute of Applied Sciences and Intelligent Systems “Eduardo Caianiello” (Italy); **Monika Ritsch-Marte**, Medizinische Univ. Innsbruck (Austria); **Christoph K. Hitzberger**, Medizinische Univ. Wien (Austria)

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Biocompatible materials (or “Biomaterials”) are substances that are intended to interact with biological systems. For the safe and reliable function of implants, materials are as important as form. Surfaces may require appropriate coatings or functionalization. Therefore the last two decades have seen strong advancements in biomaterials and related science, with capital investments and research efforts into the development of new products in several fields of applications. Biomaterials science embraces several disciplines such as medicine, biology, chemistry, tissue engineering and materials science.

When a new material is designed and created or optimized and adopted for some application process, proper characterization is of paramount importance. The need of imaging and metrological tools is very important in defining and measuring properties of the materials from different points of view: morphological signature and their evolutions, mechanical properties (stress and strain analysis), surface characterization, reaction to stimulus, degradation, assembling, and many more.

INNOVATIVE ASPECTS

Optical techniques have some advantageous features: they are largely non-invasive, non-contact, possibly have a large field of view and high spatial resolution and very high sensitivity for measuring and evaluating most of physical and material parameters. This gives them a prominent role among diagnostic tools. The requirements

depend on the situation, varying substantially from single cell and tissue engineering to complex biological systems or components.

In analogy to what occurred in „Photomechanics“ which furnished many decisive answers in the past 40 years, in a variety of engineering problems (in materials engineering, testing and characterization of components and structures for aerospace, automobile industry, optics and micromechanics industries), optical metrology can provide answers for emerging problems and key issues in biomaterials research.

INTENTION

The intention of this conference is to bring together researchers working in the emerging fields of biomaterials, either at microscopic or at macroscopic scale. The conference will provide a rare platform for detailed exchange between groups working on the development of “biomaterials” and experts in “optical metrology”, in order to promote and stimulate stronger interaction between these topics. We plan to invite experts from very different areas, who are usually not attending the same conferences, and we expect new collaborations to come into being from these encounters.

The emphasis of the conference lies on the development of new and smart diagnostic metrological tools of biomaterials, to furnish quantitative data to optimize engineering design, fabrication and characterization of biomaterials.

Continued

Optical Methods for Inspection, Characterization, and Imaging of Biomaterials *continued*

EXPECTED TOPICS AMONG CONTRIBUTIONS INCLUDE:

- characterization of implantable devices and their materials
- visualization and evaluation of self-assembly processes at the nanoscale/microscale of biological/polymeric matter
- biocompatible polymers and their characterization
- biodegradable polymers and their characterization
- mechanical strength, strain, optical and other bone property
- measurements polymer scaffold characterization for tissue engineering
- single cell mechanics, cell motility, cell adhesion and morphological evolution and correlation to biomechanisms and cell fate
- collagen and other tissue investigation
- optics of the eye and vision correction (i.e. characterization of intraocular lenses)
- materials for dental applications
- diagnostic systems on innovative phase-contrast imaging
- optical micro-manipulation for materials characterization
- study of liquid-solid interfaces by optical/imaging methods
- bioinspired biomimetic and nanobiomaterials
- investigation and characterization of biological nano-diffractive materials/surfaces
- characterization of soft-like biomaterials
- optical method for study fluids at micro and nanoscale.

CONTRIBUTIONS ARE EXPECTED BUT NOT LIMITED TO THE FOLLOWING APPROACHES AND METHODS:

- quantitative phase contrast imaging
- digital differential image contrast imaging
- interference microscopy
- holographic interferometry
- SLM-based microscopy
- lensless imaging
- spectroscopy, microscopy, and endoscope optics
- optical absorption, reflection, transmission and scattering techniques
- 3D modeling and profiling
- speckle interferometry and imaging
- optical methods for biomechanics of materials and evaluation of its functionalities
- fluorescence microscopy techniques
- optical coherence tomography and microscopy
- terahertz imaging
- nonlinear optical imaging
- adaptive optics with SLMs
- wavefront sensing
- fringe projection accurate shape measurement
- topography and 3D shape measurements
- photoacoustic imaging
- fringe pattern analysis for accurate materials properties.

Automated Visual Inspection and Machine Vision (OM106)

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

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This conference addresses image acquisition and image exploitation topics to solve visual inspection and machine vision tasks automatically. Since elaborated approaches for acquiring images constitute the crucial base to successfully accomplish inspection tasks, particularly illumination, optics, sensors, and the complete acquisition setup composed of these ingredients are within the focus of the conference. Moreover, to extract the inspection-relevant information from images, signal processing and exploitation methods that account for the physical formation of the images are of great interest. As many inspection tasks cannot be solved based on a single image, frequently it is necessary to acquire sequences of images that have to be fused in an adequate manner to draw a final inspection decision. Therefore, the question is not only how to acquire appropriate single images, but how to acquire controlled image series that comprise sufficient information with respect to the inspection task and how such image series can be exploited efficiently.

GENERAL ITEMS

- automated visual inspection
- machine vision
- robust, high performance inspection
- visual quality monitoring and control
- image acquisition and exploitation.

METHODOLOGY

- image data based on diverse optical properties of materials (reflectance, roughness, spectrum, complex refraction index, etc.)
- illumination techniques
- deflectometry
- mathematical models and methods
- image series, image fusion and active vision
- image processing and exploitation methods
- detection and classification
- physically-based image formation models
- pattern recognition.

APPLICATIONS

- automated inspection of industrially produced goods
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