

SPIE Europe

Optical Metrology

Wolfgang Osten, Univ. Stuttgart (Germany)

Malgorzata Kujawska, Warsaw Univ. of Technology (Poland)

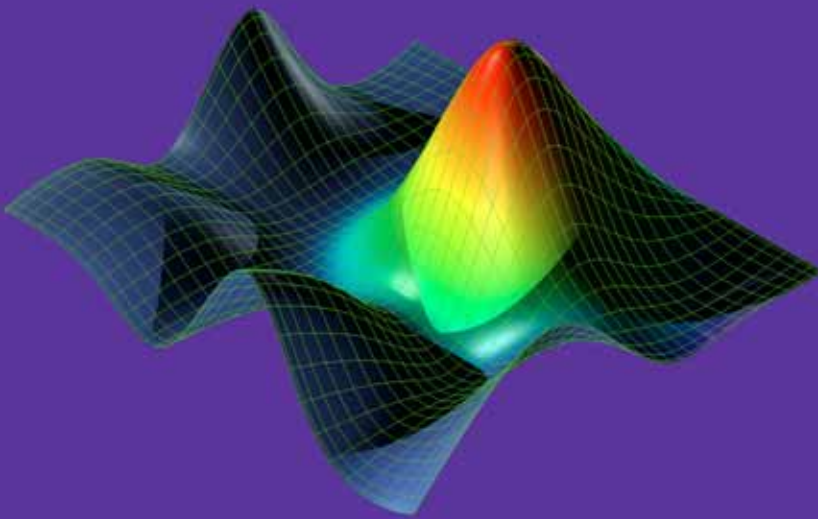
Ralph P. Tatam, Cranfield Univ. (UK)

2007 Symposium Chairs

Optical Measurement
Systems for Industrial
Inspection

Modeling Aspects in
Optical Metrology

O3A: Optics for Arts,
Architecture, and
Archaeology



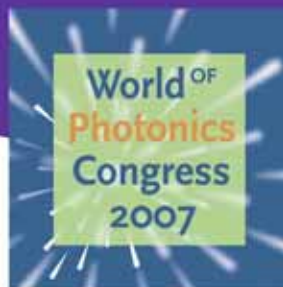
Munich ICM

International Congress
Centre Munich, Germany

18–22 June 2007

Sponsored by SPIE Europe

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18th International Congress on Photonics in Europe

co-located with LASER 2007. World of Photonics

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Optical Metrology

18–22 June 2007 ICM—International Conference Centre Munich • Munich, Germany

Co-located with:

**LASER 2007, World of Photonics,
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Cooperating Organisations:



EOS European Optical Society

WLT German Scientific Laser Society
(Wissenschaftliche Gesellschaft
Lasertechnik e.V.)

Welcome to Munich!

Enjoy this opportunity to interact with scientists, engineers, researchers, and applications and product developers in the field of optics and laser applications in metrology and art and archaeology conservation. Co-located with Laser 2007 in Munich, Germany, this symposium will address the role of lasers in the following areas:

- **Optical Measurement Systems for Industrial Inspection**
- **Modeling Aspects in Optical Metrology**
- **O3A: Optics for Arts, Architecture, and Archaeology**

You will have a 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 in the micro- and nanoscales to the forefront of optical metrology.

Exchange new ideas, address your shared concerns, and get access to information not yet published in these topical areas. We are glad that you are here to share the most recent developments and applications at the 2007 Optical Metrology Symposium.

Symposium Chairs



Wolfgang Osten,
Univ. Stuttgart (Germany)



Malgorzata Kujawinska,
Warsaw Univ. of
Technology (Poland)



Ralph P. Tatam,
Cranfield Univ. (UK)

SPIEEurope would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, and session chairs who have so generously given of their time and advice to make this symposium possible. The symposium, like our other conferences and activities, would not be possible without the dedicated contribution of our participants and members.

Organising Committee

- Bernd Bodermann**, Physikalisch-Technische Bundesanstalt (Germany)
Harald Bosse, Physikalisch-Technische Bundesanstalt (Germany)
Costas Fotakis, Foundation for Research and Technology-Hellas (Greece)
Christophe Gorecki, Univ. de Franche-Comté (France)
Malgorzata Kujawska, Warsaw Univ. of Technology (Poland)
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Ralph P. Tatam, Cranfield Univ. (UK)

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Daily Schedule of Events

Monday	Tuesday	Wednesday	Thursday	Friday
Conferences				
Conf. 6616 Optical Measurement Systems for Industrial Inspection V (Osten), p. 5-10				
Conf. 6617 Modeling Aspects in Optical Metrology (Bosse), p. 11-12		Conf. 6618 Optics for Arts, Architecture, and Archaeology (Fotakis, Pezzati, Salimbeni), p. 13-15		
Special Events				
Conf. 6616, Poster Sessions , 18.00 to 19.30	Breakfast with the Experts – A Student Networking Event , 09.00 to 10.15, p. 4	Plenary Session (10.30 to 11.20 Room 1), p. 4	Conf. 6617 Poster Session , 14.00 to 15.30	
Conf. 6617, Poster Sessions , 16.30 to 17.30		Welcome Reception , 19.30 to 21.30, p. 4		

Special Events

Plenary Presentation

ICM: Room 1

Opening Remarks

Malgorzata Kujawska, Warsaw Univ. of Technology (Poland)

Wednesday 20 June 10.30 to 11.20



Optofluidics

Demetri Psaltis, EPFL, Switzerland and Caltech, USA

Abstract: Optofluidics refers to a class of adaptive optical circuits that integrate optical and fluidic devices. Familiar examples include liquid crystals and dye lasers. The introduction of liquids in these optical structures enables flexible fine-tuning and reconfiguration of circuits to perform tasks optimally in a dynamic environment. We will discuss how the emergence of fluidic transport technologies at the micron and nanometer levels opens possibilities for novel adaptive optical devices.

Approaches that are being pursued include (1) the integration of microfluidic circuits with photonic structures that contain voids into which fluids are injected and (2) the use of colloidal solutions of nanoparticles. Electrical fields or light beams redistribute the nanoparticles and modify the optical properties of the structures. Liquid dyes injected into microfluidic chips provide the optical gain necessary for building a dye laser on a chip.

Biography: **Dr. Psaltis** is a professor of electrical engineering at EPFL in Switzerland and at the California Institute of Technology in Pasadena. He received his BS, MS and PhD degrees at Carnegie Mellon University. His research group works on optical information systems including memories, computers, sensors and communications. In addition to optofluidics, their current research projects include the use of holograms as wavelength filtering elements and nonlinear propagation of femtosecond pulses in fibers and three-dimensional media.

Poster Sessions

Interactive posters will be on display in the conference area hallway. E-posters will be displayed in the ICM internet café. Poster authors, please look for the poster presentation details and poster session schedule for each conference in the EOM07 conference programs. Any papers left on the boards at the close of each conference poster session will be considered as unwanted and will be discarded. Poster authors should be at their papers during each conference poster session to answer questions from attendees.

Breakfast with the Experts – A Student Networking Event

Location: Seeblick Restaurant, Entrance West, Munich Fairgrounds

Tuesday 19 June 09.00 to 10.15

Students! Join optics experts from both the Biomedical Optics and Laser Metrology conferences for a casual meal and lively discussion. This breakfast will feature experts willing to share their accumulated wisdom on career paths within the optics and photonics industry. Take advantage of this opportunity to network with some of the best and brightest minds at this free event hosted by SPIE Student Services. Seating is limited. Please arrive promptly and present your ticket.

Welcome Reception

Wednesday 20 June 19.30 to 21.30

This evening event will feature a light meal and beverages at one of Munich's premier breweries, the Paulaner Bräuhaus. All registered conference attendees are welcome. A guest may accompany a registered attendee for an additional charge (space available) (see page 17).

Optical Measurement Systems for Industrial Inspection

Conference Chair: **Wolfgang Osten**, Univ. Stuttgart (Germany)

Cochairs: **Christophe Gorecki**, Univ. de Franche-Comté (France); **Erik L. Novak**, Veeco Instruments Inc. (USA)

Programme Committee: **Armando Albertazzi Gonçalves, Jr.**, Univ. Federal de Santa Catarina (Brazil); **Oleg V. Angelsky**, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine); **Anand K. Asundi**, Nanyang Technological Univ. (Singapore); **Harald Bosse**, Physikalisch-Technische Bundesanstalt (Germany); **Peter J. de Groot**, Zygo Corp. (USA); **Pietro Ferraro**, Istituto Nazionale di Ottica Applicata (Italy); **Cosme Furlong**, Worcester Polytechnic Institute (USA); **Steen G. Hanson**, Risø National Lab. (Denmark); **Roland Höfling**, ViALUX GmbH (Germany); **Pierre M. Jacquot**, École Polytechnique Fédérale de Lausanne (Switzerland); **Gerd Jäger**, Technische Univ. Ilmenau (Germany); **Werner P. O. Jüptner**, Bremer Institut für Angewandte Strahltechnik (Germany); **Richard M. Kowarschik**, Friedrich-Schiller-Univ. Jena (Germany); **Malgorzata Kujawinska**, Politechnika Warszawska (Poland); **Peter H. Lehmann**, Carl Mahr Holding GmbH (Germany); **Vladimir Markov**, MetroLaser, Inc. (USA); **Robert Schmitt**, FhG-IPT Aachen (Germany); **Pierre R. L. Slangen**, Ecole des Mines d'Alès (France); **Marcus Steinbichler**, Steinbichler Optotechnik GmbH (Germany); **Mitsuo Takeda**, The Univ. of Electro-Communications (Japan); **Ralph P. Tatam**, Cranfield Univ. (United Kingdom); **Hans J. Tiziani**, Univ. Stuttgart (Germany); **Satoru Toyooka**, Saitama Univ. (Japan); **Theo T. Tschudi**, Technische Univ. Darmstadt (Germany); **Wim Van Paeppegem**, Univ. Gent (Belgium); **Elmar Wagner**, Fraunhofer Institut für Physik Meßtechnik (Germany); **Toyohiko Yatagai**, Univ. of Tsukuba (Japan)

Monday 18 June

Welcome and Introduction **08.00 to 08.10**
Wolfgang Osten, Univ. Stuttgart (Germany)

SESSION 1

Room: 14c **Mon. 08.10 to 10.20**

Advanced Sensor Solutions: Optical Sensors 1

Chair: **Wolfgang Osten**, Univ. Stuttgart (Germany)

- 08.10: **Paradigm shifts in optical coherence tomography** (*Invited Paper*), R. A. Leitgeb, École Polytechnique Fédérale de Lausanne (Switzerland) [6616-01]
 Coffee Break 08.40 to 09.00
 09.00: **White light spectral interferometric technique used to measure thickness of thin films**, P. Hlubina, D. Cyprian, R. Chlebus, J. Lunacek, M. Lesnak, Technical Univ. of Ostrava (Czech Republic) [6616-02]
 09.20: **Dual-wavelength vertical scanning low-coherence interference microscopy**, J. Niehues, P. H. Lehmann, Carl Mahr Holding GmbH (Germany) [6616-03]
 09.40: **White light interferometry in combination with nanositioning and nanomeasuring machine (NPM machine)**, D. Kapusi, T. Machleidt, K. Franke, Technische Univ. Ilmenau (Germany) [6616-04]
 10.00: **Vertical scanning interferometry with a mixed-coherence light source**, R. Tutsch, G. Molnar, Technische Univ. Braunschweig (Germany) [6616-05]
 Coffee Break 10.20 to 10.35

SESSION 2

Room: 14c **Mon. 10.35 to 12.25**

Advanced Sensor Solutions: Optical Sensors 2

Chair: **Christophe Gorecki**, Univ. de Franche-Comté (France)

- 10.35: **Method for edge detection of textile preforms using a light section sensor for the automated manufacturing of fibre reinforced plastics**, R. Schmitt, A. Orth, C. Niggemann, RWTH Aachen (Germany) [6616-07]
 10.55: **Real-time multi-camera system for measurement of 3D coordinates by pattern projection**, V. C. Sainov, E. V. Stoykova, J. I. Harizanova, Central Lab. of Optical Storage and Processing of Information (Bulgaria) [6616-08]
 11.15: **3D shape measurement with phase-correlation-based fringe projection**, P. Kühmstedt, C. Munkelt, M. Heinze, C. Bräuer-Burchardt, G. Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) [6616-09]
 11.35: **Time-of-flight based pixel architecture with integrated double-cathode photodetector**, K. Oberhauser, G. Zach, A. Nemecek, H. Zimmermann, Technische Univ. Wien (Austria) [6616-10]

- 11.55: **Photon-noise limited distance resolution of optical metrology methods** (*Invited Paper*), P. Seitz, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) [6616-06]
 Lunch Break 12.25 to 13.30

✓ Pops and Posters-Monday

Chairs: Ventseslav C. Sainov, Central Lab. of Optical Storage and Processing of Information (Bulgaria); Peter H. Lehmann, Carl Mahr Holding GmbH (Germany)

Poster Pops 13.30 to 18.00

Three-minute oral presentations will take place in the conference room between 13.30 and 18.00 hrs (with coffee break scheduled 16.00 to 16.30). Each brief overview will consist of a three-minute talk including no more than three viewgraphs as part of this presentation.

Poster Session 18.00 to 19.30

Poster Pops session will be followed by the official conference poster session 18.00 to 19.30 hrs in the conference area hallway with all posters on display and authors present at their posters.

Posters-Monday

An interactive poster session will be held on Monday 18.00 to 19.30. Posters will be on display after 10.00 Monday morning in the conference area hallway.

Advanced Sensor Solutions

- ✓ **White light spectral interferometric techniques used to measure the group dispersion of isotropic and anisotropic optical elements**, P. Hlubina, D. Cyprian, R. Chlebus, Technical Univ. of Ostrava (Czech Republic) [6616-99]
- ✓ **Designing an optical sensor using wide band speckle patterns**, H. M. El Ghandoor, Ain Shams Univ. (Egypt) [6616-100]
- ✓ **Implementation a new real-time structure for driving an IRFPA and image enhancement**, A. Homaei, E. Koohestani, Rayan-Electronics (Iraq) [6616-101]
- ✓ **New features of doppler-free saturated-absorption resonance in field of counterpropagating waves**, D. V. Brazhnikov, Institute of Laser Physics SB RAS (Russia); A. V. Taichenachev, Institute of Laser Physics SB RAS (Russia) and Novosibirsk State Univ. (Russia); A. M. Tumaikin, V. I. Yudin, Institute of Laser Physics SB RAS (Russia); S. A. Zibrov, Y. O. Dudin, A. G. Radnaev, P. A. Siushev, V. Vasil'ev, V. L. Velichansky, P.N. Lebedev Physical Institute (Russia) [6616-102]
- ✓ **Multidirectional holographic interferometer with dodecanon geometry**, M. Antos, Brno Univ. of Technology (Czech Republic) [6616-104]
- ✓ **Multi-resolution optical 3D sensor**, P. Kühmstedt, M. Heinze, G. Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) [6616-105]

- ✓ **Effective dynamic range measurement for a CCD in full-field industrial X-ray imaging applications**, M. Bettuzzi, R. Brancaccio, F. Casali, M. P. Morigi, Univ. degli Studi di Bologna (Italy) . . . [6616-107]
- ✓ **White light Fourier spectrometer: test measurements and Monte-Carlo noise analysis**, E. V. Stoykova, B. L. Ivanov, Central Lab. of Optical Storage and Processing of Information (Bulgaria) . [6616-109]
- ✓ **Non-contact torsion transducer based on the measurement of Moiré patterns using optical fibres**, M. Lomer, Univ. de Cantabria (Spain); K. Contreras, Pontificia Univ. Católica del Perú (Peru) [6616-110]
- ✓ **Special lenslet array with long focal length range for Shack-Hartmann wavefront sensor**, L. Zhao, N. Bai, X. Li, Z. P. Fang, Singapore Institute of Manufacturing Technology (Singapore) [6616-111]
- ✓ **Influences of linear birefringence on bulk glasensors with return-back optical path current**, Z. Wang, X. Liu, Z. Huang, Harbin Engineering Univ. (China) [6616-114]
- ✓ **Influences of reciprocal parameters upon a Faraday-Mirror typed OCT**, Z. Huang, Z. Wang, X. Liu, C. Kang, Harbin Engineering Univ. (China) [6616-115]
- ✓ **Orthogonal conjugate reflecting current sensor**, Z. Huang, Z. Wang, H. Wang, Harbin Engineering Univ. (China) [6616-116]
- ✓ **Optical fiber rotation sensor for application in oil refinery and high electromagnetic noise environment**, T. R. Wolinski, D. Budaszewski, A. Domanski, Politechnika Warszawska (Poland); G. Goleniewski, M. Wydmanski, PKN Orlen (Poland) [6616-167]
- ✓ **Method of optical axis determination by use of light depolarization measurements**, A. W. Domanski, Politechnika Warszawska (Poland); D. Budaszewski, P. Poziemski, T. R. Wolinski, [6616-168]

Shape Measurement

- ✓ **Two-dimensional method for surface determination by optical deflectometry**, J. Campos, A. Moreno, M. Espinola, A. Lizana, Univ. Autònoma de Barcelona (Spain) [6616-118]
- ✓ **Optical scan method for fine surface roughness measurement**, Z. Wang, L. Wang, Harbin Engineering Univ. (China) [6616-119]
- ✓ **Conical beam-based laser profilometer for testing the roller bearings**, N. A. Khilo, V. N. Belyi, N. S. Kazak, A. G. Mashchenko, P. I. Ropot, B.I. Stepanov Institute of Physics (Belarus) [6616-120]
- ✓ **Correlation method for shape measurement of optical surfaces**, A. Mikš, J. Novák, P. Novák, Czech Technical Univ. in Prague (Czech Republic) [6616-121]
- ✓ **Development of a high-resolution lensmeter using a cylinder symmetry wavefront sensor and preliminary results for trial lenses**, L. A. V. Carvalho, Univ. de São Paulo (Brazil) [6616-124]
- ✓ **Accurate measurements of intraocular lenses parameters**, M. M. V. Vannoni, G. Molesini, Consiglio Nazionale delle Ricerche (Italy); R. Mencucci, R. Volpe, Univ. degli Studi di Firenze (Italy) . [6616-126]

Displacement and Strain Measurement

- ✓ **Deformation analysis in biomaterials using digital speckle interferometry**, T. Molina-Jimenez, V. Mico, J. A. Carrion, J. J. Esteve-Taboada, S. Simon, E. Perez, Asociacion Industrial De Optica, Color E Imagen (Spain); R. Salvador, R. Gonzalez-Peña, R. Cibrian, M. Buendia, F. Minguez, M. Laguia, Univ. de València (Spain) [6616-127]
- ✓ **Development of a 3D dynamic measurement system using a high-speed camera with white light scanning interference microscopy associated with real-time FPGA image processing**, G. Johnson, F. Anstotz, P. C. Montgomery, Institut d'Electronique du Solide et des Systemes (France); R. Kiefer, Institut National des Sciences Appliquées de Strasbourg (France) [6616-129]

Nondestructive Testing

- ✓ **Fiber optic-based sensors design to test concrete structures**, T. Molina-Jimenez, V. Micó, M. L. Lozano, J. J. Esteve-Taboada, J. A. Carrion, S. Simon, E. Perez, Asociacion Industrial De Optica, Color E Imagen (Spain); J. M. Lloris, M. J. Lopez, M. Cruz, C. Silvestre, F. Lopez, Instituto Tecnológico de la Construcción (Spain); D. Barrera-Villar, R. Garcia-Olcina, S. M. Sales, Univ. Politècnica de València (Spain) [6616-131]
- ✓ **Performance of the optical speckle displacement technique near-stress concentrators**, L. I. Muravsky, G. V. Karpenko Physico-Mechanical Institute (Ukraine) and Politechnika Łódzka (Poland); O. M. Sakharuk, O. P. Maksymenko, G. V. Karpenko Physico-Mechanical Institute (Ukraine) [6616-132]

- ✓ **Phase only SLM as a reference element in Twyman-Green laser interferometer for MEMS measurement**, J. Kacperski, M. Kujawinska, Politechnika Warszawska (Poland) [6616-133]
- ✓ **Laser-based ultrasound in FGM and characterization of the frequency dependent wave propagation (Stand-by Oral Presentation)**, L. Aebi, J. Vollmann, J. Dual, ETH Zürich (Switzerland) [6616-134]
- ✓ **Optical fiber sensors in health monitoring of composite high pressure vessels for hydrogen**, P. Gasior, Politechnika Warszawska (Poland); J. Kaleta, A. Sankowska, Politechnika Wroclawska (Poland) [6616-135]
- ✓ **Feasibility study of in-process weld quality control by means of scanning laser profilometry**, M. Jezerski, I. Polajnar, J. Diaci, Univ. v Ljubljani (Slovenia) [6616-136]
- ✓ **Fiber optic ring depolarizer**, M. S. Mueller, L. H. Hoffmann, A. W. Koch, Technische Univ. München (Germany) [6616-137]

Applications

- ✓ **AIT of optical payloads in AAS-F: an experience of more than 20 years**, H. Benard, S. Delmonte, J. P. Chessel, Alcatel Alenia Space (France) [6616-139]
- ✓ **Depth tracing the influence of oxygen on UV curing**, S. Pieke, W. Heering, Univ. Karlsruhe (Germany) [6616-142]
- ✓ **XtremeFringe(r): state-of-the-art software for automatic processing of fringe patterns**, J. A. Quiroga, D. Crespo, Indizen Optical Technologies (Spain); J. A. Gomez-Pedrero, Univ. Complutense de Madrid (Spain) [6616-143]
- ✓ **Optical and contact nondestructive measurement of laser remelting thin layers**, H. Chmelicková, H. Hiklová, M. Havelková, H. Lapáňanská, Univ. Palackého V Olomouci (Czech Republic); R. Medlín, P. Beneš, Univ. of West Bohemia (Czech Republic) [6616-145]
- ✓ **Laser metrology of statistical and fractal structure of biological tissues polarisation images**, Y. A. Ushenko, A. G. Ushenko, O. V. Angelsky, Y. Y. Tomka, A. Prydiy, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-146]
- ✓ **Metrology of biological tissue coherent images by means of estimation of complex degree of mutual polarisation**, Y. A. Ushenko, A. G. Ushenko, Y. G. Ushenko, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-147]
- ✓ **Mass transfer studies in transparent liquid solutions by polarization imaging**, V. K. Chhaniwal, Indian Institute of Technology (India); A. Anand, Institute for Plasma Research (India) . . . [6616-148]
- ✓ **Digital Shack-Hartmann wavefront sensor for toroidal surface measurement**, N. Bai, L. Zhao, X. Li, Z. P. Fang, Singapore Institute of Manufacturing Technology (Singapore) [6616-150]
- ✓ **Optical metrology devices for high-power laser large optics**, J. Daurios, J. Poncetta, Commissariat à l'Energie Atomique (France) [6616-151]
- ✓ **Purity of iodine cells and frequency shift of iodine stabilized Nd:YAG lasers**, J. Hrabina, F. Petru, P. Jedlicka, O. Cip, J. Lazar, Institute of Scientific Instruments (Czech Republic) [6616-152]
- ✓ **Total spectral radiant flux measurements on Xe excimer lamps from 120 nm to 1000 nm**, K. E. Trampert, M. Paravia, R. Daub, W. Heering, Univ. Karlsruhe (Germany) [6616-154]
- ✓ **Efficient LED spatial measurement to improve optical modelling**, P. Blanco, SnellOptics (Spain); A. F. Cifuentes, J. Arasa, C. Pizarro, S. Royo, Univ. Politècnica de Catalunya (Spain) [6616-155]
- ✓ **Adopting our heterodyne interferometer with sub-nm-sensitivity for industrial position metrology**, T. Schuldt, Humboldt-Univ. zu Berlin (Germany) and EADS Astrium (Germany) and FH Konstanz (Germany); M. Gohlke, Humboldt-Univ. zu Berlin (Germany) and EADS Astrium (Germany); D. Weise, EADS Astrium (Germany); A. Peters, Humboldt-Univ. zu Berlin (Germany); U. A. Johann, EADS Astrium (Germany); C. Braxmaier, FH Konstanz (Germany) and EADS Astrium (Germany) [6616-156]
- ✓ **Thin-film thickness measurement by double laser interferometry**, M. Domingo, C. Millán, M. Satorre Aznar, J. R. Canto, Univ. Politècnica de València (Spain) [6616-157]
- ✓ **Mould redesign based on 3D digitising using structured illumination, FEM methods and laser cladding techniques**, T. Molina-Jimenez, L. Granero, J. S. Sanchez, J. J. Esteve-Taboada, V. Mico, J. Hervas, J. A. Ramos, S. Simón, E. Pérez, Asociacion Industrial De Optica, Color E Imagen (Spain) [6616-158]

- ✓ **Measurement of index of refraction of air by optical frequency method**, R. Smid, B. Mikel, O. Cip, Z. Buchta, M. Cizek, J. Lazar, Institute of Scientific Instruments (Czech Republic) [6616-159]
- ✓ **Force plate for measuring small animal forces by digital speckle pattern interferometry**, P. Arroyo, Univ. de Zaragoza (Spain) [6616-161]
- ✓ **Design of an optical scanner for real-time on-line measurement of wood panel profiles**, P. Castellini, A. Bruni, N. Paone, Univ. Politecnica delle Marche (Italy) [6616-162]
- ✓ **Particles size measurement by spectrophotometric method**, D. Fontani, F. Francini, P. Sansoni, L. Mercatelli, D. Jafrancesco, Istituto Nazionale di Ottica Applicata (Italy) [6616-163]
- ✓ **Absolute interferometric measurements of flatness: application of different methods to test a 600 mm diameter reference flat**, F. Morin, S. Bouillet, Commissariat a l'Energie Atomique (France) [6616-164]
- ✓ **Determination of lens parameters with digital holography**, V. K. Chhaniwal, Indian Institute of Technology (India); A. Anand, Institute for Plasma Research (India) [6616-165]

Tuesday 19 June

SESSION 3

Room: 14c **Tues. 08.00 to 10.00**

Advanced Sensor Solutions: Optical Sensors 3

Chair: Ralph P. Tatam, Cranfield Univ. (United Kingdom)

- 08.00: **Confocal Raman AFM: a powerful tool for the characterization of surface coatings**, U. C. Schmidt, W. Ibach, J. Mueller, O. Hollricher, WITec GmbH (Germany) [6616-11]
- 08.20: **Point-diffraction interferometer by electro-optic effect in lithium niobate crystals**, M. Paturzo, Istituto Nazionale di Ottica Applicata (Italy) and Univ. degli Studi di Firenze (Italy); S. Grilli, P. Ferraro, Istituto Nazionale di Ottica Applicata (Italy); S. M. De Nicola, Istituto di Cibernetica Eduardo Caianiello (Italy) [6616-106]
- 08.40: **Super-heterodyne laser interferometer using femtosecond frequency comb for linear encoder calibration system**, M. Kajima, H. Matsumoto, National Institute of Advanced Industrial Science and Technology (Japan) [6616-13]
- 09.00: **Scatterometry-based overlay metrology investigation**, D. Kandel, KLA-Tencor Corp. (Israel); P. J. Leray, IMEC (Belgium); M. Vasconi, STMicroelectronics (Italy); B. W. Salski, QWED Sp. Zoo (Poland) [6616-14]
- 09.20: **Improved microinterferometric tomography method for reconstruction of refractive index**, P. Kniazewski, M. Kujawinska, Politechnika Warszawska (Poland) [6616-15]
- 09.40: **High-resolution tomographic interferometry of optical phase elements**, W. Górski, S. Rafler, W. Osten, Institut für Technische Optik (Germany) [6616-16]
- Coffee Break 10.00 to 10.30

SESSION 4

Room: 14c and B13 **Tues. 10.30 to 12.20**

Advanced Sensor Solutions: Optical Sensors 4

Chair: Tobias Haist, Univ. Stuttgart (Germany)

- 10.30: **Properties of the DMD digital micromirror device for new emerging applications in optical engineering (Invited Paper)**, C. Dunn, Texas Instruments Inc. (USA); R. Höfling, ViALUX GmbH (Germany) [6616-17]
- 11.00: **Realisation of quantitative Makyoh topography using a digital micromirror device**, F. Riesz, Research Institute for Technical Physics and Materials Science (Hungary) [6616-18]
- 11.20: **Beam halo monitor based on adaptive optics**, C. P. Welsch, CERN (USA); E. Bravin, T. Lefevre, CERN (Switzerland) [6616-19]
- 11.40: **Realisation of a holographic micro laser scalpel using a digital mirror device**, S. Zwick, ITO, University of Stuttgart (Germany); M. Warber, T. Haist, W. Osten, ITO, University of Stuttgart (USA) [6616-20]
- 12.00: **Digital micromirror device application for inline characterization of solar cells by tomographic light beam-induced current imaging**, R. Gupta, O. Breitenstein, Max-Planck-Institut für Mikrostrukturphysik (Germany) [6616-21]
- Lunch Break 12.20 to 13.50

SESSION 5

Room: 14c **Tues. 13.50 to 15.50**

Advanced Sensor Solutions: Optical Sensors 5

Chair: Rainer Tutsch, Technische Univ. Braunschweig (Germany)

- 13.50: **Single pixel camera based on compressive sensing**, K. F. Kelly, Rice Univ. (USA) [6616-22]
- 14.10: **Hyperspectral image projector based on spatial light modulators (Presentation Only)**, J. P. Rice, J. E. Neira, S. W. Brown, R. R. Bousquet, National Institute of Standards and Technology (USA) [6616-23]
- 14.30: **External-cavity diode laser utilizing a micromirror device for spectral tuning**, M. Breede, C. Kasseck, C. Brenner, N. C. Gerhardt, M. R. Hofmann, Ruhr-Univ. Bochum (Germany); R. Höfling, ViALUX GmbH (Germany) [6616-24]
- 14.50: **In-situ monitoring of periodic domain formation in ferroelectric crystals**, S. Grilli, Istituto Nazionale di Ottica Applicata (Italy); M. Paturzo, L. Miccio, Istituto Nazionale di Ottica Applicata (Italy) and LENS (Italy); P. Ferraro, Istituto Nazionale di Ottica Applicata (Italy) [6616-25]
- 15.10: **Dispersive white light interferometry for 3D inspection of thin film layers of flat panel displays**, S. Kim, Y. Ghim, J. You, Korea Advanced Institute of Science and Technology (South Korea) . [6616-96]
- 15.30: **Phase-measuring micro-fringe projection as an inline 3D measuring technology for industrial manufacturing facilities**, G. J. Frankowski, GFMesstechnik GmbH (Germany) [6616-85]
- Coffee Break 15.50 to 16.20

SESSION 6

Room: 14c **Tues. 16.20 to 18.00**

Advanced Sensor Solutions: Optical Sensors 6

Chair: Simonetta Grilli, Istituto Nazionale di Ottica Applicata (Italy)

- 16.20: **Polarization correlometry of polarization singularities of biological tissues object fields**, Y. A. Ushenko, A. O. Angelskaya, O. V. Angelsky, A. G. Ushenko, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-28]
- 16.40: **Fluid mechanics measurement based on the anisotropic core structures of pseudo-phase singularities in analytic signal representation of speckle pattern**, W. Wang, The Univ. of Electro-Communications (Japan); M. R. Dennis, Univ. of Southampton (United Kingdom); R. Ishijima, T. Yokozeki, A. Matsuda, The Univ. of Electro-Communications (Japan); S. G. Hanson, Risø National Lab. (Denmark); M. Takeda, The Univ. of Electro-Communications (Japan) [6616-29]
- 17.00: **Coherent fringe projector for 3D surface profilometry**, P. J. Da Silva Tavares, Prudente and Tavares (Portugal); N. Viriato, J. Reis, M. A. Vaz, Univ. do Porto (Portugal) [6616-103]
- 17.20: **W-band speckle contrast images for inspection of concealed objects**, I. Jaeger, L. Zhang, G. Koers, J. H. Stiens, H. Sahli, R. A. Vounckx, Vrije Univ. Brussel (Belgium) [6616-31]
- 17.40: **Using optical bistability effect in metrology systems**, C. Y. Zenkova, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-32]

Wednesday 20 June

SESSION 7

Room: 14c **Wed. 08.00 to 10.00**

Advanced Sensor Solutions: Phase Retrieval 1

Chair: Jonathan M. Huntley, Loughborough Univ. of Technology (United Kingdom)

- 08.00: **Reaching lambda/100 resolution in static fringes interferometry using linear prediction**, M. J. Mestre, Ecole normale supérieure de Cachan (France); D. Pasquelin, Optics Concept (France) [6616-33]
- 08.20: **Composition of virtual speckle pattern for spatial fringe analysis method in ESPI by using single camera**, Y. Arai, Kansai Univ. (Japan) [6616-34]
- 08.40: **Phase measurement errors due to holographic interferograms compression**, E. Darakis, Univ. of Strathclyde (United Kingdom); V. R. Singh, A. K. Asundi, Nanyang Technological Univ. (Singapore); J. J. Soraghan, Univ. of Strathclyde (United Kingdom) [6616-36]

- 09.00: **Fourier-based design of asynchronous phase detection algorithms**, J. A. Gomez-Pedrero, J. A. Quiroga, Univ. Complutense de Madrid (Spain); D. Crespo, Indizen Optical Technologies (Spain) [6616-35]
- 09.20: **Phase retrieval based on wavefront modulation**, F. Zhang, G. Pedrini, W. Osten, Univ. Stuttgart (Germany) [6616-37]
- 09.40: **Real-time dual-wavelength digital holographic microscopy with a single hologram**, J. G. Kühn, T. Colomb, École Polytechnique Fédérale de Lausanne (Switzerland); F. Montfort, Lycée Tec SA (Switzerland); F. Charrière, C. D. Depeursinge, École Polytechnique Fédérale de Lausanne (Switzerland) [6616-38]
- Coffee Break 10.00 to 10.30

Plenary Presentation

Room: 1 10.30 to 11.20

Optofluidics

D. Psaltis, EPFL (Switzerland) and Caltech (USA)

SESSION 8

Room: 14c Wed. 11.30 to 12.10

Advanced Sensor Solutions: Phase Retrieval 2

Chair: **Jonathan M. Huntley**, Loughborough Univ. of Technology (United Kingdom)

- 11.30: **Fast demodulation technique for a quasi-distributed temperature sensor**, C. I. Crunelle, M. Wuilpart, C. Caucheteur, P. Mégret, Faculté Polytechnique de Mons (Belgium) [6616-39]
- 17.00: **S-transform analysis of projected fringe patterns**, O. Kocahan, S. Özder, E. Coskun, Canakkale Onsekiz Mart Univ. (Turkey) . [6616-43]
- Lunch Break 12.10 to 13.40

SESSION 9

Room: 14c Wed. 13.40 to 16.00

Advanced Sensor Solutions: Algorithms

Chair: **Seung-Woo Kim**, Korea Advanced Institute of Science and Technology (South Korea)

- 13.40: **Uncertainty analysis for the TMS method: influence of high spatial frequencies**, A. Wiegmann, R. D. Geckeler, M. Schulz, C. Elster, Physikalisch-Technische Bundesanstalt (Germany) [6616-41]
- 14.00: **Characterisation and compensation of decorrelations in an interferometric set up using active optics**, E. J. Hällstig, Optronik (Sweden); A. Svanbro, Luleå Univ. of Technology (Sweden) .. [6616-42]
- 14.20: **Laser acoustics in planar, layered, and graded structures: measurements, phenomena, simulations**, J. Vollmann, J. Bryner, L. Aebi, J. Dual, ETH Zürich (Switzerland); D. M. Profunser, Hokkaido Univ. (Japan) [6616-90]
- 14.40: **Efficient mesh oriented algorithm for 3D measurement in multiple camera fringe projection**, A. Vieira Fantin, A. Albertazzi Gonçalves, Jr., Univ. Federal de Santa Catarina (Brazil) [6616-44]
- 15.00: **Complete digital optics applied to digital holographic microscopy: application to chromatic aberration compensation**, T. Colomb, F. Charrière, J. G. Kühn, École Polytechnique Fédérale de Lausanne (Switzerland); F. Montfort, Lycée Tec SA (Switzerland); C. D. Depeursinge, École Polytechnique Fédérale de Lausanne (Switzerland) [6616-45]
- 15.20: **Simulation of the elastic wave propagation in anisotropic microstructures**, J. Bryner, J. Vollmann, D. M. Profunser, J. Dual, ETH Zürich (Switzerland) [6616-89]
- 15.40: **Novel algorithm to stitch adjacent cloud of points of long cylindrical surfaces**, M. R. Viotti, A. Albertazzi Gonçalves, Jr., Univ. Federal de Santa Catarina (Brazil) [6616-47]
- Coffee Break 16.00 to 16.20

SESSION 10

Room: 14c Wed. 16.20 to 18.00

Shape Measurement: Interferometry

Chair: **Werner P. O. Jüptner**, Bremer Institut für Angewandte Strahltechnik (Germany)

- 16.20: **Derivation of quasi-parallel glass plate parameters tested in a Fizeau interferometer**, K. Patorski, A. R. Styk, Politechnika Warszawska (Poland) [6616-48]
- 16.40: **Influence of nonlinearities in wavelength-swept absolute distance interferometry**, L. Perret, P. Pfeiffer, A. Chakari, Univ. Louis Pasteur (France) [6616-49]
- 17.00: **Proposal on MEMS-based interferometric profiler for in-situ etching depth control**, A. B. Smirnov, All-Union Scientific Research Institute of Experimental Physics (Belarus); J. Shreiber, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); U. Richter, SENTECH Instruments GmbH (Germany) [6616-50]
- 17.20: **Improving the measurement of thick and thin films with optical profiling techniques**, C. Cadevall, C. Oriach-Font, R. Artigas, A. Pintó, F. Laguarda, Univ. Politècnica de Catalunya (Spain) [6616-51]
- 17.40: **Interferometry of thick and thin films**, M. Conroy, Taylor Hobson Ltd. (United Kingdom) [6616-52]

Thursday 21 June

SESSION 11

Room: B13 Thurs. 08.00 to 10.10

Shape Measurement: Micro & Nano Structures

Chair: **Mitsuo Takeda**, The Univ. of Electro-Communications (Japan)

- 08.00: **Precision mechatronics based on high-precision measuring and position systems and machines (Invited Paper)**, G. Jäger, Technische Univ. Ilmenau (Germany) [6616-53]
- 08.30: **Experimental validation of 20nm sensitivity of singular beam microscopy**, B. Spektor, Technion - Israek Institue of Technology (Israel); A. Normatov, Technion -Israel Institute of Technology (Israel); J. Shamir, Technion-Israel Institute of Technology (Israel) [6616-54]
- 08.50: **Measuring 3D geometries of microstructures with the laser scanning confocal vibrometer microscope**, C. Rembe, S. Bödecker, B. Armbruster, Polytec GmbH (Germany) [6616-55]
- 09.10: **Application of the metrological scanning probe microscope for high-precision, long-range, traceable measurements**, N. Dorozhovets, T. Hausotte, G. Jäger, E. Manske, Technische Univ. Ilmenau (Germany) [6616-56]
- 09.30: **Grating projection Moiré interferometry for high-speed 3D inspection of mesoscale objects**, S. Lee, M. Kang, IntekPlus Co., Ltd. (South Korea); S. Kim, Korea Advanced Institute of Science and Technology (South Korea) [6616-57]
- 09.50: **Artefacts with rough surfaces for verification of optical microsensors**, W. Ehrig, U. Neuschaefer-Rube, Physikalisch-Technische Bundesanstalt (Germany) [6616-58]
- Coffee Break 10.10 to 10.30

SESSION 12

Room: B13 Thurs. 10.30 to 12.10

Shape Measurement: Wavefront Sensing

Chair: **Hans J. Tiziani**, Univ. Stuttgart (Germany)

- 10.30: **Superposition fringes for profiling applications**, J. Schwider, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) [6616-59]
- 10.50: **Using phase objects to qualify the transfer function of Fizeau interferometers for high spatial frequencies**, S. Bouillet, Commissariat à l'Énergie Atomique (France); J. Daurios, Commissariat à l'Énergie Atomique (France) [6616-60]
- 11.10: **New technique for flexible and rapid measurement of precision aspheres**, E. Garbusi, C. Pruss, Univ. Stuttgart (Germany); J. Liesener, Univ. Stuttgart (Germany) and Zygo Corp. (Germany); W. Osten, Univ. Stuttgart (Germany) [6616-61]
- 11.30: **Shack-Hartmann wavefront sensing for surface and beam measurements**, X. Levecq, J. D. Floriot, S. Bucourt, Imagine Optic (France) [6616-62]

11.50: **Nematic liquid crystals light valve: application to phase shifting speckle interferometry**, P. R. L. Slangen, B. Gautier, Ecole des Mines d'Alès (France) [6616-169]
Lunch Break 12.10 to 13.40

SESSION 13

Room: B13 Thurs. 13.40 to 16.00

**Shape Measurement:
Inspection of Micro and Macro Structures**

Chair: Richard M. Kowarschik, Friedrich-Schiller-Univ. Jena (Germany)

13.40: **Large-scale full-field metrology using projected fringes: some challenges and solutions**, J. M. Huntley, T. Ogundana, Loughborough Univ. of Technology (United Kingdom); R. Burguete, Airbus UK (United Kingdom); R. Coggrave, Phase Vision Ltd. (United Kingdom) . [6616-64]
14.00: **Optical scanner for the measurement of surface profile of large size panels: analysis of metrologic performance and measurement uncertainty**, P. Castellini, Univ. Politecnica delle Marche (Italy) [6616-65]
14.20: **Measurement errors of mirrorlike, tilted objects in white light interferometry**, R. Berger, Univ. Stuttgart (Germany); T. Sure, Fachhochschule Giessen-Friedberg (Germany); W. Osten, Univ. Stuttgart (Germany) [6616-123]
14.40: **3D optical measurement of curved edges**, S. S. Naudet-Collette, F. Gaspard, F. Dekeyser, Commissariat à l'Energie Atomique (France) [6616-67]
15.00: **Optical correlation measurement of surface roughness**, O. V. Angelsky, A. P. Maksimyak, P. P. Maksimyak, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-68]
15.20: **Profile detection by projection of coloured patterns**, D. Fontani, F. Francini, P. Sansoni, D. Jafrancesco, L. Mercatelli, Istituto Nazionale di Ottica Applicata (Italy) [6616-69]
15.40: **Nonlinearity correction in digital fringe projection profilometry by using histogram matching technique**, H. Guo, Z. Zhao, Shanghai Univ. (China) [6616-70]
Coffee Break 16.00 to 16.20

SESSION 14

Room: B13 Thurs. 16.20 to 18.20

**Displacement and Strain Measurement:
Static Displacements**

Chair: Satoru Toyooka, Saitama Univ. (Japan)

16.20: **Digital holocameras for laboratory and outdoor measurements of engineering objects**, A. Michalkiewicz, M. Kujawinska, Politechnika Warszawska (Poland); K. Stasiewicz, L. R. Jaroszewicz, Wojskowa Akademia Techniczna (Poland) [6616-71]
16.40: **Electronic speckle pattern interferometry at 10 microns wavelength**, J. Vandenrijt, M. P. Georges, Univ. de Liege (Belgium) [6616-72]
17.00: **Stress behavior of ball grid array (BGA) studied by dynamic electronic speckle pattern interferometry (DESPI)**, V. D. Madjarova, S. Toyooka, H. Chida, H. Kadono, Saitama Univ. (Japan) [6616-73]
17.20: **Surface strain measurement using multi-component shearography with fibre-optic imaging bundles**, D. Francis, S. W. James, R. P. Tatam, Cranfield Univ. (United Kingdom) [6616-74]
17.40: **Application of reflection hologram interferometry with a high resolution to residual stresses characterisation by local material removing**, V. S. Pisarev, Central Aero-Hydrodynamics Institute (Russia) [6616-75]

Friday 22 June

SESSION 15

Room: B13 Fri. 08.00 to 10.10

**Displacement and Strain Measurement:
Dynamic Displacements**

Chair: Armando Albertazzi Gonçalves, Jr., Univ. Federal de Santa Catarina (Brazil)

08.00: **Micro- and nanometrology (Invited Paper)**, R. J. Pryputniewicz, Worcester Polytechnic Institute (USA) [6616-76]
08.30: **In-plane displacement measurement with sub-pixel resolution: application to vibration characterization of a shear-force scanning probe**, P. Sandoz, J. M. Friedt, E. Carry, FEMTO-ST/LOPMD (France) [6616-77]
08.50: **Measurement of the thermal deformation of a highly stable antenna with pulse ESPI**, E. Nösekel, Steinbichler Optotechnik GmbH (Germany); T. Ernst, HPS GmbH (Germany); W. Haefker, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [6616-78]
09.10: **Fast displacements dynamical measurements of MEMS and MOEMS by digital holography microscopy (DHM) operating in pulsed stroboscopic mode**, Y. Emery, F. Marquet, N. Aspert, F. Montfort, S. Bourquin, E. Cuhe, Lyncée Tec SA (Switzerland); C. D. Depeursinge, École Polytechnique Fédérale de Lausanne (Switzerland) [6616-79]
09.30: **Projection Moiré measurement of the deflection of composite plates subject to bird strike impact**, A. Shulev, Bulgarian Academy of Sciences (Bulgaria); A. Moentjens, Univ. Gent (Belgium); J. I. Harizanova, Bulgarian Academy of Sciences (Bulgaria); W. Van Paepegem, J. Degrieck, Univ. Gent (Belgium); V. C. Sainov, Bulgarian Academy of Sciences (Bulgaria) [6616-80]
09.50: **Double exposure time-averaged in-line digital holography**, V. R. Singh, A. K. Asundi, J. Miao, Nanyang Technological Univ. (Singapore) [6616-81]
Coffee Break 10.10 to 10.30

SESSION 16

Room: B13 Fri. 10.30 to 12.20

Applications 1

Chair: Wim Van Paepegem, Univ. Gent (Belgium)

10.30: **Laser ultrasonics in aircraft NDT (Invited Paper)**, C. von Kopylow, Bremer Institut für Angewandte Strahltechnik (Germany) [6616-82]
11.00: **Multi-technique platform for dynamic and static MEMS-characterisation**, K. Gastinger, SINTEF ICT (Norway); O. D. Hunderi, P. Løvhaugen, Norwegian Univ. of Science and Technology (Norway) [6616-83]
11.20: **Terahertz multiwavelength phase imaging without ambiguity**, Y. Zhang, L. Zhang, Capital Normal Univ. (China) [6616-26]
11.40: **Fiber-coupled THz spectroscopy system for monitoring polymeric compounding processes**, N. Vieweg, N. Krumbholz, R. Wilk, Technische Univ. Braunschweig (Germany) and Joint Optical Metrology Ctr. (Germany); V. Bartels, V. Petukhov, C. Keseberg, Technische Univ. Braunschweig (Germany); L. Wetenkamp, Fachhochschule Stralsund (Germany); M. Koch, Technische Univ. Braunschweig (Germany) and Joint Optical Metrology Ctr. (Germany) [6616-27]
12.00: **Inspection of plastic weld joints with terahertz imaging**, S. Wietzke, T. Hasek, C. Jördens, Technische Univ. Braunschweig (Germany) and Joint Optical Metrology Ctr. (Germany); B. Baudrit, M. Bastian, SKZ-KFE gGmbH (Germany); M. Koch, Technische Univ. Braunschweig (Germany) and Joint Optical Metrology Ctr. (Germany) [6616-98]
Lunch Break 12.20 to 13.30

SESSION 17

Room: B13 Fri. 13.30 to 15.50

Non-Destructive Testing

Chair: Pierre R. L. Slangen, Ecole des Mines d'Alès (France)

13.30: **Fibre grating refractometer sensors for composite process monitoring**, S. J. Buggy, E. Chehura, S. W. James, R. P. Tatam, Cranfield Univ. (United Kingdom) [6616-87]

13.50: **Quantification of defect size in shearing direction by shearography and wavelet transform**, F. R. Michel, DEIOS s.a. (Belgium) and HOLOLAB (Belgium); V. Moreau, DEIOS s.a. (Belgium); V. Rosso, S. L. M. Habraken, HOLOLAB (Belgium); B. Tilkens, DEIOS s.a. (Belgium) [6616-88]

14.10: **3D defect detection using optical wide-field microscopy**, V. Tympel, M. Schaaf, JENTECH engineering GmbH (Germany); B. Srocka, HSEB Dresden GmbH (Germany) [6616-46]

14.30: **Quantification of displacement and velocity noise in vibrometer measurements on transversely moving or rotating surfaces**, A. Dräbenstedt, Polytec GmbH (Germany) [6616-128]

14.50: **Online-monitoring of the laser-brazing process of overlap joints**, R. Schmitt, K. U. Vielhaber, Fraunhofer-Institut für Produktionstechnologie (Germany); F. Klocke, Fraunhofer Institut für Produktionstechnologie (Germany); D. Donst, Fraunhofer-Institut für Produktionstechnologie (Germany) [6616-91]

15.10: **Fiber optic strain measurement for machine monitoring**, L. H. Hoffmann, M. S. Mueller, A. W. Koch, Technische Univ. München (Germany) [6616-92]

15.30: **Interference microscopes for tribology and corrosion quantification**, E. L. Novak, Veeco Instruments Inc. (USA); T. Stout, Veeco Instruments (USA) [6616-84]

Coffee Break 15.50 to 16.20

Stand-by Oral Presentation:

Laser-based ultrasound in FGM and characterization of the frequency dependent wave propagation, L. Aebi, J. Vollmann, J. Dual, ETH Zürich (Switzerland) [6616-134]

SESSION 18

Room: B13 Fri. 16.20 to 18.00

Applications 2

Chair: Erik L. Novak, Veeco Instruments Inc. (USA)

16.20: **Interferometric characterization of capacitor micromachined ultrasound transducers and validation by electrical measurements**, H. Martinussen, A. Aksnes, H. E. Engan, Norges Teknisk-Naturvitenskapelige Univ. (Norway) [6616-130]

16.40: **On-axis, non-contact measurement of glass thicknesses and airgaps in optical systems with submicron accuracy**, R. C. Wilhelm, A. Courteville, F. Garcia, F. de Vecchi, Fogale Nanotech (France) [6616-95]

17.00: **Multiscale segmentation method for small inclusion detection in 3D industrial computed tomography**, G. Zauner, B. Harrer, Fachhochschule Wels (Austria) [6616-93]

17.20: **Polarization metrology of speckle-reconstructed biological layers roughness**, Y. A. Ushenko, A. G. Ushenko, Y. G. Ushenko, A. Dubolazov, V. V. Istratiy, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6616-97]

17.40: **Shape and vibration measurement of fast rotating objects employing novel laser Doppler techniques**, T. Pfister, L. Büttner, J. W. Czariske, Technische Univ. Dresden (Germany) [6616-86]

Modeling Aspects in Optical Metrology

Conference Chair: **Harald Bosse**, Physikalisch-Technische Bundesanstalt (Germany)

Cochairs: **Bernd Bodermann**, Physikalisch-Technische Bundesanstalt (Germany); **Richard M. Silver**, National Institute of Standards and Technology (USA)

Programme Committee: **Markus Bär**, Physikalisch-Technische Bundesanstalt (Germany); **Jörg Bischoff**, TEL/Timbre Technologies, Inc. (USA); **Sven Burger**, Zuse Institute Berlin (Germany); **Andreas Erdmann**, Fraunhofer Institut IISB (Germany); **Christian Hafner**, ETH Zürich (Switzerland); **Wolfgang Holzapfel**, Dr. Johannes Heidenhain GmbH (Germany); **Bernd H. Kleemann**, Carl Zeiss AG (Germany); **Roderick Köhle**, Qimonda AG (Germany); **Giovanni Mana**, INRIM, Torino (Italy); **Wolfgang Osten**, Univ. Stuttgart (Germany); **Andreas Rathsfeld**, WIAS (Germany); **Thomas Scherübl**, Carl Zeiss SMS GmbH, (Germany); **Patrick Schiavone**, Laboratoire des Technologies de la Microelectronique CNRS (France); **Michael Totzeck**, Carl Zeiss SMT AG (Germany); **Jari P. Turunen**, Univ. Joensuu (Finland); **Frank Wyrowski**, Friedrich-Schiller-Univ. Jena (Germany)

Monday 18 June

Welcome and Introduction 08.00 to 08.10
Harald Bosse, PTB Braunschweig (Germany)

SESSION 1

Room: B13 Mon. 08.10 to 10.20

Optical Systems

Chair: **Harald Bosse**, Physikalisch-Technische Bundesanstalt (Germany)

08.10: **Electromagnetic optical engineering for optical metrology (Invited Paper, Presentation Only)**, F. Wyrowski, Friedrich Schiller Univ. and LightTrans GmbH (Germany); H. Schimmel, LightTrans GmbH (Germany); J. P. Turunen, J. Tervo, Joensuu Yliopisto (Finland) [6617-01]
Coffee Break 08.40 to 09.00

09.00: **Simulation of the detectors response of an autocollimator**, G. Fütterer, Physikalisch-Technische Bundesanstalt (Germany) .. [6617-02]

09.20: **Capabilities and limitations of paraxial operator approach for modeling of nanoscale feature evaluation**, B. Spektor, A. Normatov, Technion - Israel Institute of Technology (Israel); J. Shamir, Technion-Israel Institute of Technology (Israel) [6617-03]

09.40: **Modeling image formation on pixelated devices for vision systems using wave-front coding**, S. Bosch Puig, F. Gómez-Morales, G. Carles, Univ. de Barcelona (Spain); J. A. Ferré-Borrull, Rovira i Virgili Univ. (Spain) [6617-04]

10.00: **Lateral shear and digital holographic microscopy to check dynamic behaviour of biological cell**, L. Miccio, S. Grilli, Istituto Nazionale di Ottica Applicata (Italy); S. M. De Nicola, A. Finizio, Istituto di Cibernetica Eduardo Caianiello (Italy); P. Ferraro, Istituto Nazionale di Ottica Applicata (Italy) [6617-05]
Coffee Break 10.20 to 10.35

SESSION 2

Room: B13 Mon. 10.35 to 11.45

Optical Wave Propagation

Chair: **Bernd H. Kleemann**, Carl Zeiss AG (Germany)

10.35: **Multiple multipole program analysis of metallic optical waveguides (Invited Paper)**, C. Hafner, X. Cui, A. Bertolace, R. VahlDieck, ETH Zürich (Switzerland) [6617-06]

11.05: **Sharp trench waveguide bend with photonic crystals: simulation, fabrication and characterisation**, X. Cui, ETH Zürich (Switzerland) [6617-07]

11.25: **Frequency-domain simulations of optical antenna structures**, C. Hafner, X. Cui, A. Bertolace, R. VahlDieck, ETH Zürich (Switzerland) [6617-08]

SESSION 3

Room: B13 Mon. 11.45 to 12.45

Interferometry and Phase Retrieval I

Chair: **Frank Wyrowski**, Friedrich-Schiller-Univ. Jena (Germany)

11.45: **Effect of broadband illumination on reconstruction error of phase retrieval in optical metrology**, G. R. Brady, J. R. Fienup, Univ. of Rochester (USA) [6617-09]

12.05: **Wavefront sensing with random amplitude mask and phase retrieval: a conceptual study**, A. Anand, Institute for Plasma Research (India); G. Pedrini, W. Osten, Univ. Stuttgart (Germany); P. F. Almoró, Univ. of the Philippines (Philippines) [6617-10]

12.25: **Optical vortex interferometry with wavefront division**, A. Popiolek-Masajada, J. C. Masajada, M. Leniec, Wrocław Univ. of Technology (Poland) [6617-11]
Lunch Break 12.45 to 14.00

SESSION 4

Room: B13 Mon. 14.00 to 15.40

Interferometry and Phase Retrieval II

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

14.00: **Phase and amplitude modulation of the alignment-influenced optical wavefront and its application to multi-element mis-alignment correction**, H. Lee, Rutherford Appleton Lab. (United Kingdom) and Univ. of Oxford (United Kingdom) and Yonsei Univ. (South Korea); G. B. Dalton, Univ. of Oxford (United Kingdom) and Rutherford Appleton Lab. (United Kingdom); I. A. J. Tosh, Rutherford Appleton Lab. (United Kingdom); S. Kim, Yonsei Univ. (South Korea) [6617-12]

14.20: **Robust Shack-Hartmann wavefront sensing with ultraflat microaxicons**, R. Grunwald, S. Huferath, M. Bock, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) [6617-13]

14.40: **Modeling white light interferometer (Presentation Only)**, F. Wyrowski, Friedrich Schiller Univ. and LightTrans GmbH (Germany); H. Schimmel, LightTrans GmbH (Germany) [6617-14]

15.00: **Fresnel wavefront propagation model for shearography shape measurement**, A. Anand, Institute for Plasma Research (India); R. M. Groves, G. Pedrini, W. Osten, Univ. Stuttgart (Germany) [6617-15]

15.20: **Local adaptable quadrature filters for single fringe pattern demodulation with closed fringes**, J. C. Estrada Rico, M. Servin, Ctr. de Investigaciones en Óptica, A.C. (Mexico) [6617-16]
Coffee Break 16.00 to 16.30

✓ Posters-Monday

An interactive poster session will be held on Monday 16.30 to 17.30. Posters will be on display after 10.00 Monday morning in the conference area hallway.

✓ **MTF measurements of dual waveband diffractive lenses (Stand-by Oral Presentation)**, J. M. Infante, M. C. de la Fuente, Indra Sistemas S.A (Spain) [6617-35]

✓ **Influence of target distance to lens distortion variation**, C. Bräuer-Burchardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) [6617-36]

- ✓ **Numerical simulation tool for synthetic speckle pattern images and their intensity-based integration under variable conditions for metrology applications (Stand-by Oral Presentation)**, F. Riechert, Univ. Karlsruhe (Germany); G. Bastian, Univ. Trier (Germany); U. Lemmer, Univ. Karlsruhe (Germany) [6617-37]
- ✓ **Modeling of image formation of a low-cost white light bench microscope with a linear CMOS image sensor: its application in metrology**, M. P. Macedo, Instituto Superior de Engenharia de Coimbra (Portugal) and Univ. de Coimbra (Portugal); A. G. Fernandes, A. J. Barata, C. M. B. A. Correia, Univ. de Coimbra (Portugal) [6617-38]
- ✓ **Modeling of propagation of ultrashort light pulses in optical systems**, A. Miks, J. Novák, P. Novák, Czech Technical Univ. in Prague (Czech Republic) [6617-39]
- ✓ **Apodised fibre Bragg grating design for gain flattening of EDFA**, A. Khare, Government Engineering College Bhopal (India) . [6617-40]
- ✓ **Scattering at silver-enhanced gold particles inside subwavelength-apertured metallic layers**, T. Glaser, JENOPTIK Laser, Optik, Systeme GmbH (Germany) [6617-41]
- ✓ **Applications of optical vortex birefringence compensator**, A. Popiolek-Masajada, M. Borwinska, P. Kurzynowski, Wroclaw Univ. of Technology (Poland) [6617-42]
- ✓ **Opportunities and limits for interferometry in production control**, T. Blümel, R. Kafka, FISBA OPTIK GmbH (Germany); J. Fehse, W. H. Boeck, FISBA OPTIK AG (Switzerland) [6617-46]
- ✓ **Computer and experimental modeling of light scattering**, O. V. Angelsky, A. P. Maksimyak, P. P. Maksimyak, Yuriy Fedkovych Chernivtsi National Univ. (Ukraine) [6617-48]
- ✓ **Optical characterization procedure for large thin films**, J. F. Trigo, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (Spain); L. Soriano, Univ. Autónoma de Madrid (Spain); J. Herrero, M. T. Gutiérrez, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (Spain) [6617-49]

Tuesday 19 June

SESSION 5

Room: B13 Tues. 08.40 to 10.00

Maxwell Solvers

Chair: Christian Hafner, ETH Zürich (Switzerland)

- 08.40: **Adaptive MBPE algorithm for speeding up the computation**, K. Tavzarashvili, C. Hafner, X. Cui, R. Vahldieck, ETH Zürich (Switzerland) [6617-17]
- 09.00: **Fast lithography near-field and imaging simulation using the waveguide method (Presentation Only)**, P. Evanschitzky, A. Erdmann, Fraunhofer-Institut für Integrierte Systeme und Bauelementetechnologie (Germany) [6617-18]
- 09.20: **Enhancements to FDTD modeling for optical metrology applications**, B. W. Salski, Politechnika Warszawska (Poland) and QWED (Poland); M. Celuch, W. K. Gwarek, Politechnika Warszawska (Poland) [6617-19]
- 09.40: **3D simulations of electromagnetic fields in nanostructures using the time-harmonic finite-element method**, S. Burger, L. W. Zschiedrich, F. Schmidt, Zuse Institute Berlin (Germany); R. Köhle, Qimonda AG (Germany); T. Henkel, C. Nölscher, Qimonda Dresden GmbH & Co OHG (Germany) [6617-20]
- Coffee Break 10.00 to 10.30

SESSION 6

Room: B13 Tues. 10.30 to 12.20

Modeling in Semiconductor Metrology

Chair: Andreas Erdmann, Fraunhofer Institut IISB (Germany)

- 10.30: **Model-based analysis of the limits of optical metrology with experimental comparisons (Invited Paper)**, R. M. Silver, B. M. Barnes, R. Attota, E. Marx, M. D. Stocker, National Institute of Standards and Technology (USA) [6617-21]
- 11.00: **In-chip overlay metrology for 45 nm processes**, Y. Ku, H. Pang, C. Tung, Y. Lee, Industrial Technology Research Institute (Taiwan); N. P. Smith, Hermes-Epitek Corp. (Taiwan) [6617-22]

- 11.20: **Approach to validation of rigorous modeling in optical CD microscopy by comparison of measurement results with independent methods**, H. Bosse, Physikalisch-Technische Bundesanstalt (Germany); B. Bodermann, PTB (Germany) ... [6617-47]
- 11.40: **Comparison of rigorous modelling of different structure profiles on photomasks for quantitative linewidth measurements by means of UV- or DUV-optical microscopy**, G. Ehret, B. Bodermann, M. Wöhler, Physikalisch-Technische Bundesanstalt (Germany) ... [6617-24]
- 12.00: **Validation of the Kirchhoff thin mask approximation for contact hole gratings (Presentation Only)**, R. Köhle, Infineon Technologies AG (Germany) [6617-25]
- Lunch Break 12.20 to 14.00

SESSION 7

Room: B13 Tues. 14.00 to 15.50

Scatterometry

Chair: Markus Bär, PTB Berlin (Germany)

- 14.00: **In-line etching process control using dynamic scatterometry (Invited Paper)**, S. Soulan, M. Besacier, P. Schiavone, Ctr. National de la Recherche Scientifique (France) [6617-26]
- 14.30: **Optical scatterometry with analytic approaches applied to periodic nano-arrays including anisotropic layers**, I. S. Abdulhalim, Ben-Gurion Univ. of the Negev (Israel) [6617-27]
- 14.50: **Scatterometry at crossed grating structures in different configurations**, T. Schuster, S. Rafler, W. Osten, Univ. Stuttgart (Germany); P. Reinig, T. Hingst, Qimonda Dresden GmbH & Co. OHG (Germany) [6617-28]
- 15.10: **Numerical analysis of DUV scatterometry on EUV masks**, M. Wurm, B. Bodermann, R. Model, H. A. Gross, Physikalisch-Technische Bundesanstalt (Germany) [6617-29]
- 15.30: **Structure modeling for scatterometric characterization of photoinduced surface relief gratings**, P. C. Logofatu, I. Apostol, V. S. Damian, I. Iordache, D. Apostol, National Institute for Lasers, Plasma and Radiation Physics (Romania); M. C. Castex, Univ. Paris-Nord (France) [6617-30]
- Coffee Break 15.50 to 16.20

SESSION 8

Room: B13 Tues. 16.20 to 17.40

EUV Scatterometry

Chair: Richard M. Silver, National Institute of Standards and Technology (USA)

- 16.20: **Finite element analysis of EUV lithography**, J. Pomplun, S. Burger, F. Schmidt, Zuse Institute Berlin (Germany); F. Scholze, C. Laubis, Physikalisch-Technische Bundesanstalt (Germany); U. Dersch, Advanced Mask Technology Ctr. (Germany) [6617-31]
- 16.40: **Rigorous solution for electromagnetic scattering from multilayer structures having asperities of any kind in X-ray-EUV ranges**, L. I. Goray, International Intellectual Group, Inc. (USA) and Institute for Analytical Instrumentation (Russia) [6617-32]
- 17.00: **Influence of line edge roughness and CD uniformity on EUV scatterometry for CD characterization of EUV masks**, F. Scholze, C. Laubis, Physikalisch-Technische Bundesanstalt (Germany); U. Dersch, Advanced Mask Technology Ctr. (Germany); J. Pomplun, S. Burger, F. Schmidt, Zuse Institute Berlin (Germany) [6617-33]
- 17.20: **Optimal sets of measurement data for profile reconstruction in scatterometry**, H. A. Gross, Physikalisch-Technische Bundesanstalt (Germany); A. Rathsfeld, Weierstrass-Inst für Angewandte Analysis und Stochastik (Germany); F. Scholze, M. Bär, Physikalisch-Technische Bundesanstalt (Germany) [6617-34]

03A: Optics for Arts, Architecture, and Archaeology

Conference Chairs: **Costas Fotakis**, Foundation for Research and Technology-Hellas (Greece); **Luca Pezzati**, National Institute of Applied Optics/CNR (Italy); **Renzo Salimbeni**, Institute of Applied Physics N. Carrara/CNR (Italy)

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Wednesday 20 June

Welcome and Introduction 09.00 to 09.20

Costas Fotakis, Foundation for Research and Technology Hellas/FORTH (Greece); **Luca Pezzati**, Istituto Nazionale di Ottica Applicata/INOA CNR (Italy); **Renzo Salimbeni**, Istituto di Fisica Applicata "N. Carrara"/IFAC CNR (Italy)

Keynote Presentation 09.20 to 10.00

President Kennedy in Dallas: Dealy Plaza memorialized (*Invited Paper*), J. F. Asmus, Univ. of California/San Diego (USA) ... [6618-01]

Coffee Break 10.00 to 10.30

Plenary Presentation

Room: 1 10.30 to 11.20

Optofluidics

D. Psaltis, EPFL (Switzerland) and Caltech (USA)

SESSION 1

Room: 12 Wed. 11.30 to 12.50

Optical Coherence Tomography I

11.30: **Optical coherence tomography for varnish ablation monitoring** (*Invited Paper*), P. Targowski, Nicolaus Copernicus Univ. (Poland); J. Marczak, Military Univ. of Technology (Poland); M. Gora, Nicolaus Copernicus Univ. (Poland); A. Rycyk, Military Univ. of Technology (Poland) [6618-02]

12.10: **Noninvasive refractive index measurements of paints containing common historic artist pigments using optical coherence tomography**, B. Peric, H. Liang, Nottingham Trent Univ. (United Kingdom); M. Spring, The National Gallery (United Kingdom) . [6618-03]

12.30: **Multiwavelength optical coherence tomography as a new technique for the examination of museum objects**, H. Liang, B. Peric, Nottingham Trent Univ. (United Kingdom); M. Hughes, Univ. of Kent (United Kingdom); A. G. Podoleanu, Univ. of Kent at Canterbury (United Kingdom); D. R. Saunders, The British Museum (United Kingdom); M. Spring, The National Gallery (United Kingdom) [6618-04]

Lunch Break 12.50 to 14.20

SESSION 2

Room: 12 Wed. 14.20 to 15.00

Optical Coherence Tomography II

14.20: **Nondestructive pigment identification of stratified pictorial layers by SOCT**, G. Latour, J. Moreau, M. Elias, J. M. Frigerio, Univ. Pierre et Marie Curie (France) [6618-05]

14.40: **Full-field high-speed optical coherence tomography system for evaluating multilayer and random tissues**, I. Gurov, A. Karpets, N. Margariants, E. Vorobeva, St. Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russia) [6618-06]

SESSION 3

Room: 12 Wed. 15.00 to 17.30

3D Modelling I

15.00: **Characterisation of the varnish-object interface using white light confocal profilometry** (*Invited Paper*), W. Wei, Netherlands Institute for Cultural Heritage (Netherlands); J. Frohn, NanoFocus AG (Germany) [6618-07]

15.40: **X-ray 3D computed tomography of large objects: investigation of an ancient globe created by Vincenzo Coronelli**, M. P. Morigi, F. Casali, A. Berdondini, M. Bettuzzi, D. Bianconi, R. Brancaccio, A. Castellani, V. D'Errico, A. Pasini, A. Rossi, N. Scianna, Univ. degli Studi di Bologna (Italy) [6618-08]

Coffee Break 16.00 to 16.30

16.30: **Optical micro-profilometry for roughness measurement**, R. E. M. Fontana, C. Daffara, M. C. Gambino, E. M. Pampaloni, L. Pezzati, Istituto Nazionale di Ottica Applicata (Italy) [6618-09]

16.50: **Digitization of art pieces based on 3D, colour and texture parameters**, J. Chambard, V. Chalvidan, HOLO3 (France); F. Larue, J. Dischler, Univ. Louis Pasteur (France); V. Vurpillot, A. Legrand, Univ. Jean Monnet Saint-Etienne (France) [6618-10]

17.10: **Cordless handheld optical 3D sensor**, C. Munkelt, C. Braeuer-Burchardt, P. Kühmstedt, I. Schmidt, G. Notni, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) [6618-11]

Thursday 21 June

SESSION 4

Room: 14c Thurs. 08.20 to 10.00

3D Modelling II

08.20: **Using 3D scanning to monitor wood deformations and to evaluate preservation strategies**, M. Callieri, Consiglio Nazionale delle Ricerche (Italy); P. Pingi, Istituto Nazionale Ottica Applicata (Italy); C. Montani, R. Scopigno, Consiglio Nazionale delle Ricerche (Italy); M. T. Brunetti, IVALLSA - Institute for the valorization of the arboreal wood and the species (Ireland) [6618-12]

08.40: **Three-dimensional survey of paint layer**, E. M. Pampaloni, R. E. M. Fontana, M. C. Gambino, L. Pezzati, P. Carcagni, R. Piccolo, Istituto Nazionale di Ottica Applicata (Italy); P. Pingi, Consiglio Nazionale delle Ricerche (Italy); A. Casaccia, R. Bellucci, Opificio delle Pietre Dure (Italy) [6618-13]

09.00: **3D acquisition and modeling for silexes analysis**, B. Loriot, Y. Fougerolle, C. Sestier, R. Seulin, Univ. de Bourgogne (France) [6618-14]

09.20: **Creating a 3D urban model by terrestrial laser scanners and photogrammetry techniques: a case study on the historical peninsula of Istanbul**, B. Ergun, Gebze Yüksek Teknoloji Enstitüsü (Turkey) [6618-15]

09.40: **Polarimetry as tool to improve phase measurement in an amplitude modulated laser for submarine archaeological sites inspection**, M. Francucci, L. Bartolini, L. De Dominicis, M. Ferri de Colibus, G. G. Fornetti, M. Guarneri, E. Paglia, C. Poggi, R. Ricci, ENEA (Italy) [6618-16]

Coffee Break 10.00 to 10.30

SESSION 5

Room: 14c **Thurs. 10.30 to 12.50**

Spectroscopic Techniques

- 10.30: **Multispectral fluorescence imaging for cultural heritage** (*Invited Paper*), D. Comelli, G. Valentini, R. Cubeddu, L. Toniolo, Politecnico di Milano (Italy) [6618-17]
- 11.10: **Scanning hyperspectral lidar fluorosensor for fresco diagnostics during the 2006 campaign in Bucovina**, A. Palucci, ENEA (Italy) [6618-18]
- 11.30: **Design of a versatile microfadometer for lightfastness testing and pigment identification**, A. J. Lerwill, Tate (United Kingdom); H. Liang, Nottingham Trent Univ. (United Kingdom); J. Townsend, S. Hackney, Tate (United Kingdom) [6618-33]
- 11.50: **Laser-induced fluorescence imaging for studies of cultural heritage**, R. Grönlund, Lund Univ. (Sweden); S. Svanberg, J. Hällström, K. Barup, Lunds Tekniska Högskola (Sweden); G. Cecchi, V. Raimondi, D. Lognoli, L. Palombi, Istituto di Fisica Applicata Nello Carrara (Italy) [6618-20]
- 12.10: **Nondestructive detection of lead glass alteration by reflectance spectroscopy**, M. Elias, Univ. Pierre et Marie Curie (France); C. Cécile, Ctr. de Recherche et de Restauration des Musées de France (France); J. M. Frigerio, Univ. Pierre et Marie Curie (France) .. [6618-21]
- 12.30: **Effects Of gamma irradiation on the colour of pigments**, D. C. Negut, C. C. Ponta, R. M. Georgescu, V. I. Moise, Horia Hulubei National Institute of Physics and Nuclear Engineering (Romania); G. Niculescu, A. I. M. Lupu, Consultant (Romania) [6618-40]
- Lunch Break 12.30 to 14.00

✓ Posters-Thursday

An interactive poster session will be held on Thursday 14.00 to 15.30. Posters will be on display after 10.00 Thursday morning in the conference area hallway.

- ✓ **Micro-Raman spectroscopy of protein-based binding media found in paintings**, A. Nevin, Institute of Electronic Structure and Laser of the Foundation for Research and Technology-Hellas (Greece) and Univ. of London (United Kingdom); I. Osticioli, Univ. degli Studi di Firenze (Italy); D. Anglos, Institute of Electronic Structure and Laser of the Foundation for Research and Technology-Hellas (Greece); E. M. Castellucci, European Lab. for Non-linear Spectroscopy (Italy) and Univ. degli Studi di Firenze (Italy); C. Fotakis, FORTH Institute of Electronic Structure and Laser (Greece) [6618-19]
- ✓ **NDT methods in artwork corrosion monitoring**, D. Ambrosini, D. Paoletti, A. Paoletti, S. Sfarra, Univ. degli Studi dell'Aquila (Italy) [6618-35]
- ✓ **Bayes decision model for the watercolour analysis**, V. Kokla, Univ. of Westminster (United Kingdom) [6618-36]
- ✓ **Acquisition of multispectral image and 3D shape reconstruction of Francesco Squarcione**, M. Fedel, CNR-INFN (Jamaica); G. Cortelazzo, A. Paviotti, L. Poletto, Univ. degli Studi di Padova (Italy) [6618-37]
- ✓ **Color appearance of painted artworks through protective glass**, A. Farini, Istituto Nazionale di Ottica Applicata (Italy); A. M. Piegari, I. Di Sarcina, A. Krasilnikova, ENEA (Italy) [6618-38]
- ✓ **Cleaning of silver artifacts by KrF laser**, V. Nassisi, Univ. degli Studi di Lecce (Italy); D. Aiello, ENEL-Italian Electric Power Co. (Italy); A. Buccolieri, G. Buccolieri, A. Castellano, L. S. Leo, A. Lorusso, M. Di Giulio, C. Troisio, Univ. degli Studi di Lecce (Italy) [6618-39]
- ✓ **Volumetric 3D display for visualization of archaeological samples investigated with neutron tomography**, V. Fiasconaro, F. Andreoli, M. Palomba, A. Papaleo, R. Rosa, ENEA (Italy) [6618-41]
- ✓ **Deformation measurement of RC building by 3D laser scanning**, Y. M. Chang, National Central Univ. (Taiwan) [6618-43]

- ✓ **Batory's Chapel at Wawel Castle, Cracow: laser cleaning and hue measurements of epitaph and stalls**, J. Marczak, R. Ostrowski, A. Rycyk, M. Strzelec, Military Univ. of Technology (Poland); A. Koss, Interacademy Institute of Conservation and Restoration of Works of (Poland) [6618-44]
- ✓ **Laser damage thresholds of bone objects**, J. Marczak, R. Ostrowski, A. Rycyk, M. Strzelec, Military Univ. of Technology (Poland); A. Koss, Interacademy Institute of Conservation and Restoration of Works of (Poland) [6618-45]
- ✓ **Optical coherence diagnostics for painting conservation**, R. E. M. Fontana, M. Bellini, M. G. Mastroianni, M. Materazzi, L. Pezzati, A. Tortora, C. Corsi, Istituto Nazionale di Ottica Applicata (Italy) [6618-46]
- ✓ **Laser-induced breakdown spectroscopy in paintings and sculpture research**, W. Skrzeczanowski, A. Sarzynski, J. Marczak, Military Univ. of Technology (Poland) [6618-47]
- ✓ **Relationship between surface incline and confocal chromatic aberration sensor response**, J. W. McBride, P. J. Boltryk, Z. Zhao, W. Sun, Univ. of Southampton (United Kingdom) [6618-48]
- ✓ **Physical phenomena disturbing LIBS analysis**, W. Skrzeczanowski, A. Sarzynski, J. Marczak, Military Univ. of Technology (Poland) [6618-49]
- ✓ **Performance analysis and comparison of imaging systems for IR reflectography**, C. Daffara, M. C. Gambino, L. Pezzati, Istituto Nazionale di Ottica Applicata (Italy) [6618-50]
- ✓ **Cost effective spectral imager for work of art characterization**, P. M. Boher, D. Glinel, M. Luet, T. R. Leroux, ELDIM (France) . [6618-51]

Friday 22 June

SESSION 6

Room: B32 **Fri. 09.00 to 12.10**

Coherent Techniques

- 09.00: **Multifunctional encoding system for assessment of cultural heritage** (*Invited Paper*), V. Tornari, Foundation for Research and Technology-Hellas (Greece); W. Osten, Univ. Stuttgart (Germany); G. Marc, Univ. de Liège (Belgium); G. Hustinx, OPTRION s.a. (Belgium); M. Doulgeridis, National Gallery of Athens (Greece); S. Hackney, Tate (United Kingdom) [6618-22]
- 09.40: **Phase-stepping ESPI applied to the quantitative assessment of structural conservation of easel paintings**, C. R. Young, M. Debashis, Courtauld Institute of Art (United Kingdom) [6618-23]
- Coffee Break 10.00 to 10.30
- 10.30: **Defect detection of wall paintings in the 'Château de Versailles' using TV-holography and IR thermography**, J. Chambard, HOLO3 (France); A. Roche, Lab. d'Analyses et de Recherche pour la Conservation et la Restauration des Oeuvres d'Art (France) .. [6618-24]
- 10.50: **Development of multifunctional sensor for holographic detection of movable artwork signatures: preliminary results with digital speckle holographic interferometry**, I. Bernikola, V. Tornari, K. Xatzghiannakis, Y. Orphanos, Foundation for Research and Technology-Hellas (Greece) [6618-25]
- 11.10: **Role of shearography in a multifunctional sensor for the detection of signature features in moveable cultural heritage**, R. M. Groves, W. Osten, Univ. Stuttgart (Germany) [6618-26]
- 11.30: **Explosive embossing of holographic structures**, T. B. Scholz, J. Seewig, Univ. Hannover (Germany) [6618-27]
- 11.50: **Role of dynamic holography with photorefractive crystals in a multifunctional sensor for the detection of signature features in moveable cultural heritage**, M. P. Georges, C. Thizy, Centre Spatial de Liège - Université de Liège (Belgium) [6618-28]
- Lunch Break 12.10 to 13.40

SESSION 7

Room: B32 **Fri. 13.40 to 16.00**

Imaging

13.40: **Multispectral IR reflectography** (*Invited Paper*), R. E. M. Fontana, D. Bencini, P. Carcagni, M. Greco, M. G. Mastroianni, M. Materazzi, E. M. Pampaloni, L. Pezzati, Istituto Nazionale di Ottica Applicata (Italy) [6618-29]

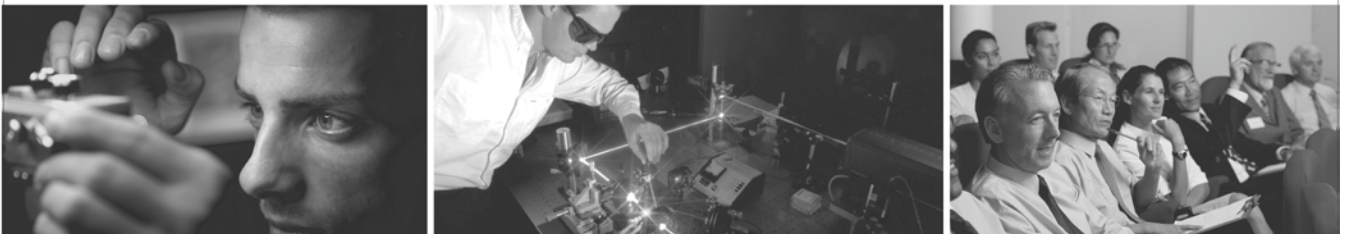
14.20: **Application and development of the multispectral imaging system for the investigation of two paintings by Giotto: the famous Crucifix and the panel of the Holy Father, Padua**, R. Mazzeo, E. Joseph, Univ. degli Studi di Bologna (Italy); M. E. Klein, Art Innovation BV (Netherlands); C. Palazzi, S. Prati, G. Sciutto, Univ. degli Studi di Bologna (Italy) [6618-30]

14.40: **Portable multispectral imaging system for remote in situ examination of wall paintings**, T. Vajzovic, H. Liang, Nottingham Trent Univ. (United Kingdom) [6618-31]

15.00: **Scanning device for multispectral imaging of paintings**, E. M. Pampaloni, R. E. M. Fontana, M. Greco, M. G. Mastroianni, M. Materazzi, L. Pezzati, P. Carcagni, A. Della Patria, Istituto Nazionale di Ottica Applicata (Italy); C. Bonifazzi, A. Romano, Univ. degli Studi di Ferrara (Italy) [6618-32]

15.20: **Applications of optical microscopy in the preservation of the built heritage**, S. Pavia, The Univ. of Dublin, Trinity College (Ireland) [6618-34]

15.40: **Novel method for laser stains removal from archaeological oil painting**, G. Abdellatif, O. El-Feky, S. Darwish, L. M. El Nadi, Cairo Univ. (Egypt) [6618-52]



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Sunday	11.00 to 17.00
Monday through Thursday	8.00 to 17.00
Friday	8.00 to 10.30

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Coffee Breaks

Ground Level Foyer

Monday	16.00 to 16.30
Tuesday	10.00 to 10.30 and 16.00 to 16.30
Wednesday-Friday	10.00 to 10.30 and 16.00 to 16.30

Coffee will be served in the Ground Level Foyer from 10.00 to 10.30, and 16.00 to 16.30 each day.

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Nonattendee nonmember price: \$295

Welcome Reception

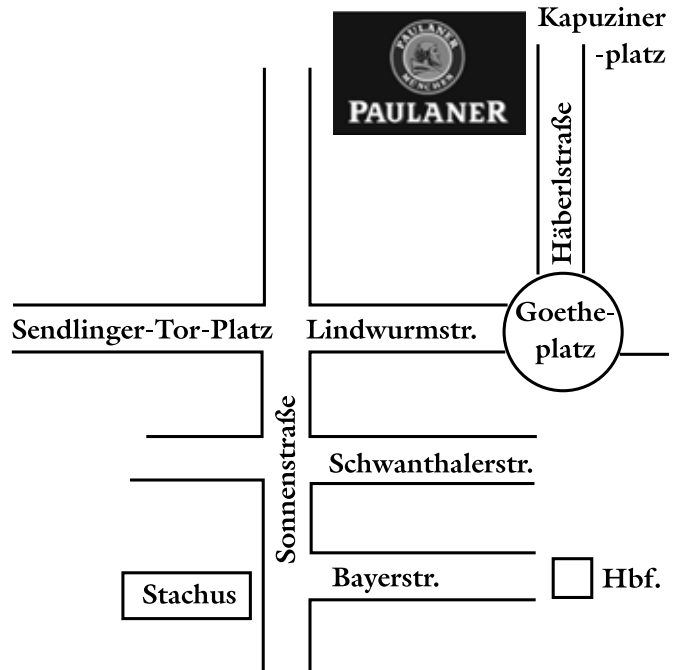
Wednesday 20 June 19.30 to 21.30

This evening event will feature a light meal and beverages at one of Munich's premier breweries, the Paulaner Bräuhaus. All registered conference attendees are welcome. A guest may accompany a registered attendee for an additional charge (space available). Please see SPIE Europe Cashier for tickets.

Directions from International Convention Centre

By public transport: Take local train to Marienplatz, then change into U3/U6 in direction of Fuerstenried West or Klinikum Grosshadern, get off at stop "Goetheplatz" - from there walk through Häberlstrasse; 2 mins on foot.

By Car: Go towards city centre, railway station, middle ring, Sendlinger-Tor-Platz, Lindwurmstrasse to Goetheplatz, turn left into Häberlstrasse (straight across from the employment office)



Rental Cars

Lasers in Metrology / Lasers in Art
June 18-21, 2007
Munich, Germany


MEET WITH SUCCESS THE HERTZ WAY
HERTZ CAR RENTAL CHECKLIST

1. Call the Hertz International Reservation Center at 1-800-654-3001 in the USA or your local Hertz Reservation Center to receive a special discount for the Lasers in Metrology / Lasers in Art Meeting . You will receive 15% off qualifying retail rates with Unlimited Mileage at participating locations in Germany.

Be sure to identify yourself as a Lasers in Metrology / Lasers in Art meeting attendee. The PC# below must be on your advance reservation to receive this special offer. You must present this coupon at time of rental in order to receive this discount.

2. This special offer is available for rentals from June 1-30, 2007

ENJOY YOUR TRIP!

<p>Lasers in Metrology Lasers in Art</p> <p>ATTENDEE DISCOUNT</p> <p>15% OFF</p> <p>Qualifying Retail Rates</p> <p><u>PC# 991410</u></p>	 <p>Important Rental Information</p> <ol style="list-style-type: none"> 1. The Lasers in Metrology/Lasers in Art Meeting discount is available at participating locations in Germany 2. The 15% Discount applies to rentals on Affordable Rates from June 1-30, 2007. 3. Reservations must be made at least 24 hours prior to vehicle pickup, using the PC# on the coupon. 4. Minimum rental period is 1 days. 5. Offer includes Compact and above (manuals and automatics) 6. Discount does not apply to taxes, intercity drop charges, insurance or optional services. 7. Certificate has no cash value and may not be combined with any other offer, discount or promotion. Certificate must be presented and surrendered at time of rental. 8. Normal intercity rules and rate restrictions apply. 9. Minimum rental age is 25 (exceptions apply). Hertz standard driver and credit qualifications for the rental location apply. Blackout periods may apply.
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Hotel Reservation Information

Hotel Accommodations

Optical Metrology 2007 provides links to accommodations in Munich and near the Munich International Conference Centre. You can use their online directory to search for hotels and make reservations. There are hotels in all price ranges and locations for you to select from.

To search the Directory, please see:
<http://www.world-of-photonics.net/link/en/16211399>

The following is a sampling of available hotels. Quoted travel times to the International Conference Centre are approximate using public transportation.

NH Munchen Neue Messe *****/5 minutes
<http://www.nh-hotels.com>
253 rooms, restaurants, bistro/bar, fitness area, sauna, steam bath, solarium and parking
Located near the Munich fairgrounds with connections to the centre of Munich, airport and the main train station.
Standard Room prices from €110
Tel. +49.89.993450 Fax. +49.89.99345400
nhmuenchenneuemesse@nh-hotels.com

Hotel Excelsior **** / 25 minutes
<http://www.excelsior-muenchen.de>
Great location in the city, near Hauptbahnhof station and on the direct U-Bahnline to the Messe.
Price per single room: €155 to €200 Double room €200 to €280
Tel: 49 (0) 89 55 137 0; Fax 49 (0) 89 551 37 122
Excelsior@geisel.hotels.de

Hotel Ludwig *** / 20 Minutes
<http://www.hotel-ludwig.net>
Hotel offers 139 rooms and suites in a modern and confirmatable style.
Price per single room from €79 Double room from €99
Tel: 49 (0) 89 551390; Fax: 49 (0) 89 593403

Participants must make their own determination of suitability considering price and location. Each hotel will determine when they will accept reservations for this event. Listed rates are approximate at time of publication and are subject to change without notice.

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

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Student Housing Accommodations

Discounted accommodations for students are available in Munich. Please also refer to the following web site for additional information about available hostels:

Munich Hostels
<http://www.hostelmunich.com/>

CVJM Munchen (YMCA)
<http://www.cvjm-muenchen.org/english/index.html>

Euro Youth Hostel
<http://www.euro-youth-hotel.de>

Haus International
<http://www.haus-international.de/gb/index/htm>

Transportation from Airport to City Centre

The Franz Josef Strauss Airport (MUC) is located 17 miles (27 km) northeast of the Centre of Munich. Please refer to the Munich International Airport website for more detailed information:
<http://www.munich-airport.de/EN/index.html>

Taxi: Taxis are available outside the airport terminal. The cost is high, approximately 40, and the trip will take 30-45 minutes to the Centre of Munich.

Train: The Airport Rapid Transit Trains leave for the Centre of Munich frequently. Stations Marienplatz and Hauptbahnhof (central railway Station) are the stops in the Centre. The trip will take 30-40 minutes and the cost is approximately 8. Follow the signs as you leave the customs area.

Bus: during the international trade fair, a special Trade Fair Shuttle Bus Service operates between Munich Airport and the ICM. The buses run at 30 minute intervals non-stop from the airport to the trade fair grounds. This service is free of charge upon presentation of a valide trade fair admission ticket, which can be obtained either at the trade fair information counter in the central area of the Munich airport or on the bus. Otherwise, the fair is approximately 8 for a single and for a return journey. The journey takes about 35 minutes, depending on volumes of traffic.

How to Reach the ICM — International Congress Centre München
At Munich Central Station take the underground U2. The journey to the trade fair grounds takes about 17 minutes. Please refer to the Laser 2007 website for more detailed information, <http://www.world-of-photonics.net/link/en/16211399>

Transportation from Munich City Centre to ICM — International Congress Centre München

The ICM is about 30-45 minutes from downtown Munich.

Free Public Transport

All registered conference attendees are eligible to use all Munich City Transport (MW- urban railway, underground, trams, and buses) and Laser Airport shuttle by presenting a corresponding ticket together with a conference entrance pass. Passes will be provided onsite with registration.

For the most current information about all transport options, schedules, and prices, please visit: <http://www.munich-airport.de/EN/Areas/Consumer/Verkehrsanbindung/index.html>

Leverage Experience

SPIE is a highly respected, not-for-profit international society well-known for its **interdisciplinary** coverage of optics and photonics research, related technologies and their many applications. SPIE Digital Library currently contains nearly **235,000 papers** with 17,000 added each year. This extensive research tool is an essential resource offering your choice of technology alerts by newsfeed (RSS) or e-mail.

Powering patents

Patent citations are an important measure of the relevance of research and development to the world economy. SPIE Conference Proceedings papers and Journals, with their emphasis on cutting-edge applied science and engineering, are broadly cited in **US patents**. Nearly 35,000 SPIE papers are cited in 20,000 USPTO high-technology patents, with the expansion of US patents **citing SPIE** publications four times greater than the overall growth rate in patents.

Subscription Information

For complete information on how you and your organization can **become a subscriber**, see SPIDigitalLibrary.org for options and contact information.



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2007 Symposium Chairs

Optical Measurement
Systems for Industrial
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Modeling Aspects in
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O3A: Optics for Arts,
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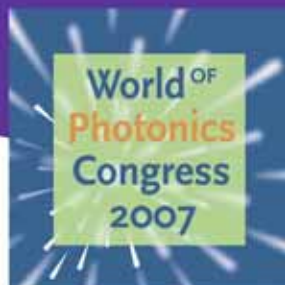
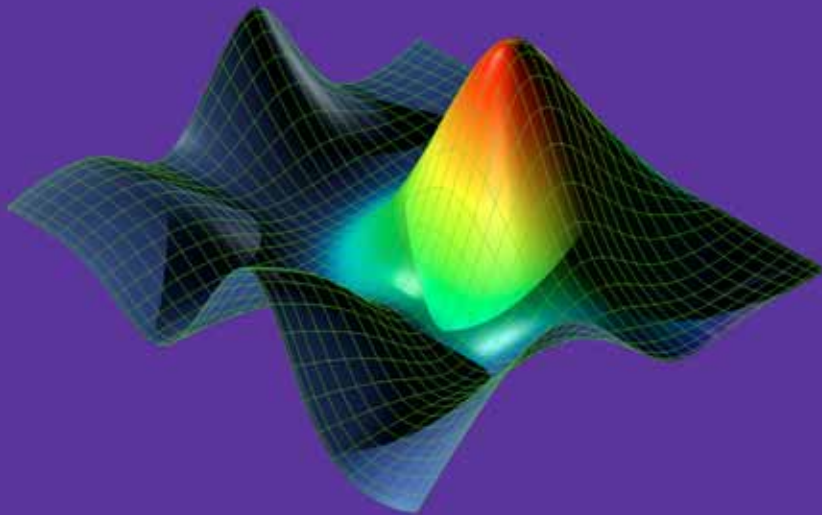
Munich ICM

International Congress
Centre Munich, Germany

18–22 June 2007

Sponsored by **SPIE Europe**

SPIEEurope.org/eom



18th International Congress on Photonics in Europe

co-located with LASER 2007, World of Photonics

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