Digital Holography and Three-Dimensional Imaging (DH)

Topical Meeting and Tabletop Exhibit

Collocated with

Biomedical Optics (BIOMED)
Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)

March 17-19, 2008
Hilton St. Petersburg Bayfront
St. Petersburg, Florida, USA

Postdeadline Submissions Deadline: February 19, 2008 at 12:00 p.m. EST (17.00 GMT)
Hotel Reservation Deadline: February 12, 2008
Pre-Registration Deadline: February 21, 2008

Spring Optics and Photonics Congress

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Collocated Topical Meetings

Biomedical Optics (BIOMED)

Digital Holography and Three-Dimensional Imaging (DH)

Laser Applications of Chemical, Security and Environmental Analysis (LACSEA)

Dates and Location	Important Deadlines
March 16-20, 2008 Hilton St. Petersburg Bayfront St. Petersburg, Florida, USA	**Postdeadline Submissions Deadline:** February 19, 2008 at 12:00 p.m. EST (17.00 GMT) **Hotel Reservation Deadline:** February 12, 2008 **Pre-Registration Deadline:** February 21, 2008

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Advanced Research Technology
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Swamp Optics
Time-Bandwidth Products

Topics to be Discussed

BIOMED Topics

- Methods for Diffuse Optical Imaging and Tomography
- Methods for Optical Spectroscopy and Spectroscopic Imaging
- Optical Coherence Tomography
- Optical Microscopy Techniques
- Photonic Biomedical Nanotechnology
- Optics in Neuroscience
- Optics in Diagnostics and Clinical Translation

DH Topics

- Digital holography theory and systems
- Diffractive optics
- Optical data storage
- Phase unwrapping and phase retrieval
- Computer generated holograms
- Spatial light modulators for holography
- Incoherent digital holography
- Holographic optical elements
- 2D and 3D pattern recognition
- Optical correlators
- Three-dimensional imaging and

- Optics in Molecular and Small Animal Imaging
- Optical Therapeutics

LACSEA Topics

- Laser-analytical Systems
- New Optical and Photonic Sources
- Laser-analytical Optics
- Prediction and Theoretical Treatment of UV, VIS, NIR, MIR and THz Spectra
- Application of Laser-analytical Systems to chemical, biophysical and biochemical analysis, homeland security and environmental measurements in industry as well as basic research.

processing
- Three-dimensional display
- Stereo-matching and stereoscopic cameras
- 2D-3D content conversion
- Shape and deformation measurement
- Polarization analysis
- Holographic imaging and microscopy
- Holographic nanofabrication methods
- Holographic optical micro-manipulation

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About DH

The topical meeting on Digital Holography and Three-Dimensional Imaging provides a forum for disseminating the science and technology of holographic interferometry for deformation or contour measurement, 3-D optical remote sensing, 3-D holographic microscopy, 3-D optical image processing and 3-D display, digital holography for life sciences applications.

Digital Holography and Three-Dimensional Imaging (DH) Meeting Topics To Be Considered:

- Digital holography theory and systems
- Diffractive optics
- Optical data storage
- Phase unwrapping and phase retrieval
- Computer generated holograms
- Spatial light modulators for holography
- Incoherent digital holography
- Holographic optical elements
- 2D and 3D pattern recognition
- Optical correlators
- Three-dimensional imaging and processing
- Three-dimensional display
- Stereo-matching and stereoscopic cameras
- 2D-3D content conversion
- Shape and deformation measurement
- Polarization analysis
- Holographic imaging and microscopy
- Holographic nanofabrication methods
- Holographic optical micro-manipulation

Program Committee

Ting-Chung Poon, *Virginia Tech, USA*, **Chair**
Byoungho Lee, *Seoul National Univ., Korea,* **Co-Chair**

George Barbastathis, *MIT, USA*
Min Gu, *Swinburne Univ. of Technology, Australia*
Sung-Kyu Kim, *Korea Inst. of Science and Technology, Korea*
Wolfgang Osten, *Univ. Stuttgart, Germany*
Joe Rosen, *Ben Gurion Univ. of the Negev, Israel*
Jim Swoger, *Ctr. for Genomic Regulation, Spain*
Frank Wyrowski, *Univ. of Jena, Germany*
Ichirou Yamaguchi, *Gunma Univ., Japan*
Hiroshi Yoshikawa, *Nihon Univ., Japan*

Invited Speakers

DMA1, Coherence Holography and Spatial Frequency Comb for 3-D Coherence Imaging; *Mitsuo Takeda[1], Wei Wang[2], Zhihui Duan[1], Yoko Miyamoto[1], Joseph Rosen[3]; [1]Univ. of Electro-Communications, Japan, [2]Heriort-Watt Univ., United Kingdom, [3]Ben-Gurion Univ. of the Negev, Israel.*

DMA6, Using Partial Coherence and Digital Holography for 3-D Imaging and Profile Extraction; *Zeev Zalevsky[1], Ofer Margalit[1], Emanuel Vexberg[1], Roy Pearl[1], Javier Garcia[2]; [1]Bar-Ilan Univ., Israel, [2]Univ. de València, Spain.*

DMB1, Optical Imaging of Ocean Plankton: A Fantastic Voyage; *Cabell Davis; Woods Hole Oceanographic Inst., USA.*

DMB6, 3-D Fibre-Optical Nonlinear Optical Microscopy Imaging; *Min Gu; Swinburne Univ. of Technology, Australia.*

DMC1, Reconstruction of Three-Dimensional Images of Real Objects by Electronic Holography; *Tomoyuki Mishina, Makoto Okui; Natl. Inst. of Information and Communications Technology, Japan.*

DTuA1, Applications of Integral Photography for Real-Time Imaging; *Fumio Okano; NHK Science and Technical Res. Labs, Japan Broadcasting Corp., Japan.*

DTuA6, Bio/Medical Applications Using High Definition 3-D Stereo Camera and Monitor System; *Nam Kim; Chungbuk Natl. Univ., Republic of Korea.*

DTuB1, Measuring Dynamics and Interactions of Colloidal Particles with Digital Holographic Microscopy; *Ryan McGorty, Jerome Fung, David Kaz, Steven Ahn, Vinothan N. Manoharan; Harvard Univ., USA.*

DTuB6, A Demonstration of Total Internal Reflection Holographic Microscopy for the Study of Cellular Motion; *William M. Ash III, Myung K. Kim; Univ. of South Florida, USA.*

DWA1, Holographic 3-DTV Research within the European 3-DTV Project; *Levent Onural; Bilkent Univ., Turkey.*

DWA6, Current Research and Development Activities for 3-D Applications in Korea; *Seung-Hyun Lee, Ji-Sang Yoo, Dong-Wook Kim; Kwangwoon Univ., Republic of Korea.*

DWB1, Assessment of 3-D Angular Movements of Diffuse Objects Using Holographic Interferometry; *Partha P. Banerjee[1], G. Nehmetallah[1], M. R. Chatterjee[1], S. C. Praharaj[2], N. V. Kukhtarev[3]; [1]Univ. of Dayton, USA, [2]DMS Technologies Inc., USA, [3]Alabama A&M Univ., USA.*

Digital Holography and Three-Dimensional Imaging (DH) Abstracts

• Monday, March 17, 2008 •

Conference Registration
7:00 a.m.–6:00 p.m.
Registration Open

Harborview
7:50 a.m.–8:00 a.m.
DH Opening Remarks

DMA • 3-D Imaging I

Harborview
8:00 a.m.–10:00 a.m.
DMA • 3-D Imaging I
Ichirou Yamaguchi; Gunma Univ., Japan, Presider

DMA1 • 8:00 a.m. Invited
Coherence Holography and Spatial Frequency Comb for 3-D Coherence Imaging, *Mitsuo Takeda[1], Wei Wang[2], Zhihui Duan[1], Yoko Miyamoto[1], Joseph Rosen[3]; [1]Univ. of Electro-Communications, Japan, [2]Heriort-Watt Univ., UK, [3]Ben-Gurion Univ. of the Negev, Israel.* The principle and the applications of a recently proposed unconventional holography technique, called *coherence holography*, and a related technique for dispersion-free 3-D coherence imaging based on a spatial frequency comb will be reviewed.

DMA2 • 8:30 a.m.
Passive 3-D Imaging with Quasi-Rotating PSFs, *Sri Rama Prasanna Pavani, Rafael Piestun; Univ. of Colorado at Boulder, USA.* Quasi-rotating point spread functions (QPSFs) are engineered three-dimensional (3-D) point spread functions (PSFs) for high efficiency 3-D imaging systems. QPSFs have over 30 times higher light throughput efficiency than strictly rotating PSFs.

DMA3 • 8:45 a.m.
Removing Ambiguity in 2-D Image Information by Means of 3-D Models, *William T. Rhodes[1,2], Diego Pava[2]; [1]Georgia Tech, USA, [2]Florida Atlantic Univ., USA.* If moving objects in low-resolution 2-D video imagery are placed in their 3-D context, object uncertainties can be removed. We consider the case of detecting distant humans subtending only tens of pixels in digital video.

DMA4 • 9:00 a.m.
Small Reconstruction Distance in Convolution Formalism, *Tristan Colomb[1,2], Frédéric Montfort[3], Christian Depeursinge[2]; [1]Ctr. de Neurosciences Psychiatriques, Dept. de Psychiatrie, Ctr. Hospitalier Univ. Vaudois Lausanne, Switzerland, [2]Ecole Polytechnique Fédérale de Lausanne, Switzerland, [3]Lyncée Tec SA, Switzerland.* Different numerical wavefront propagations in Fresnel approximation are proposed in digital holography. Standard convolution formalism fails for small reconstruction distances. We developed a simplified convolution formalism that is equivalent to the angular spectrum.

DMA5 • 9:15 a.m.
Holographic Microscopy with Second Harmonic Signals, *Ye Pu[1], Martin Centurion[2], Demetri Psaltis[3]; [1]Dept. of Electrical Engineering, Caltech, USA, [2]Lab for Attosecond and High-Field Physics, Max-Planck-Inst. für Quantenoptik, Germany, [3]Ecole Polytechnique Fédérale de Lausanne (EPFL), Lab d'Optique, Switzerland.* We demonstrate a new holographic principle that records digital holograms between independently generated second harmonic signals and reference. This technique is uniquely suited for ultrafast four-dimensional contrast microscopy to capture molecular biological events.

DMA6 • 9:30 a.m. Invited
Using Partial Coherence and Digital Holography for 3-D Imaging and Profile Extraction, *Zeev Zalevsky[1], Ofer Margalit[1], Emanuel Vexberg[1], Roy Pearl[1], Javier Garcia[2]; [1]Bar-Ilan Univ., Israel, [2]Univ. de València, Spain.* Two approaches for 3-D imaging are presented. At first we use partial coherence of the light source and in the second we compute the unwrapped phase by illuminating the object from several slightly different angles.

St. Petersburg Ballroom
10:00 a.m.–10:30 a.m.
Coffee Break

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

DMB • 3-D Imaging II

Harborview
10:30 a.m.–12:30 p.m.
DMB • 3-D Imaging II
Zeev Zalevsky; Bar-Ilan Univ., Israel, Presider

DMB1 • 10:30 a.m. Invited

Optical Imaging of Ocean Plankton: A Fantastic Voyage, *Cabell Davis; Woods Hole Oceanographic Inst., USA.* Plankton are the primary form of life in the ocean and constitute the base of the marine food web. New digital optical sampling methods from video to holography are providing new insights in plankton ecology.

DMB2 • 11:00 a.m.

3-D Representation of Retinal Blood Vessels through Digital Interference Holography, *Mariana C. Potcoava, Myung K. Kim; Univ. of South Florida, USA.* This paper presents a 3-D amplitude model of a pig retina sample with micron-scale resolution using Digital Interference Holography. We concentrate on the retinal vessels visualization and the retinal vessels width estimation.

DMB3 • 11:15 a.m.

Imaging Interferometry for Investigation of Mechanics of Multiple Cells in a Large Field of View, *Jason Reed[1,2], Matthew Frank[1], Joshua J. Troke[1], Joanna Schmit[3], Sen Han[3], Michael A. Teitell[1,2], James K. Gimzewski[1]; [1]Univ. of California at Los Angeles, USA, [2]California NanoSystems Inst., USA, [3]Veeco Instruments, USA.* We demonstrate the mechanical probing of tens of cells simultaneously while an interferometric optical profiler measures both the force of the probes and the response of the cells with nanometer accuracy over a wide field.

DMB4 • 11:30 a.m.

Simultaneous Depth Determination of Multiple Objects by Focus Analysis in Digital Holography, *Toyohiko Yatagai[1,2], Mark L. Tachiki[2]; [1]Utsunomiya Univ., Japan, [2]Univ. of Tsukuba, Japan.* Focus analysis techniques from computer vision are applied to digital holography to automate the process of focusing on various objects in the image and estimating their depths. Computer simulation and experimental results are presented.

DMB5 • 11:45 a.m.

Dual-Wavelength Reflection Digital Holographic Microscopy Applied to the Detection of Pores in Coal Samples, *Alexander Khmaladze[1], Alejandro Restrepo-Martínez[2], Myung Kim[1], Roman Castañeda[2], Astrid Blandón[2]; [1]Univ. of South Florida, USA, [2]Univ. Natl. de Colombia Sede Medellín, Colombia.* The detection of pores in coal samples using the multi-wavelength phase imaging digital holography is discussed and compared to software unwrapping.

DMB6 • 12:00 p.m. Invited

3-D Fibre-Optical Nonlinear Optical Microscopy Imaging, *Min Gu; Swinburne Univ. of Technology, Australia.* The recent development of fibre-optical nonlinear optical microscopy for 3- endoscope tissue imaging is reported. The new compact probe is designed with double-clad photonic crystal fibre components and a microelectromechanical system (MEMS) mirror.

12:30 p.m.–1:30 p.m.
Lunch Break

DMC • Digital/Electronic Holography

Harborview
1:30 p.m.–3:30 p.m.
DMC • Digital/Electronic Holography
Hiroshi Yoshikawa; Nihon Univ., Japan, Presider

DMC1 • 1:30 p.m. Invited

Reconstruction of Three-Dimensional Images of Real Objects by Electronic Holography, *Tomoyuki Mishina, Makoto Okui; Natl. Inst. of Information and Communications Technology, Japan.* This paper described methods to display real objects with electronic holography. With a holographic display that applied these methods, autostereoscopic images of real, moving objects could be viewed at a distance of 40 cm.

DMC2 • 2:00 p.m.

Grating Phase-Shifting In-Line Digital Holography, *Wenjing Zhou[1,2], Yingjie Yu[1], Ping Ni[1], Anand Asundi[3], Zhijiang Zhang[1]; [1]Shanghai Univ., China, [2]Dept. of Automation, Guangdong Ocean Univ., China, [3]Nanyang Technological Univ., India.* In-line digital holograms with object illuminated by the phase-shifted fringes exported on an SLM are recorded by CCD. The object-wave is reconstructed by phase-shifting algorithm and diffraction theory. The method is validated experimentally with phase-grating.

DMC3 • 2:15 p.m.

Fresnel Incoherent Digital Holograms Directly Recorded by Multiple Viewpoint Projections, *Natan T. Shaked, Joseph Rosen; Ben Gurion Univ. of the Negev, Israel.* We present and experimentally demonstrate a new, efficient, direct and accurate method of obtaining a modified Fresnel hologram under incoherent illumination by directly processing the projections of the three dimensional scene, and without using approximations.

DMC4 • 2:30 p.m.
Reconstruction of Digital Color Holograms and Application to Full Field Metrology, *Pascal Picart[1,2], Denis Mounier[3], Eudes-Evrard Bobboh-Ebo[2], Jean-Michel Desse[4]; [1]Lab d'Acoustique de l'Univ. du Maine, France, [2]Ecole Natl. Supérieure d'Ingénieurs du Mans, France, [3]Lab de Physique de l'Etat Condensé, France, [4]Office Natl. d'Etudes et de Recherches Aérospatiales, France.* This paper focuses on new opportunities given by high spatial resolution multi-wavelength digital holographic metrology. The method and its application to simultaneous deformation measurement of an object submitted to mechanical loading are described.

DMC5 • 2:45 p.m.
Metrology of Fluids with Digital Color Holography, *Jean-Michel Desse[1], Patrice Tankam[2], Pascal Picart[2,3]; [1]Office Natl. d'Etudes et de Recherches Aérospatiales, France, [2]Lab d'Acoustique de l'Univ. du Maine, France, [3]Ecole Natl. Supérieure d'Ingénieurs du Mans, France.* A digital three-color holographic interferometer devoted to the measurement of fluids is presented. Recording uses a three layer photodiode stack sensor allowing a simultaneous recording with high spatial resolution. Experimental results validate the proposed method.

DMC6 • 3:00 p.m.
Spectrometer-Based Digital Holographic Tomography, *Lingfeng Yu, Zhongping Chen; Beckman Laser Inst., Univ. of California, USA.* A digital holographic tomography system has been developed based on a fiber-based spectral interferometer. Multiple synthesized holograms of different wavelengths are obtained by transversely scanning a probe beam and then used for three-dimensional tomographic imaging.

DMC7 • 3:15 p.m.
Digital Holography with Arbitrary Temporal Phase-Shifts and Multiple Wavelengths for Shape Measurement of Rough Surfaces, *Daniel Carl, Markus Fratz, Dirk Strohmeier, Dominik M. Giel, Heinrich Höfler; Fraunhofer Inst. for Physical Measurement Techniques, Germany.* A novel implementation of lensless multi-wavelength digital holography with arbitrary temporal phase-shifts is presented. The algorithm proposed by Cai et al. [1] is used to our knowledge for the first time in lensless holography.

St. Petersburg Ballroom
3:30 p.m.–4:00 p.m.
Coffee Break

JMA • Joint DH and LACSEA Poster Session

Foyer
4:00 p.m.–6:00 p.m.
JMA • Joint DH and LACSEA Poster Session

JMA1
IVR-Based Computational Reconstruction Method in Three-Dimensional Integral Imaging with Non-Uniform Lens Array, *Chang-Keun Kim, Keong-Jin Lee, Dong-Choon Hwang, Seung-Cheol Kim, Eun-Soo Kim; 3-D Display Res. Ctr., Natl. Res. Lab of 3-D Media, Dept. of Electronic Engineering, Kwangwoon Univ., Republic of Korea.* In this paper, we propose an IVR-based computational reconstruction method to enhance the resolution of reconstructed images in three-dimensional integral imaging with a non-uniform lenslet array having different focal lengths and aperture sizes.

JMA2
Depth-Enhanced Integral Floating Imaging System with Variable Image Planes Using Polymer-Dispersed Liquid-Crystal Films, *Youngmin Kim, Joohwan Kim, Yunhee Kim, Jae-Hyun Jung, Byoungho Lee; School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea.* A depth-enhanced three-dimensional integral floating imaging system with variable imaging planes is proposed. Polymer-dispersed liquid-crystal films are used for implementing the variable planes. The proposed method is described and experiment results are provided.

JMA3
Optical Sectioning Method Using Wigner Distribution Function Filtering, *Sung-Wook Min[1], Hwi Kim[2], Byoungho Lee[2], Ting-Chung Poon[3]; [1]Kyung Hee Univ., Republic of Korea, [2]Seoul Natl. Univ., Republic of Korea, [3]Virgina Tech, USA.* An optical sectioning method for optical scanning holography using Wigner distribution function is proposed. The feasibility of the proposed method is shown with the simulation of the Wigner distribution function filtering of two layer signals.

JMA4
Digital Holographic Security System Using Photopolymer, *Nam Kim, HyeonSeop Jeong, JaeHyeong Park; Chungbuk Natl. Univ., Republic of Korea.* In this paper, we introduced digital holography and its application in photopolymer. We propose the double-side dual hologram reconstruction scheme and demonstrate the holographic smart card system using digital holographic memory technique.

JMA5
3-D Image Quality Enhancement in Computational Integral Imaging System by Additional Use of an Interpolation Method, *Dong-Hak Shin, Hoon Yoo; Dongseo Univ., Republic of Korea.* We propose a computational integral imaging reconstruction method using interpolation algorithms to improve the viewing quality of 3-D reconstructed images. To show the usefulness of the proposed method, we carry out experiments on real objects.

JMA6
Non-Holographic Method for Detection of Spatial Positions of Microparticles by Means of Conical Waves, *Peeter Piksarv, Ando Aasa, Kaido Reivelt; Inst. of Physics, Univ. of Tartu, Estonia.* The possible applications of conical waves for simultaneus, real-time determination of spatial configuration of multiple microparticles has been studied.

JMA7
Quantitative Phase Microscopy with Multi-Wavelength Unwrapping and Tomographic 3-D Reconstruction, *Matthew T. Rinehart, Michael Giacomelli, Kevin Chalut, Adam Wax; Duke Univ., USA.* Asynchronous digital holography has been developed for quantitative phase measurements, and will be extended to multi-wavelength phase unwrapping and 3-D tomographic reconstruction. Results acquired from standard samples and also live cell samples will be presented.

JMA8
Resolution-Improved Image Reconstruction of 3-D Object Occluded Partially by the Unknown Occlusion in Computational Integral Imaging, *Dong-Hak Shin, Chun-Wei Tan, Hoon Yoo, Byung-Gook Lee; Dongseo Univ., Republic of Korea.* We propose a method for improved reconstruction of 3-D object occluded partially by the unknown occlusion using computational integral imaging. To verify the proposed method, some experiments are carried out and the results are presented.

JMA9
High-Performance CGH Processor for Real-Time Digital Holography, *Young-Ho Seo[1], Hyun-Jun Cho[2], Dong-Wook Kim[2]; [1]Hansung Univ., Republic of Korea, [2]Kwangwoon Univ., Republic of Korea.* This paper proposes a new hardware architecture to generate digital hologram using the modified CGH (Computer Generated Hologram) algorithm for hardware implementation and design to FPGA platform.

JMA10
An Electronic Watermarking Technique for Digital Hologram, *Hyun-Jun Choi[1], Young-Ho Seo[2], Ji-Sang Yoo[1], Young-Geun Choi[1], Hwa-Sung Kim[1], Dong-Wook Kim[1]; [1]Kwangwoon Univ., Republic of Korea, [2]Hansung Univ., Republic of Korea.* This paper propose a watermarking scheme, a method to protect the ownership, for holograms, which uses the DCT domain data as the ones to be watermarked. This scheme shows strong robustness against the considered attacks.

JMA11
Projection Moiré Profilometer Using Computer Generated Projection and Demodulation Grids on Liquid Crystals, *Jan A. N. Buytaert, Joris J. J. Dirckx; Univ. of Antwerp, Belgium.* A projection moiré interferometer for topography is presented, which uses liquid crystal light modulators for both projection and demodulation grid. High resolution is obtained by optical demodulation, the 4-bucket algorithm and discrete grid averaging theory.

JMA12
Computer-Generated Disk Hologram, *Takeshi Yamaguchi, Tomohiko Fujii, Hiroshi Yoshikawa; Nihon Univ., Japan.* It is difficult to realize a computer-generated disk hologram due to the needs of high resolution output and huge computation. We have achieved to make the computer-generated disk hologram by using the fringe printer.

JMA13
Synthesizing Incoherent Digital Holograms with Reduced Number of Projections, *Barak Katz, Natan T. Shaked, Joseph Rosen; Ben Gurion Univ. of the Negev, Israel.* We present a method of recording digital Fourier holograms under incoherent illumination, using a significantly reduced number of observed perspective projections and a digital prediction of the middle projections. The method is demonstrated experimentally.

JMA14
Three-Dimensional Display Using Integral Imaging Technique Captured by Holographic Method, *Sukhbat Purev, Seung-Cheol Kim, Eun-Soo Kim; 3-D Display Res. Ctr., Dept. of Electronic Engineering, Kwangwoon Univ., Republic of Korea.* In this paper, we propose the integral imaging reconstruction technique from the hologram pattern with some image processing. From some experimental result, we show the proposed method could be possible.

JMA15
Efficient Computational Integral Imaging Reconstruction Scheme Dsing Depth Extraction, *Jin-Mo Kang, Joohwan Kim, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We propose a new method using depth extraction for fast and efficient computational integral imaging reconstruction (CIIR). Using the depth extraction method, we can know the depth plane we should reconstruct in the CIIR method.

JMA16
Computer-Generation Method for Elemental Image of Integral Floating Display Using Virtual Integral Imaging System, *Gilbae Park, Jae-Hyun Jung, Joohwan Kim, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We propose a fast and efficient generation method of elemental images for integral imaging using computer-graphics library in integral floating display system. This method is demonstrated through experiments.

Posters JMA17–JMA45 are listed in the LACSEA abstract section of the program.

St. Petersburg Ballroom
6:30 p.m.–8:00 p.m.
Conference Reception

NOTES

• Tuesday, March 18, 2008 •

Conference Registration
7:00 a.m.–6:00 p.m.
Registration Open

DTuA • Integral Photography and Imaging: 3-D Systems

Harborview
8:00 a.m.–10:00 a.m.
DTuA • Integral Photography and Imaging: 3-D Systems
George Barbastathis; MIT, USA, Presider

DTuA1 • 8:00 a.m. **Invited**
Applications of Integral Photography for Real-Time Imaging, *Fumio Okano; NHK Science and Technical Res. Labs, Japan Broadcasting Corp., Japan.* We describe applications of integral photography modified for real-time imaging. 3-DTV that requires huge number of pixels, amplified 3-D viewer and afocal array are proposed. 3-D images were confirmed by experiments of these applications.

DTuA2 • 8:30 a.m.
A Thin 3-D–2-D Convertible Integral Imaging System Using a Pinhole Array on an Electroluminescent (EL) Sheet, *Jae-Hyun Jung, Youngmin Kim, Joohwan Kim, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We propose a thin and compact 3-D–2-D convertible integral imaging system using a pinhole array on an electroluminescent (EL) sheet. This system can electrically convert between 3-D and 2-D modes by switching EL sheet.

DTuA3 • 8:45 a.m.
Arbitrary View-Point Image Generation from Integral Imaging with Enhanced Resolution and Wide Field of View, *Jae-Hyeung Park; Chungbuk Natl. Univ., Republic of Korea.* A novel view-point image generation algorithm based on integral imaging is presented. Arbitrary view-point image is generated through the central pixel disparity estimation and elemental image mapping, alleviating field of view limitation and resolution degradation.

DTuA4 • 9:00 a.m.
Color on White-Light Three-Dimensional Images Projected on Holographic Screens by Three-Chromatic Multiple Projection: First Results for an Image Point, *Jose J. Lunazzi, Daniel S. F. Magalhães; Campinas State Univ. (UNICAMP), Brazil.* We describe the first elementary color representations obtained with a white-light holographic screen under lateral illumination. An image point is projected to the same position through different angular directions showing three-chromatic capability.

DTuA5 • 9:15 a.m.
Focused Image Creation Algorithms for Digital Holograms of Macroscopic Three-Dimensional Objects, *Conor P. McElhinney[1], Bryan M. Hennelly[1], Thomas J. Naughton[1,2]; [1]Natl. Univ. of Ireland, Ireland, [2]Univ. of Oulu, Finland.* When a digital hologram is reconstructed, only points located at the reconstruction distance are in focus. We have developed a novel technique for creating an in-focus image of the macroscopic objects encoded in a digital hologram.

DTuA6 • 9:30 a.m. **Invited**
Bio/Medical Applications Using High Definition 3-D Stereo Camera and Monitor System, *Nam Kim; Chungbuk Natl. Univ., Republic of Korea.* In this paper, we demonstrated high definition resolution stereoscopic microscope as bio/medical application and 24/40-inch polarized-light stereoscopic display to improve the environmental factor for small and medium scale animal surgery using stereoscopic microscope system.

St. Petersburg Ballroom
10:00 a.m.–10:30 a.m.
Coffee Break

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

DTuB • Digital Holographic Microscopy

Harborview
10:30 a.m.–12:30 p.m.
DTuB • Digital Holographic Microscopy
Min Gu; Swinburne Univ. of Technology, Australia, Presider

DTuB1 • 10:30 a.m. **Invited**
Measuring Dynamics and Interactions of Colloidal Particles with Digital Holographic Microscopy, *Ryan McGorty, Jerome Fung, David Kaz, Steven Ahn, Vinothan N. Manoharan; Harvard Univ., USA.* Micrometer-sized colloidal particles are a model system for understanding self-assembly in condensed matter. Here I present the results of digital holographic microscopy experiments that probe the 3-D structure and dynamics of these systems.

DTuB2 • 11:00 a.m.
Two-Views Multiplexing in Transmission Digital Holographic Microscopy, *Alejandro Restrepo-Martínez[1], Roman Castañeda[1], Myung Kim[2]; [1]Univ. Natl. de Colombia Sede Medellín, Colombia, [2]Univ. of South Florida, USA.* Two views of a sample are recorded in a single hologram by a standard transmission digital holographic microscope. Single and mixed views can be reconstructed. This technique can be applied for observing dynamical processes.

DTuB3 • 11:15 a.m.
Light-Induced Refractive Index Profile Measurement Using Digital Holographic Microscopy, *Chau-Jern Cheng[1], Yu-Chih Lin[1], Han-Yen Tu[2]; [1]Natl. Taiwan Normal Univ., Taiwan, [2]St. John's Univ., Taiwan.* We propose and demonstrate an in situ measurement technique of the light-induced refractive index profile in the PQ:PMMA holographic recording media by use of phase-shifting digital holographic microscopy.

DTuB4 • 11:30 a.m.
Confocal Scheme to Improve the Reconstructed Image in Digital Holographic Microscopy, *Wang-Ta Hsieh[1], Gu-Liang Chen[1], Ming-Kuei Kuo[2], Hon-Fai Yau[3], Chi-Ching Chang[4]; [1]School of Defense Science, Natl. Defense Univ., Taiwan, [2]Dept. of Electronic and Electrical Engineering, Natl. Defense Univ., Taiwan, [3]Dept. of Optics and Photonics, Natl. Central Univ., Taiwan, [4]Inst. of Electrophysics, Ming Dao Univ., Taiwan.* A confocal configuration for holographic reconstruction using an off-axis digital hologram without the additional phase-retrieval elements in the setup is presented. The optical system is capable of digital holographic microscopy with aberration free image reconstruction.

DTuB5 • 11:45 a.m.
Simultaneous Cell Morphometry and Refractive Index Measurement with Dual-Wavelength Digital Holographic Microscopy, *Benjamin Rappaz[1], Florian Charrière[1], Tristan Colomb[2], Christian Depeursinge[1], Pierre J. Magistretti[1,2], Pierre Marquet[2]; [1]Ecole Polytechnique Fèdèrale de Lausanne, Switzerland, [2]Ctr. de Neurosciences Psychiatriques, Dept. de Psychiatrie, Ctr. Hospitalier Univ. Vaudois Lausanne, Switzerland.* The refractive index and cellular thickness information contained in the phase signal recorded by Digital Holographic Microscopy is measured independently with a dual-wavelength technique exploiting the dispersion of a dye present in the perfusion medium.

DTuB6 • 12:00 p.m. Invited
A Demonstration of Total Internal Reflection Holographic Microscopy for the Study of Cellular Motion, *William M. Ash III, Myung K. Kim; Univ. of South Florida, USA.* Total internal reflection holographic microscopy (TIRHM) is a synthesis of evanescent wave microscopy with digital holography being developed for real-time quantitative phase microscopy of the interface of biological cells moving over a glass substrate.

12:30 p.m.–1:30 p.m.
Lunch Break

DTuC • Digital Holography and Holographic Microscopy

Harborview
1:30 p.m.–3:15 p.m.
DTuC • Digital Holography and Holographic Microscopy
Mitsuo Takeda; Univ. of Electro-Communications, Japan, Presider

DTuC1 • 1:30 p.m.
On-Axis Single Shot Digital Holography Using Polarization Based Two Sensing Channels, *Daesuk Kim, Byung Joon Baek; Chonbuk Natl. Univ., Republic of Korea.* On-axis single shot digital holography using polarization based two sensing channels is described. This study proposes a novel on-axis single shot method that can provide the same reconstruction quality as on-axis multiple shot scheme.

DTuC2 • 1:45 p.m.
Sub-Nanometer Resolution over Several Microns Range with Real-Time Dual-Wavelength Digital Holographic Microscopy, *Jonas Kühn[1], Tristan Colomb[2], Christophe Pache[1], Florian Charrière[1], Christian Depeursinge[1]; [1]Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, [2]Ctr. de Neurosciences Psychiatriques, Dept. de Psychiatrie, Ctr. Hospitalier Univ. Vaudois Lausanne, Switzerland.* Single-acquisition dual-wavelength digital holographic microscopy provides real-time phase measurement range over several microns. We demonstrate axial resolution enhancement down to sub-nanometer range thanks to the non-correlation between both available wavefronts.

DTuC3 • 2:00 p.m.
Refractive Index Tomography by Digital Holographic Microscopy, *Christian Depeursinge[1], Nicolas Pavillon[1], Jonas Kühn[1], Tristan Colomb[2], Pierre Marquet[2]; [1]Ecole Polytechnique Fèdèrale de Lausanne, Switzerland, [2]Ctr. de Neurosciences Psychiatriques, Dept. de Psychiatrie, Ctr. Hospitalier Univ. Vaudois Lausanne, Switzerland.* 3-D Refractive Index (RI) tomography appears as a challenging perspective in the observation of microscopic 3-D objects, biological cells in particular. Recent developments in Digital Holographic Microscopy have permitted to achieve accurate RI 3-D images.

DTuC4 • 2:15 p.m.
Three-Wavelength Phase Imaging Digital Holography of MEMS Motion, *Christopher J. Mann, Philip R. Bingham, Kenneth W. Tobin; Oak Ridge Natl. Lab, USA.* Three-wavelength digital holography is applied to obtain holographic movies of MEMS motion. Three lasers are used to generate phase movies without the 2π ambiguities while maintaining the noise to that in the single-wavelength profile.

DTuC5 • 2:30 p.m.
Single-Shot Measurement of the Full Spatio-Temporal Field of Ultrashort Pulses with Multi-Spectral Digital Holography, *Rick Trebino, Pablo Gabolde; School of Physics, Georgia Tech, USA.* We present a single-shot, simple technique for measuring the full spatio-temporal electric field of ultra-short laser pulses by measuring multiple digital holograms in a single camera frame. We experimentally demonstrate this technique using femtosecond pulses.

DTuC6 • 2:45 p.m.
Comparison of Reconstruction Methodologies for Off-Axis and In-Line Digital Holographic Microscopy, *John F. Restrepo, Jorge A. Herrera, Román Castañeda; Univ. Natl. de Colombia, Colombia.* Transmission Digital Holographic microscopy is implemented to obtain phase profiles of a thin film; different methodologies for the holographic reconstruction process are implemented and a comparison has been made.

DTuC7 • 3:00 p.m.
Colloidal Stability Evaluation via Digital In-Line Holographic Microscopy, *Diego A. Hincapie[1], Cesar Restrepo[2], Herley Casanova[2], Jurgen Kreuzer[3], Jorge Garcia-Sucerquia[1,3,4]; [1]Univ. Natl. de Colombia Sede Medellín, Colombia, [2]Univ. de Antioquia, Colombia, [3]Dalhousie Univ., Canada, [4]Laval Univ., Canada.* Stability of colloidal systems is measured with Digital In-line Holographic Microscopy (DIHM). The DIHM portability and the correctness of the obtained results make this approach an attractive option for *in situ* studies of colloidal systems.

St. Petersburg Ballroom
3:30 p.m.–4:00 p.m.
Coffee Break

NOTES

• Wednesday, March 19, 2008 •

Conference Registration
7:00 a.m.–6:00 p.m.
Registration Open

DWA • 3-D Displays and Systems

Harborview
8:00 a.m.–10:00 a.m.
DWA • 3-D Displays and Systems
Partha P. Banerjee; Univ. of Dayton, USA, Presider

DWA1 • 8:00 a.m. **Invited**
Holographic 3-DTV Research within the European 3-DTV Project, *Levent Onural; Bilkent Univ., Turkey.* A European project on 3DTV has been functional since September 2004. Holographic displays for 3DTV and signal processing issues associated with diffraction and holography are among research interests. The research has already generated interesting results.

DWA2 • 8:30 a.m.
Moving Parallax Barrier Panel Design Using Cross Connector, *Seung-Hyun Lee[1], Sung-Min Wi[1], Ji-Sang Yoo[1], Dong-Wook Kim[1], Hyung-Chul O. Li[1], Kee-Taek Kham[2]; [1]Kwangwoon Univ., Republic of Korea, [2]Kangwon Natl. Univ., Republic of Korea.* In this paper, a method of the moving parallax barrier is introduced to supplement a disadvantage of the conventional parallax barrier that provides observation at the specific locations.

DWA3 • 8:45 a.m.
Multiplex Computer-Generated Holograms for 3-D Color Display, *William J. Dallas; Dept. of Radiology, Univ. of Arizona, USA.* A multiplex CGH encodes more than one wavefront. We look at the particular subject of encoding the modulus for two encoded wavefronts. The application is color, 3-D display.

DWA4 • 9:00 a.m.
GPU-Based Acceleration Method for Coherent Holographic Stereogram Calculation, *Hoonjong Kang, Takeshi Yamaguchi, Hiroshi Yoshikawa; Dept. of Electronics and Computer Science, Nihon Univ., Japan.* In this paper, we show an acceleration method of the coherent holographic stereogram calculation by means of the GPU, and demonstrate the performance gain up to a factor of over 10 compared with CPU-based computing.

DWA5 • 9:15 a.m.
Method of Measuring Subjective 3-D Visual Fatigue: A Five-Factor Model, *Hyung-Chul O. Li[1], Junho Seo[1], Keetaek Kham[2], Seunghyun Lee[1]; [1]Kwangwoon Univ., Republic of Korea, [2]Kangwon Natl. Univ., Republic of Korea.* 3-D visual fatigue has delayed the widespread use of commercial 3-D displays. This study shows how the full range of characteristics of subjective 3-D visual fatigue have been measured and proposes a five-factor model.

DWA6 • 9:30 a.m. **Invited**
Current Research and Development Activities for 3-D Applications in Korea, *Seung-Hyun Lee, Ji-Sang Yoo, Dong-Wook Kim; Kwangwoon Univ., Republic of Korea.* The Korean government and industry deem 3-D field to be the next generation industry and make a lot of investments. The status of recent study and development in 3-D application field is described.

St. Petersburg Ballroom
10:00 a.m.–10:30 a.m.
Coffee Break

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

DWB • Holographic Interferometry, Modulators, Filters, and Materials

Harborview
10:30 a.m.–12:30 p.m.
DWB • Holographic Interferometry, Modulators, Filters, and Materials
Myung K. Kim; Univ. of South Florida, USA, Presider

DWB1 • 10:30 a.m. DH **Invited**
Assessment of 3-D Angular Movements of Diffuse Objects Using Holographic Interferometry, *Partha P. Banerjee[1], G. Nehmetallah[1], M. R. Chatterjee[1], S. C. Praharaj[2], N. V. Kukhtarev[3]; [1]Univ. of Dayton, USA, [2]DMS Technologies Inc., USA, [3]Alabama A&M Univ., USA.* We have developed a dynamic holographic interferometry (DHI) setup to measure changes in attitudes, distortions and vibrations of objects, using a holocamera. Digital algorithms have been developed to calculate above parameters from DHI images.

DWB2 • 11:00 a.m.
Optical Phase Unwrapping with Laser-Diode Phase Shifting Interferometry, *Nilanthi Warnasooriya, Myung K. Kim; Univ. of South Florida, USA.* A Michelson type multi-wavelength phase shifting interferometer illuminated by laser diodes is used to obtain quantitative phase images. The 2π ambiguities in phase images are removed by using 3-wavelength optical phase unwrapping.

DWB3 • 11:15 a.m.
Phase and Amplitude Modulation by Complementarily Combined TNLC Spatial Light Modulator, *Joonku Hahn, Yongjun Lim, Byoungho Lee; Natl. Creative Res. Ctr. for Active Plasmonics Applications Systems, Inter-Univ. Semiconductor Res. Ctr. and School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea.* The complementarily combined twisted nematic liquid crystal (TNLC) spatial light modulator (SLM) with two sub-SLMs is proposed. With this SLM we present the enhanced diffraction image from the CGH with small deviation of amplitude modulation.

DWB4 • 11:30 a.m.
Volumetric Film Patterning Method Using a Digital Micro-Mirror Device and Telecentric Lens, *Yongjun Lim, Joonku Hahn, Byoungho Lee; Natl. Creative Res. Ctr. for Active Plasmonics Applications Systems, Inter-Univ. Semiconductor Res. Ctr. and School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea.* We propose a volumetric film patterning method using commercially available digital micro-mirror device (DMD) and telecentric lens. In addition, the reduction of the image size using telecentric lens is to be suggested.

DWB5 • 11:45 a.m.
Digital Holographic Microscope for Characterization of Micro-Optical Diffractive Components, *Vijay Raj Singh[1], Oi Choo Chee[1], Hao Yan[2], Eddy Sim[1], Anand Asundi[2]; [1]Ngee Ann-AEM Ctr. of Innovation, Singapore, [2]School of Mechanical and Aerospace Engineering, Nanyang Technological Univ., Singapore.* We report a low-cost DHM for characterization of micro-optical devices. The software allows live reconstruction of the amplitude and phase images. The results are compared with those of conventional phase contrast microscopy and confocal microscopy.

DWB6 • 12:00 p.m.
Volume Holographic Angle-Depth-Wavelength Filters for Spatial-Spectral Imaging Systems, *Yuan Luo[1,2], Paul J. Gelsinger[1], George Barbastathis[3], Jennifer K. Barton[1,2,4], Raymond K. Kostuk[1,2]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA, [3]Dept. of Mechanical Engineering, MIT, USA, [4]Div. of Biomedical Engineering, Univ. of Arizona, USA.* In this paper, we present the design and performance of angle-multiplexed holographic filters formed at 488nm and reconstructed with a LED operated at ~630nm. Image data extracted with the holographic filters are also experimentally demonstrated.

DWB7 • 12:15 p.m.
Direct Laser-Writing of Diffractive Optical Elements in Photopolymer Layers, *Markus Fratz, Dietmar Eberhard, Wolfgang J. Riedel, Dominik M. Giel; Fraunhofer Inst. for Physical Measurement Techniques, Germany.* We present on direct writing of diffractive optical elements in thin polymer layers. The direct-writing process introduces optical birefringence in the polymer. The resulting elements can be described as polarization holograms. Experimental results are demonstrated.

Harborview
12:30 p.m.–12:40 p.m.
DH Closing Remarks

Key to Authors and Presiders

(**Bold** denotes Presider or Presenting Author)

Digital Holography and Three-Dimensional Imaging (DH) Postdeadline Paper Abstracts

•Monday, March 17, 2008•

JMA • Joint DH and LACSEA Poster Session

Foyer
4:00 p.m.–6:00 p.m.
JMA • Joint DH and LACSEA Poster Session

PDPJMA1
An Electronic Watermarking Technique for Digital Hologram, *Hyun-Jun Choi[1], Young-Ho Seo[2], Ji-Sang Yoo[1], Young-Geun Choi[1], Hwa-Sung Kim[1], Dong-Wook Kim[1]; [1]Kwangwoon Univ., Republic of Korea, [2]Hansung Univ., Republic of Korea.* This paper proposes an electronic watermarking scheme, a method to protect the ownership, for digital holograms, which uses the DCT domain data as the ones to be watermarked.

PDPJMA2
Mapping of Refractive Index by Pulsed Digital Holographic Image Field Correlation, *Mikael Sjödahl; Luleå Univ. of Technology, Sweden.* The possibility to use digital holographic reconstructions to map three-dimensional refractive index fields is presented. The technique uses depth reconstructions in combination with speckle movements and phase information in an imaging system.

PDPJMA3
Digital Reconstruction of Optical Fields in Nonlinear Media, *Christopher Barsi, Wenjie Wan, Jason W. Fleischer; Princeton Univ., USA.* We extend the technique of digital holography to the case of beam propagation through nonlinear media. We experimentally verify the technique by reconstructing nonlinear wave dynamics within a self-defocusing medium and nonlinearly imaging through it.

PDPJMA4
Partially Coherent Response of Volume Holographic Imaging Systems, *Se Baek Oh, George Barbastathis; MIT, USA.* We present the response of volume holographic imaging systems (VHIs) to quasi-monochromatic partially coherent illumination. The result with different aperture sizes is numerically evaluated and measured by a wavefront folding interferometer cascaded to the VHIs.

PDPJMA5
FINCHSCOPE: Motionless Fluorescence Digital Holographic Microscopy, *Gary Brooker[1], Joseph Rosen[2]; [1]Johns Hopkins Univ. Microscopy Ctr., Johns Hopkins Univ. at Montgomery County, USA, [2]Ben-Gurion Univ. of the Negev, Israel.* We show new 3-D fluorescence holographic microscopes which are fast, simple, immune to vibration, since the interference occurs in a single beam path, and achieve high resolution 3-D microscopic images using high numerical aperture objectives.

PDPJMA6
Stability of the Digital Holographic Inverse Problem as a Function of Particle Density, *Jose A. Dominguez-Caballero, George Barbastathis; MIT, USA.* The stability of the inverse problem associated with a digital holographic system for particle imaging is discussed. The defined stability metric is computed for a given configuration to find the optimum particle density.

PDPJMA7
Real-Time Probing the Biological Processes by Holographic Recording in Polarization-Sensitive Bacteriorhodopsin Films, *Elena Korchemskaya[1,2], Nikolaj Burykin[2], Dmitrij Stepanchikov[3], Tatyana Dyukova[4]; [1]Inst. of Physics, Natl. Acad. of Sciences, Ukraine, [2]Inst. of Applied Optics, Natl. Acad. of Sciences, Ukraine, [3]Zhytomir State Univ., Ukraine, [4]Inst. of Theoretical and Experimental Biophysics, Russian Acad. of Sciences, Russian Federation.* Bacteriorhodopsin is a photosensitive protein similar to visual rhodopsin. We propose to apply photoinduced anisotropy and holographic recording in bacteriorhodopsin films for real-time analysis of the biological tissue image and study of retina dark adaptation.

PDPJMA8
Digital Holography for Imaging Tissue Cells Using Coherent Lights, *Hongyue Sun[1], Bing Song[2], Jingxing Ou[2], John Watson[1], Min Zhao[3]; [1]School of Engineering, Univ. of Aberdeen, UK, [2]School of Medical Sciences, Univ. of Aberdeen, UK, [3]Dermatology, Ctr. for Neuroscience, School of Medicine, Univ. of California at Davis, USA.* Visible and near-infrared lasers are examined to see how laser coherence length and wavelength affect the image quality in digital holographic microscopy. With opaque and partially transparent animal tissues, NIR-lasers show advantages over visible laser.

Key to Authors

(**Bold** Denotes Presenting Author)