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Special Section on the Interface of Holography and MEMS

Pierre-Alexandre Blanche
Partha Banerjee
Christophe Moser
Myung K. Kim

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Pierre-Alexandre Blanche
University of Arizona
College of Optical Sciences
1630 East University Boulevard
Tucson, Arizona 85721, United States
E-mail: pablanche@optics.arizona.edu

Partha Banerjee
University of Dayton
Department of Electrical and Computer Engineering
300 College Park Avenue
Dayton, Ohio 45469, United States
E-mail: pbanerjee1@udayton.edu

Christophe Moser
École Polytechnique Fédérale de Lausanne
Lab of Applied Photonic Devices
Station 17, CH-1015
Lausanne, Switzerland
E-mail: christophe.moser@epfl.ch

Myung K. Kim
University of South Florida
Department of Physics
ISA 2019
4202 East Fowler Avenue
Tampa, Florida 33620, United States
E-mail: mkkim@usf.edu

Since its discovery, the field of holography has gone through two paradigm shifts: the first owing to the invention of the laser as a source of coherent light, the second from the introduction of dynamic spatial light modulators such as MOEMS (micro-optical electro-mechanical system) and LCoS (liquid crystal on silicon) devices. By providing a means to display a dynamic diffraction pattern, MOEMS have freed holography from one of its last shackles. By taking advantage of the micron size elements, high refresh rate, and large number of pixels in MOEMS, a new generation of holographic applications has been enabled. As in a symbiotic relationship, the benefit has been mutual, holography has advanced from MOEMS, and conversely micro-electromechanical device (MEMS) development has taken advantage of holographic techniques such as maskless lithography for manufacturing, and holographic interferometry for dynamic surface metrology. Both the fields of holography and MEMS are currently experiencing a profound transformation due to their mutual interaction, and new developments and applications are happening on a daily basis.

This special section of the *Journal of Micro/Nanolithography*, *MEMS*, and *MOEMS* contains 13 papers that offer a comprehensive overview of the latest technologies and capabilities of MOEMS for holography and holography for MEMS. There are two overview papers from Haist and Osten that summarize the state-of-the-art in holography using pixelated spatial light modulators, covering both theory and applications. New techniques using MEMS are described in papers from Rahlves et al. about maskless lithography for the fabrication of holographic structures, Pham et al. on a compressive sensing profilometer based on an optical frequency comb, and Rosen et al. using phase-only SLM for incoherent digital holography. A new type of MEMS is introduced by Khoury and Vella demonstrating an optically addressed deformable mirror for low-light applications.

Metrology techniques applied to MEMS and taking advantage of holography are reported by Georges and Thizy, who employ a photorefractive camera to monitor the MEMS deformation, Picard et al. who use a three-wavelength digital interferometer to characterize the topography of nanometric thin films, and Di et al. who have developed a holographic microscope using a dual-wavelength technique.

The numerical aspect of the holographic pattern generated by pixelated structures such as MEMS is detailed in three papers. Zhang et al. present a near-lossless compression method for digital holograms, Ferraro has developed a numerical tool for the characterization of MEMS by digital holographic microscopy, and Li et al. describe the image formation of a holographic 3D display using a spatial light modulator (SLM). In their approach to 3D display, Smalley et al. are not using MEMS but, instead, a leaky-mode modulator for its higher space bandwidth product, an aspect where MEMS still need improvement to be competitive at video holography.

We would like to thank all of the authors for their valuable contributions. We also hope you find these articles interesting and continue to follow the development of MEMS and holography techniques in JM3 and more generally in SPIE publications.

Pierre-Alexandre Blanche is an associate research professor at the College of Optical Sciences, the University of Arizona, Tucson. He received a PhD in physics from the University of Liege (Belgium) in the field of nonlinear optics and holography. He then held a post-doctoral position at the University of Arizona, where he developed photorefractive polymer materials for dynamic holography. In Belgium, he co-founded a company manufacturing large volume phase holographic gratings for the optics industry, astronomers, and space applications. He returned to the University of Arizona in 2005, where he developed a holographic 3D display as well as a diffractive optical switch for data communication based on MOEMS and computer generated holograms. He is author or co-author of more than 50 peer-reviewed papers, 6 books or book chapters, and has 5 patents in the field of holography.

Partha Banerjee is professor and director of electro-optics and professor of electrical and computer engineering (ECE) at the University of Dayton (UD), Dayton, Ohio, USA. From 2000-2005, he was chair of ECE at UD. Prior to UD, he was with the University of Alabama in Huntsville from 1991–2000 and with Syracuse University from 1984-2001. He received his MS and PhD from the University of Iowa in 1980 and 1983, respectively. His areas of research interest are photorefractives, digital holography, metamaterials, nonlinear optics, and acousto-optics. To date he has coauthored 5 textbooks, over 125 journal papers, and over 150 conference papers. He is a fellow of SPIE, OSA, and IoP (FInstP), and senior member of IEEE.

Christophe Moser is currently associate professor of optics in the Microengineering Department at EPFL (Switzerland). He obtained his PhD at the California Institute of Technology in optical information processing in 2000. He co-founded and was the CEO of Ondax Inc., Monrovia, California, a leader in ultranarrow band filters for the laser industry, for 10 years before joining EPFL in 2010. His interests are analog and digital holography for imaging, endoscopy, head worn displays, and optics for solar concentration. He is the author and co-author of 50 publications and 30 patents.

Myung K. Kim obtained a BS degree in physics and mathematics from UCLA (1979) and a PhD in physics from UC Berkeley (1986). After two and half years as a postdoctoral fellow at SRI International in Menlo Park, California, he moved to Michigan for an assistant professor position at Wayne State University (1988). In 1995, he moved to Florida for an associate professor position at the University of South Florida, where he has since been and became a full professor in 2004. His research interests are in the development of novel imaging techniques of digital holography using coherent and incoherent lights and applications ranging from biomedical microscopy, ophthalmology, metrology, and to astronomy. In 2010, he was elected a fellow of the Optical Society of America, and became a senior member of SPIE in 2013.