Adv. Opt. Techn., Vol. 1 (2012), pp. 101–102 • Copyright © 2012 THOSS Media and De Gruyter. DOI 10.1515/aot-2012-0024

Editorial

Micro-optics and diffractive optics: Introduction to the topical issue

Optical technologies have undergone dramatic changes and revolutionary advances in the past decades. A strong push from high-volume mobile device production and laser material processing technologies combined with nano-technological support available from semiconductor industries led to photo and video cameras and laser devices with unprecedented performance at small overall dimensions. We may compare the evolution of micro-optics with that of personal computers, as originally simplified devices, which later had far overperformed monster computer systems.

Micro- and nano-structuring of optical surfaces with diffractive and other photonics structures seems to be one of the major factors for latest breakthroughs in optical systems. However, there is a gap between classical optical design oriented towards fabrication and simulation of fine diffractive structures suitable for academic research. This topical issue makes an attempt to bridge the gap between the industrial and academic communities by providing publications of interdisciplinary and joint interest, written by experts from both industry and academia.

The tutorial by H. Zappe represents micro-optics as not just "small optics" but as a bunch of novel technologies and optical components. The review by R. Voelkel and the paper by A.J. Waddie et al. discuss wafer-based and photonic crystal fiber-based technologies for the fabrication of micro-optics, unparalleled in conventional opto-mechanical production. Generalization of multilayer optical coating towards multiple diffractive and waveguide layers is studied in the paper by T. Saastamoinen et al. Applications of diffractive optics and computer-generated holograms are discussed in the review by J. Rosen et al., in the review by T.R.M. Sales, and the paper by M. Hillenbrand et al. Quality control of various optical elements by modern interferometry is reviewed by R. Smythe. The papers of this topical issue discuss and address such practically important examples of micro-optics and diffractive optics as engineered light diffusers, beam and pupil shaping, hybrid and refractive elements for sensors of proximity, distances and wall thicknesses, holograms of three-dimensional objects, micro-optics for endoscopes, ophthalmology, smart phones, fiber communication networks and projection lithography.

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Michael A. Golub received a PhD degree in 1982 from the Lebedev Physical Institute, Moscow. He was appointed to a professor position in Samara State Aerospace University, Russia in 1982–1995. He held visiting professor positions in the National High School of Physics in Strasbourg, France, in the University of Jena, Germany, and in the Weizmann Institute of Science, Israel. He was also Chief Scientist in Holo-Or Ltd. and Explay Ltd. He joined Tel Aviv University in 2005, where he is currently Professor of the Electrical Engineering-Physical Electronics Department. His main area of expertise is in diffractive optics, micro-optics and optical design. He has authored and co-authored more than 60 papers in peer-reviewed journals, invited conference presentations, patents and a book "Laser Beam Mode Selection by Computer Generated Holograms". He is a member of European Optical Society (EOS), SPIE, and a Senior member of Optical Society of America (OSA).

Hans Peter Herzig received a diploma degree in physics from the Swiss Federal Institute of Technology, Zurich, Switzerland, in 1978, and a PhD degree in optics from the University of Neuchâtel, in 1987. From 1978 to 1982, he was a Scientist with the Department of Optics Development of Kern, Aarau, Switzerland, working in lens design and optical testing. In 1983, he was a Graduate Research Assistant with the Applied Optics Group, Institute of Microtechnology, University of Neuchâtel, Switzerland, working in the field of holographic optical elements. From 1989 to 2001, he was the Head of the Micro-Optics Research Group. From 2002 to 2008, he was a Full Professor and the Director of the Applied Optics Laboratory, University of Neuchâtel. He joined the faculty with the École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, in 2009. Currently, he is a Professor with the EPFL. His research interests include refractive and diffractive micro-optics, nanoscale optics, and optical microsystems. Dr. Herzig is a member of the Optical Society of America (OSA), IEEE Photonics Society, European Optical Society (EOS), and Swiss Society for Optics and Microscopy (SSOM). In 2009/2010, he was President of the EOS.