PROCEEDINGS OF SPIE

Modeling Aspects in Optical Metrology IV

Bernd Bodermann
Karsten Frenner
Richard M. Silver
Editors

13–14 May 2013
Munich, Germany

Sponsored by
SPIE

Cooperating Organisations
European Optical Society
German Scientific Laser Society (Wissenschaftliche Gesellschaft Lasertechnik e.V.)
The European Society for Biomaterials

Published by
SPIE

Volume 8789

Proceedings of SPIE 0277-786X, V. 8789

Modeling Aspects in Optical Metrology IV, edited by Bernd Bodermann, Karsten Frenner, Richard M. Silver,
Proc. of SPIE Vol. 8789, 878901 · © 2013 SPIE · CCC code: 0277-786X/13/$18 · doi: 10.1117/12.2028772

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Modeling Aspects in Optical Metrology IV*, edited by Bernd Bodermann, Karsten Frenner, Richard M. Silver, Proceedings of SPIE Vol. 8789 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X
ISBN: 9780819496058

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE Digital Library
SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

POSTER SESSION

Conference Committee

Symposium Chairs

Wolfgang Osten, Universität Stuttgart (Germany)
Karsten Buse, Fraunhofer-Institut für Physikalische Messtechnik IPM (Germany)
Andrew J. Moore, Heriot-Watt University (United Kingdom)

Conference Chair

Bernd Bodermann, Physikalisch-Technische Bundesanstalt (Germany)

Conference CoChairs

Karsten Frenner, Universität Stuttgart (Germany)
Richard M. Silver, National Institute of Standards and Technology (United States)

Conference Programme Committee

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

Introduction

The conference *Modelling Aspects in Optical Metrology 2013* is organised for the fourth time as part of the SPIE Optical Metrology Symposium, which is co-located with *LASER World of Photonics* 2013 in Munich, Germany. This conference is dedicated to establish a forum to present and discuss in particular basic methods, techniques, and algorithms which are necessary for a proper modelling and simulation of applied optical metrology techniques. Special emphasis is placed on the description and modelling of new methods, algorithms, components or complete measurement systems.

Optical metrology methods are in general fast, non-destructive, reliable, flexible and can nevertheless reach a high level of sensitivity. Therefore their use in industrial applications like e. g. process development or production control is continuously increasing. Concurrently the metrological requirements are soaring rapidly, leading to a strong demand both on methodical extensions and improved metrology methods.

To exploit the full potential of optical metrology it is of utmost importance to be able to fully understand the optical measurement process, which requires the ability of quantitatively predicting the dependence of the output of an optical sensor or measurement system on certain variations of the measurement object, the sensor itself, or the measurement environment. Only if these influences on the measurement result are well understood and appropriately taken into account in a suitable model of the measurement process, the measurement result and its associated measurement uncertainty can be used for example for reliable control of production processes. This in-depth understanding usually requires -or is at least strongly supported by- a reliable modelling or simulation of the optical measurement process. In this sense modelling is a prerequisite for traceable and comparable measurements.

Important topics are for example the development and verification of methods to describe the interaction of light with matter for quantitative characterization of micro- and nanostructures or the high accuracy description of light propagation in optical systems. Relevant applications range i. a. from optical metrology and inspection of nanostructures on masks and wafers in semiconductor industry, display production, the investigation of grating structures and grating-based devices, the metrology of surfaces and layers to characterisation of complex optical systems. In many applications nanometer or sub-nanometer measurement uncertainties are required. A new and very interesting field of application will arise in the physical and dimensional characterisation and the theoretical description of new and effective optical materials like photonic crystals or metamaterials, which will in future also enable a variety of novel optical components, systems and metrology systems.

I would like to thank all contributors, participants, the SPIE staff, the members of the program committee as well as the co-chairs for their support and for turning this conference into a success.

Bernd Bodermann