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Modeling Aspects in Optical Metrology VII

Bernd Bodermann
Karsten Frenner
Editors

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Introduction

The conference, Modelling Aspects in Optical Metrology 2019, was organised for the seventh time as part of the SPIE Optical Metrology symposium, which was co-located with World of Photonics Congress 2019 in Munich, Germany. This conference is dedicated to establishing a forum to present and discuss the 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, and flexible, but can nevertheless reach a high level of sensitivity. Therefore, their use in industrial applications like process development or production control is continuously increasing. Concurrently, the metrological requirements are soaring rapidly, leading to a strong demand for both 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 considered in a suitable model of the measurement process, can the measurement result and its associated measurement uncertainty be used 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. This is particularly essential for recent and novel approaches in optical nanoscopy to bridge the gap between super-resolution imaging and real metrological applications.

Examples of important topics are interaction of light with matter on the nanoscale or the high accuracy description of light propagation in optical systems. Relevant applications range from optical metrology and inspection of nanostructures on masks and wafers in semiconductor industry, display production, advanced photovoltaics, 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. New and very interesting fields of application will arise in the physical and dimensional characterisation and the theoretical description of new and effective optical materials like photonic crystals and metamaterials or in the strongly emerging field of quantum (optical) metrology. Accurate modelling of these promising methods and devices will enable both a better understanding of the physics and exploitation of corresponding sensing applications and will be the basis to move such

novel approaches from proof-of-principle research quantitative metrology applications.

We would like to thank all contributors, participants, the SPIE staff, and the members of the program committee as well as the co-chair, Karsten Frenner, for their support and for turning this conference again into a great success.

Bernd Bodermann