"Interferometric metrology of complex shapes and surface structures"

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• Abstract

Interferometric profiling was originally developed to analyze simple objects having optically smooth, continuous objects. Much of the time these objects were simple optical components themselves, such as lenses and mirrors. This trend continued with the introduction of the interference microscope, originally intended to characterize small-scale surface roughness on smooth, flat parts.

Modern high-technology products ranging from data storage read-write heads to micro-mechanical devices have complex surface structures comprised of thin films, and fine-scale, discontinuous features. Even optical parts have become more complex, comprising aspheric surfaces with stringent requirements for form and mid-spatial frequency error.

Interferometric techniques have adapted to the challenge of complex surface structures. A leading technology is Scanning White Light Interferometry or SWLI, widely adopted for 3D microscopic surface structure analysis.

In this talk, I briefly review the history and principles of SWLI, and examine the current state of the art in the following areas:

〉Thin film profiling and analysis
〉Instrument modeling for interpreting signals
〉Lateral resolution and high magnification
〉Measurement uncertainty of 0.1nm
〉SWLI of curved surfaces, including aspheric optics

I conclude with some perspectives on future research.

• SUMMARY

Peter de Groot is Director of R&D for Zygo Corporation, and invents and develops new optical instruments for high technology metrology applications. Dr. de Groot has 20 years experience in optical metrology, holds 70 patents and has published 100 papers in optics, primarily in the field of interferometry and its application to distance measurement and topographical profiling and characterization of surface form and structure.

• RESEARCH INTERESTS

Interference microscopy
Ellipsometry
Phase shifting interferometry
Holography
Displacement measuring interferometry
Industrial metrology
Absolute distance interferometry
Semiconductor metrology

• EDUCATION

1987 PhD Physics, University of Connecticut
1983 Lic Physics, University of Grenoble (France)
1984 MS Physics, University of Maine
1980 BA History, University of Utah

• PROFESIONAL EXPERIENCE

1992-present Senior Scientist & Director of R&D / Zygo Corporation
1990-1992 Research Scientist / Boeing High Technology Center
1987-1990 Research Scientist / Perkin Elmer / Hughes
1988-1989 Physics Professor / University of Bridgeport
1983-1987 Research Assistant, Atomic, Molecular and Optical Physics / University of Connecticut University of Maine
1980-1994 Physics Instructor and Internaltional Science Education Consultant / US Peace Corps