Title

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Authors

Barber, Samuel K.
Soldate, Paul
Cambie, Rosanna
et al.

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Binary Pseudo-random Gratings and Arrays for Calibration of the Modulation Transfer Function of Surface Profilometers: Recent Developments

Samuel K. Barber,[a)] Paul Soldate,[b)] Erik Anderson,[a)] Rossana Cambie,[a)]
Wayne R. McKinney,[a)] Peter Z. Takacs,[c)] Dmytro L. Voronov,[a)] Valeriy V. Yashchuk[a)]

[a)] *Lawrence Berkeley National Laboratory, Berkeley, California, 94720*
[b)] *Rensselaer Polytechnic Institute, Troy, New York, 12180*
[c)] *Brookhaven National Laboratory, Upton, New York 11973*

Authors:

Samuel K. Barber

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 2R0400,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-486-4077
Email address: SBarber@lbl.gov

Paul Soldate

Affiliation: Rensselaer Polytechnic Institue, Troy, NY, 12180, USA
Mailing address: 1245 Bertha Lane,
Santa Rosa, CA 95405, USA
Telephone number: +1-707-337-3200
Email address: Psoldate@aol.com

Rossana Cambie

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 62-313,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-486-4820
Email address: RCambie@lbl.gov

Erik H. Anderson

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 2R0400,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-486-4446

Fax number: +1-510-486-4955
Email address: EHAnderson@lbl.gov

Wayne R. McKinney

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 2R0400,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-486-4395
Fax number: +1-510-486-7696
Email address: WRMcKinney@lbl.gov

Peter Z. Takacs

Affiliation: Brookhaven National Laboratory, Upton, New York, 11973
Mailing address: Brookhaven National Laboratory
MS 535B
Upton, NY 11973-5000
Telephone number: +1- (631) 344- 2824
Fax number: +1- (631) 344-5773
Email address: takacs@bnl.gov

Dmytro Voronov

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 2R0400,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-486-4863
Email address: DLVoronov@lbl.gov

Valeriy V. Yashchuk

Affiliation: Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA
Mailing address: Lawrence Berkeley National Laboratory,
1 Cyclotron Road, MS 2R0400,
Berkeley, CA 94720-8199, USA
Telephone number: +1-510-495-2592
Fax number: +1-510-486-7696
Email address: VVYashchuk@lbl.gov

Presentation preference: Oral Presentation

Principle author's biography:

Samuel Barber received his BS degree in Physics with a minor in Spanish from the University of California at Los Angeles in 2007. He then completed a brief fellowship at the National Laboratories of Frascati, Italy, where he assisted in the design and simulation of quadrupole and dipole magnets. He is currently working in the Optical Metrology Laboratory at the Advanced Light Source, Lawrence Berkeley National Laboratory. His current research interest is in x-ray optical instrumentation and metrology.

Abstract text:

The major problem of measurement of power spectral density (PSD) distributions of surface heights with surface profilometers arises due to the unknown Modulation Transfer Function (MTF) of the instruments. The MTF tends to distort the PSD at higher spatial frequencies. It has been suggested (Proc. SPIE **7077**-7, 2007) that the instrumental MTF of a surface profiler can be precisely measured using standard test surfaces based on binary pseudo-random (BPR) patterns. In the cited work, a one dimensional (1D) realization of the suggested method based on use of BPR gratings has been demonstrated. Here, we present recent achievements made in fabricating and using two-dimensional (2D) BPR arrays that allow for a direct 2D calibration of the instrumental MTF. The 2D BPRAs were used as standard test surfaces for MTF calibration of the MicroMap^{TM}-570 interferometric microscope with all available objectives. The effects of fabrication imperfections on the efficiency of calibration are also discussed.

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Keywords: surface metrology, surface profilometer, interferometric microscope, modulation transfer function, power spectral density, calibration, error reduction, fabrication tolerances, metrology of x-ray optics