PROCEEDINGS OF SPIE

MOEMS and Miniaturized Systems XXIII

Hans Zappe Wibool Piyawattanametha Yong-Hwa Park Editors

29–30 January 2024 San Francisco, California, United States

Sponsored by SPIE

Cosponsored by Mirrorcle Technologies, Inc. (United States)

Published by SPIE

Volume 12899

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers 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 these proceedings: Author(s), "Title of Paper," in MOEMS and Miniaturized Systems XXIII, edited by Hans Zappe, Wibool Piyawattanametha, Yong-Hwa Park, Proc. of SPIE 12899, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510670587

ISBN: 9781510670594 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2024 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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



Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

Contents

v Conference Committee

SESSION 1	TUNABLE OPTICAL COMPONENTS I
12899 02	Dynamic polarization and mechanical tuning of slanted wire diffraction gratings [12899-4]
SESSION 2	TUNABLE OPTICAL COMPONENTS II
12899 03	Closed-loop wavefront calibration of a multi-electrode electrowetting-based tunable microlens (Best Student Paper Award) [12899-6]
12899 04	Driving and control of an optofluidic wavefront modulator through pulse width modulation [12899-7]
SESSION 3	SPECTROMETERS
12899 05	Characterization of new silicon-based micro-electro-mechanical systems for photoacoustic trace-gas detection [12899-12]
12899 06	Remote motion sensing system utilizing enhanced video motion magnification [12899-13]
12899 07	Spectral compensation of extended InGaAs photodetector thermal drift in miniaturized FTIR spectral sensors [12899-14]
12899 08	Arbitrary spectrum generation engine using digital micromirror device [12899-15]
252224	
SESSION 4	LIDAR AND 3D IMAGING
12899 09	Multi-tap parallel-phase demodulation method to suppress the ambient light interference in MEMS scanning AMCW LiDAR (Invited Paper) [$12899-16$]
12899 0A	A long-distance 6D pose estimation system for space object recognition using region-scanning LiDAR [12899-17]
12899 OB	A water-immersible scanning mirror with hybrid polymer and elastomer hinges for high-speed and wide-field 3D ultrasound imaging [12899-18]
12899 OC	Dynamic focus control in a coherent lidar using a fast MEMS mirror [12899-19]

SESSION 5	MICROMIRRORS AND SCANNERS
12899 OD	Characterization of MEMS piston mirror arrays with comb drive actuator (Invited Paper, Best Paper Award) [12899-20]
12899 OE	Low-power multi-scan patterns capable 3D-constructed piezoelectric MEMS mirrors [12899-21]
12899 OF	Improved scanning mirror micro spectrometer for material recognition in recycling applications [12899-22]
12899 OG	Modeling of photonic MEMS Michelson interferometers comprising curved micromirrors under partially coherent light excitation [12899-23]
12899 OH	Biaxial resonant MEMS mirrors with large field of view for LiDAR systems [12899-24]
SESSION 6	NOVEL MATERIALS, PROCESSES, AND DEVICES
12899 01	A novel stereoscopic 3D motion measurement using bi-axial optical system with one image sensor for remote machine health monitoring [12899-26]
12899 OJ	SF6 mixed in N2 gas sensing responses from CMOS-compatible AIN and ScAIN pyroelectric detectors $[12899-27]$
12899 OK	Structural coloring with low-index polymer nanostructures via multipolar decomposition-based design and optimization [12899-28]
	POSTER SESSION
12899 OL	Accurate and portable plastic sorting using diffuse reflection and transmission MEMS spectrometer in the mid-infrared [12899-30]
12899 OM	Modelling the side-wall roughness scattering loss of MEMS-based optical waveguides using the perturbation theory and the generalized Harvey-Shack model $[12899-31]$
12899 ON	Highly nonlinear behavior of UV-curable photopolymer under elastomer-templated low-pressure nanoimprinting [12899-32]
12899 00	Modeling and analysis of nonuniform metal-coating of deeply etched vertical micromirrors [12899-33]
12899 OP	Design and fabrication of an electrothermally actuated 2D scanning micromirror [12899-34]
12899 OQ	An imaging homogenizer for DLP-based 3D printer [12899-35]
12899 OR	Vectorial micro scanning mirror for fast beam positioning of a compact medical therapy laser [12899-36]