PROCEEDINGS OF SPIE

Fourth International Conference on Photonics Solutions (ICPS2019)

Tetsuya Kawanishi Surachet Kanprachar Waranont Anukool Ukrit Mankong Editors

20–22 November 2019 Chiang Mai, Thailand

Organized by

Biomedical Engineering Institute, Chiang Mai University (Thailand) National Institute of Information and Communications Technology (Japan) Optical Society of Japan (Japan)

Sponsored by

Thailand Optics and Photonics Society (TOPS) (Thailand)
National Institute of Information and Communications Technology (NICT) (Thailand)
Trienergy Instrument Company, Ltd. (Thailand)
Yokogawa (Thailand) Ltd.
IRC Technologies, Ltd. (Thailand)

Published by SPIE

Volume 11331

Proceedings of SPIE 0277-786X, V. 11331

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Fourth International Conference on Photonics Solutions (ICPS2019), edited by Tetsuya Kawanishi, Surachet Kanprachar, Waranont Anukool, Ukrit Mankong, Proc. of SPIE Vol. 11331, 1133101 © 2020 SPIE · CCC code: 0277-786X/20/\$21 · doi: 10.1117/12.2567302

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 Fourth International Conference on Photonics Solutions (ICPS2019), edited by Tetsuya Kawanishi, Surachet Kanprachar, Waranont Anukool, Ukrit Mankong, Proceedings of SPIE Vol. 11331 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510634299

ISBN: 9781510634305 (electronic)

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

Copyright © 2020, Society of Photo-Optical Instrumentation Engineers.

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 copying fees. The Transactional Reporting Service base fee for this volume is \$21.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online 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. The CCC fee code is 0277-786X/20/\$21.00.

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: Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article 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

Authors νii Conference Committee ix **OPTICAL SENSING AND IMAGING** 11331 02 Development of a mobile TOMBO system for multi-spectral imaging [11331-26] 11331 03 Plasmon resonance of spherical and ellipsoidal gold particles in hexagonal-plasmonic arrays [11331-14] 11331 04 Improvement of acquisition time using high speed MEMS bolometer in active imaging [11331-27] 11331 05 Quadrant-mapping-based computer generated hologram compression [11331-18] **OPTICAL COMMUNICATION SYSTEMS** 11331 06 Advanced IF-over-fiber systems for mobile fronthaul (Invited Paper) [11331-6] 11331 07 Plantar pressure detection with mechanically induced long period fiber grating system [11331-30] 11331 08 Performance of MMF at low-frequency passbands in SCM with 4-ASK and linear block codes [11331-19] 11331 09 Duplex optical amplifier for 10 Gb/s ethernet link over 120 km SSMF and 15 km DCF [11331-21] SPECIAL SESSION ON SHORT RANGE COMMUNICATIONS 11331 0A Quantum key distribution solution over indoor visible light communication networks [11331-15] 11331 OB pH and temperature underwater monitoring with application using visible light communications [11331-12] 11331 0C Three-dimensional VLC indoor positioning system using smart device camera receiver with image processing technique [11331-32]

METAMATERIALS, QUANTUM, AND ATOM OPTICS

11331 OD	The study of geometries effect of hexagonal metamaterial absorber in the terahertz regime [11331-17]
11331 OE	3D printed assembly and software development for silicon photonics sensor device measurement [11331-28]
11331 OF	Synchrotron radiation study of nitrogen in chemical fertilizer used as explosive: feasibility study [11331-10]
	OPTICAL SIGNAL PROCESSING
11331 0G	Self-interference along boundaries between positive and negative refractive index media for 3D displays [11331-16]
11331 OH	A novel method for camera calibration and image alignment of a thermal/visible image fusion system [11331-29]
	OPTICS FOR AGRICULTURAL AND INDUSTRIAL
11331 01	Brix percentage estimation using artificial intelligence approaches [11331-4]
11331 OJ	Detection of rice grain chalkiness level with volume estimation from image processing [11331-34]
11331 OK	
	Measuring of the petroleum product leaks by distributed systems [11331-35]
11331 OL	Measuring of the petroleum product leaks by distributed systems [11331-35] Implementation of Bragg grating to a geotextile for detection a critical infrastructure [11331-36]
11331 OL	
11331 OL	Implementation of Bragg grating to a geotextile for detection a critical infrastructure [11331-36]
11331 OL	
11331 OL 11331 OM	Implementation of Bragg grating to a geotextile for detection a critical infrastructure [11331-36]
	Implementation of Bragg grating to a geotextile for detection a critical infrastructure [11331-36] OPTICS IN METROLOGY
11331 0M	Implementation of Bragg grating to a geotextile for detection a critical infrastructure [11331-36] OPTICS IN METROLOGY Precision longitudinal alignment of matter-wave near-field interferometer [11331-11]

SPECIAL SESSION ON SILICON PHOTONICS FOR SENSING 11331 0Q Silicon-photonic matrix switches and control technologies to accelerate switching speed **(Invited Paper)** [11331-7] **BIOMEDICAL APPLICATIONS** 11331 OR Analysis and optimization of Raman scattering for malaria infected blood [11331-20] 11331 OS Validation of a method to estimate hemoglobin concentration of seven-layered skin model with three subjects [11331-13] **OPTICAL FIBER TECHNOLOGY** 11331 OT The design of high birefringence hollow core with nested anti-resonance nodeless fiber [11331-23] Reflective wavefront control using random zero refractive index medium [11331-31] 11331 OU 11331 OV Property investigation of photorefractive crystal using transport of intensity technique [11331-33] 11331 OW Spatiotemporal solitons and vortices in graded-index multimode lossy fibers [11331-3] 11331 OX A numerical investigation of broadband absorption of TE-polarized wave in photonic **hypercrystal** [11331-24]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Anukool, Waronont, OE, ON, OP

Bamrungthai, P., 0H Bantitadawit, Parut, 0V Bouthwong, A., 0E Buathong, Sitti, 0M Bubpawan, T., 0B

Buranasiri, Prathan, OG, OV, OX

Chamsuk, P., 0E Chattham, N., 0J Cheaupan, K., 0J

Chitaree, Ratchapak, 07, 0D, 0R, 0T

Cyriac, Meril, 05 Daibo, Masahiro, 0G, 0U Dang, Ngoc T., 0A Dararutana, Pisutti, 0F Dawes, Judith M., 03 Deachapunya, Sarayut, 0M

Deachapunya, Sarayut Fajkus, Marcel, OL G., Kanjana, 05 Hirakawa, Kazuhiro, 04 Hosako, Iwao, 04 Hruby, David, 0K, 0L Ikeda, Kazuhiro, 0Q Ishimura, Shota, 06 Ittipratheep, N., 0E

luchi, Kaito, OS Jaros, Jakub, OK, OL Kagawa, Keiichiro, O2 Kanprachar, Surachet, O8 Kawanishi, Tetsuya, O6 Kawashima, Hitoshi, OQ Kittiya, Aekawit, ON Kongklad, Gunganist, OR Konoike, Ryotaro, OQ Kumnorkaew, Pisist, O3 Lin, Mengyao, OS M. K., Sheeja, O5

Mai, Vuong V., 0A Malomed, Boris A., 0W Mankong, Ukrit, 0C, 0E Masaki, Yasuo, 02 Matsumoto, A., 0E Matsuura, Hiroyuki, 0Q

Mayteevarunyoo, Thawatchai, 0W

Morohashi, Isao, 04

Muangnapoh, Tanyakorn, 03

Nakanishi, Tetsuya, 02 Namiki, Shu, 0Q Nishimura, Kosuke, 06 Nontapot, Kanokwan, 00 Osotchan, Tanakorn, 03 Panthinuan, Kittipong, 0P Patmanee, Jaruwat, 08 Pham, Hien T. T., 0A Pham, Quang Thai, 0I Pham, Thu A., 0A Pham, Tien Dat, 0I Phanchat, Natthawat, 0T Pilapong, Chalermchai, 0P Pinthong, Chairat, 08 Plaipichit, Suwan, 0V, 0X

Potha, S., OC

Poungprasert, Maneerat, 0V

Puntsri, K., OB

Puttharugsa, Chokchai, 0X

Qiu, Boqi, 04
Raj N. R., Nelwin, 05
Rattakorn, P., 0C
Rattananupong, P., 07
Reangchan, Nareephorn, 0X
Sakda, Natsima, 0D
Sakulsermsuk, Sumet, 0P
Sekine, Norihiko, 04
Sinsarp, Asawin, 03
Sitpathom, Nonthanan, 03
Skrybin, Dmitry V., 0W
Srisuphaphon, Sorakrai, 0M

Stratil, Tomas, OK, OL

Sujarit, A., OJ

Supruangnet, Ratchadaporn, OF

Suwana, Sujin, 03 Suzuki, Keijiro, 0Q Suzuki, Masatoshi, 06 Tabuchi, Tomoya, 0G, 0U Taechalertpatsarn, Tana, 0R

Tanaka, Kazuki, 06 Tanida, Jun, 02 Tsumura, Norimichi, 0S Udomsom, S., 0E Umezawa, T., 0E Vasinek, Vladimir, 0K, 0L Vorapamorn, Vittavat, 09

Vu, Minh B., 0A Wada, Naoya, 09

Wannawichian, Suwicha, ON Watcharangkool, Apimook, ON

Wicharn, Surawut, 0X Wongkamchang, P., 0H Won-in, Krit, 0F Worasucheep, Duang-rudee, 09 Yindeemak, A., 0B Zhang, Ya, 04

Conference Committee

International Advisory Committee

Sarun Sumriddetchkajorn, National Electronics and Computer Technology Center (Thailand)
 Kyu Yoshimori, Iwate University (Japan)
 Boris A. Malomed, Tel Aviv University (Israel)
 Tipparatana Wongcharoen, Bangkok University (Thailand)
 Perry Shum, Nanyang Technological University (Singapore)

General Chair and Co-chairs

Ukrit Mankong, Chiang Mai University (Thailand)
Jun Tanida, Osaka University (Japan)
Athikom Roeksabutr, Mahanakorn University of Technology (Thailand)

Technical Program Committee Chair and Co-chairs

Surachet Kanprachar, Naresuan University (Thailand) **Tetsuya Kawanishi**, Waseda University (Japan) **Waranont Anukool**, Chiang Mai University (Thailand)

Special Session Chairs

Atsushi Kanno, National Institute of Information and Communications Technology (Japan)

Toshimasa Umezawa, National Institute of Information and Communications Technology (Japan)

Pham Tien Dat, National Institute of Information and Communications Technology (Japan)

Tsutomu Shimura, University of Tokyo (Japan) **Norimichi Tsumura**, Chiba University (Japan)

Technical Program Committee

Wisit Singhsomroje, Mahidol University (Thailand)
Sujint Wangsuya, Mahidol University (Thailand)
Surakrai Srisuphaphon, Burapha University (Thailand)
Sarayut Deachapunya, Burapha University (Thailand)
Nithiwadee Thaicharoen, Physikalisches Institut Heidelberg (Germany)
Pimonpan Sompet, Max Planck Institute of Quantum Optics (Germany)
Shintaro Hisatake, Osaka University (Japan)
Hiroshi Murata, Mie University (Japan)
Akihiko Hirata, Chiba Institute of Technology (Japan)

Tsuyoshi Konishi, Osaka University (Japan)

Keisaku Yamane, Hokkaido University (Japan)

Stavros lezekiel, University of Cyprus (Cyprus)

Yusuf Nur Wijayanto, Indonesian Institute of Sciences (Indonesia) **Hwan Seok Chung**, Electronics and Telecommunications Research

Institute (Korea, Republic of)

Nathan J. Gomes, University of Kent (United Kingdom)

Christina Lim, The University of Melbourne (Australia)

Sevia Mahdaliza Idrus, The University of Warwick (United Kingdom)

Chanchai Thaijiam, Srinakharinwirot University (Thailand)

Local Arrangement Chair

Tharadol Komolmis, Chiang Mai University (Thailand)

Local Arrangement Committee

Paopatra Kampikul, Chiang Mai University (Thailand) **Kanitpong Pengwon**, Chiang Mai University (Thailand)

Publication Chairs

Kanitpong Pengwon, Chiang Mai University (Thailand)Kidsanapong Puntsri, Rajamangala University of Technology Isan (Thailand)

Website Chair

Patiwet Wuttisarnwattana, Chiang Mai University (Thailand)

Financial Chairs

Sermsak Uatrongjit, Chiang Mai University (Thailand) **Nipon Theera-Umpon**, Chiang Mai University (Thailand)

General Secretariat

Paopatra Kampiku, Chiang Mai University (Thailand)