PROCEEDINGS OF SPIE

Metro and Data Center Optical Networks and Short-Reach Links IV

Atul K. Srivastava Madeleine Glick Youichi Akasaka Editors

6–11 March 2021 Online Only, United States

Cosponsored by Corning Incorporated (United States) NTT Electronics America, Inc. (United States)

Published by SPIE

Volume 11712

Proceedings of SPIE 0277-786X, V. 11712

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

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 Metro and Data Center Optical Networks and Short-Reach Links IV, edited by Atul K. Srivastava, Madeleine Glick, Youichi Akasaka, Proceedings of SPIE Vol. 11712 (SPIE, Bellingham, WA, 2021) Seven-digit Article CID Number.

ISSN: 0277-786X ISSN: 1996-756X (electronic)

ISBN: 9781510642591 ISBN: 9781510642607 (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 © 2021, 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/21/\$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

AI AND SECURITY IN NETWORKS

- 11712 05 Machine-learning-based equalization for short-reach transmission: neural networks and reservoir computing (Invited Paper) [11712-2]
- 11712 07 **Quantum networks in the UK (Invited Paper)** [11712-4]

TRANSCEIVER TECHNOLOGIES

11712 08	Transmitter and receiver solutions for VCSEL exploitation in access and metro networks (Invited Paper) [11712-5]
11712 09	Latest standardization trend for leading edge high-speed optical transceivers [11712-6]
11712 0A	Multi-Tb/s photonic transceivers for metro optical network connectivity evolution [11712-7]
11712 OB	High temperature AlGaInAs-based 25g DML-DFB lasers operating in O-band for data center use [11712-8]
11712 OC	Evaluation of low-complexity digital coherent receivers for short-reach transmission systems [11712-9]
	COMPONENTS AND RELATED TECHNOLOGIES
11712 0D	Photonic integrated nodes for next-generation metro optical networks (Invited Paper) [11712-10]
11712 OE	Development of optical coupling technologies for Si-photonics-die embedded package substrate (Invited Paper) [11712-11]
11712 OF	Global insights into the key technology enabling the exponential growth of digital communication networks [11712-12]
11712 0G	The path to 1Tb/s and beyond datacenter interconnect networks: technologies, components, and subsystems (Invited Paper) [11712-13]
	NETWORK SLICING
11712 OK	Enabling service provisioning and quality maintenance in sliceable optical networks [11712-17]

- 11712 OL Single-lane >100 Gb/s CAP-based data transmission over VCSEL-MMF links using lowcomplexity equalization (Invited Paper) [11712-18]
- 11712 0M Recent trends in coherent free-space optical communications (Invited Paper) [11712-19]
- 11712 ON ADC/DAC resolution tolerance improvement by implementing probabilistic shaping distributions in PAM and QAM modulation schemes [11712-20]