PROCEEDINGS OF SPIE

Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies XI

Marian Vladescu
Razvan D. Tamas
Ionica Cristea
Editors

25–28 August 2022
Constanta, Romania

Organized and Sponsored by
University "Politehnica" of Bucharest - Optoelectronics Research Center (Romania)
Maritime University of Constanta (Romania)

Published by
SPIE

Volume 12493

Proceedings of SPIE 0277-786X, V. 12493

Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies XI, edited by
Marian Vladescu, Razvan D. Tamas, Ionica Cristea, Proc. of SPIE Vol. 12493, 1249301
© 2023 SPIE · 0277-786X · doi: 10.1117/12.2672522

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 *Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies XI*, edited by Marian Vladescu, Razvan D. Tamas, Ionica Cristea,
Proc. of SPIE 12493, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510660939
ISBN: 9781510660946 (electronic)

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

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.

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.org

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

QUANTUM TECHNOLOGIES (COMMUNICATIONS, ENCRYPTION, COMPUTING, ETC.)

SENSORS, MICROSYSTEMS, AND INSTRUMENTS

MODELLING, DESIGN, AND SIMULATION

OPTICS-INSPIRED APPROACHES FOR NON-OPTICAL APPLICATIONS: SYSTEMS, DEVICES, AND SIGNAL PROCESSING

BIOMEDICAL OPTOELECTRONICS, ORGANIC OPTOELECTRONIC MATERIALS AND DEVICES; PLASMA METHODS AND DIAGNOSTIC USED FOR SURFACE TREATMENTS

PROPAGATION, RELIABILITY, AND SECURITY ISSUES IN WIRELESS AND OPTICAL COMMUNICATIONS

Conference Committee

Conference Chair

Paul Schiopu, University "Politehnica" of Bucharest (Romania)

Conference Co-chairs

Cornel Panait, Maritime University of Constanta (Romania)
Violeta-Vali Ciucur, Maritime University of Constanta (Romania)

Technical Program Chair

Razvan Tamas, Maritime University of Constanta (Romania)

Technical Program Co-chair

George Caruntu, Maritime University of Constanta (Romania)

Conference General Manager

Ionica Cristea, University "Politehnica" of Bucharest (Romania)

Conference Executive Manager

Marian Vladescu, University "Politehnica" of Bucharest (Romania)

International Committee

Oleg Angelsky, Chernivtsi National University (Ukraine)
Erchin Serpedin, Texas A&M University (United States)
Yury A. Ushenko, Chernivtsi National University (Ukraine)
Mircea Guina, Tampere University of Technology (Finland)
Dan Cojoc, National Institute for Physics of Matter - TASC-INFM (Italy)
Daniela Reyna, LAAS-CNRS INSA (France)
Philippe Arguel, LAAS-CNRS INSA (France)
Radu Malureanu, Technical University of Denmark (Denmark)
Luige Vladareanu, Romanian Academy (Romania)
Henri Arsenault, Laval University (Canada)
Paul Schiopu, University Politehnica din Bucuresti (Romania)
Marian Vladescu, University "Politehnica" of Bucharest (Romania)
Raluca Muller, National Institute for R&D in Microtechnologies (Romania)
Ileana Cernica, National Institute for R&D in Microtechnologies (Romania)

Dana Cristea, National Institute for R&D in Microtechnologies (Romania)
Carmen Moldovan, National Institute for R&D in Microtechnologies (Romania)
Doina Manaila-Maximean, University "Politehnica" of Bucharest (Romania)
Mona Mihailescu, University "Politehnica" of Bucharest (Romania)

Program Committee

Marian Vladescu, University "Politehnica" of Bucharest (Romania)
Paul Şchiopu, University "Politehnica" of Bucharest (Romania)
Razvan Tamas, Maritime University of Constanta (Romania)
Ionica Cristea, University "Politehnica" of Bucharest (Romania)
Alexandru Craciun, University "Politehnica" of Bucharest (Romania)
Adrian Manea, University "Politehnica" of Bucharest (Romania)
Andrei Drumea, University "Politehnica" of Bucharest (Romania)
Nicolai Militaru, University "Politehnica" of Bucharest (Romania)
Mihaela Hnatiuc, University "Politehnica" of Bucharest (Romania)
George Caruntu, University "Politehnica" of Bucharest (Romania)
Ion Ileana, Universitatea "1 Decembrie 1918" din Alba Iulia (Romania)
Florin Garoi, National Institute of Laser, Plasma and Radiation (Romania)
Victor Damian, National Institute of Laser, Plasma and Radiation (Romania)
Mihail Iovu, Institute of Applied Physics (Moldova)
Nicolae Enachi, Academy of Sciences of Moldova (Moldova)
Gheorghe Gavriloaia, University of Pitesti (Romania)
Stephane Pellerin, University of Orleans (France)
Mona Mihailescu, University "Politehnica" of Bucharest (Romania)
Eugen Scarlat, University "Politehnica" of Bucharest (Romania)
Dorin Dadarlat, National R&D Institute for Isotopic and Molecular Technologies (Romania)
Aurica Farcas, "Petru Poni" Institute of Macromolecular Chemistry (Romania)
Alin Danisor, Maritime University of Constanta (Romania)
Maria Petrescu, National Institute of Laser, Plasma and Radiation, (Romania)
Emil Petrescu, University "Politehnica" of Bucharest (Romania)
Violeta Calin, University of Medicine and Pharmacy "Carol Davila" Bucharest (Romania)
Rodica-Claudia Constantinescu, University "Politehnica" of Bucharest (Romania)
Bogdan Alexandrescu, University "Politehnica" of Bucharest (Romania)
Stefania Bucuci, Maritime University of Constanta (Romania)

Mirel Paun, Maritime University of Constanta (Romania)
Octavian Fratu, University "Politehnica" of Bucharest (Romania)
Simona Halunga, University "Politehnica" of Bucharest (Romania)
Adrian Tulbure, Universitatea "1 Decembrie 1918" din Alba Iulia (Romania)
Valentin-Ionel Feies, University "Politehnica" of Bucharest (Romania)
Andrei Dragulinescu, University "Politehnica" of Bucharest (Romania)
Ana Barar, University "Politehnica" of Bucharest (Romania)
Ionut-Romeo Schiopu, University "Politehnica" of Bucharest (Romania)
Alina-Elena Marcu, University "Politehnica" of Bucharest (Romania)

Local Organizing Committee

Cornel Panait, Maritime University of Constanta (Romania)
Violeta-Vali Ciucur, Maritime University of Constanta (Romania)
Razvan Tamas, Maritime University of Constanta (Romania)
Alin Danisor, Maritime University of Constanta (Romania)
Mirel Paun, Maritime University of Constanta (Romania)
Stefania Bucuci, Maritime University of Constanta (Romania)
Andreea Platica, Maritime University of Constanta (Romania)
Cosmin Danisor, Maritime University of Constanta (Romania)
Andreea Furtuna, Maritime University of Constanta (Romania)
Andreea Cazan, Maritime University of Constanta (Romania)
Madalina Dragan, Maritime University of Constanta (Romania)
Milis Nilgun Caibula, Maritime University of Constanta (Romania)
Cristina Clapone, Maritime University of Constanta (Romania)
Mihaela Constantin, Maritime University of Constanta (Romania)
Adelaida Heiman, Maritime University of Constanta (Romania)
Marius Pastorcici, Maritime University of Constanta (Romania)
Mariana Rotaru, Maritime University of Constanta (Romania)
Elena Ionita, Maritime University of Constanta (Romania)
Cecilia Balanescu, Maritime University of Constanta (Romania)

Session Chairs

1 Opening Session
Paul Schiopu, University "Politehnica" of Bucharest (Romania)
George Caruntu, Maritime University of Constanta (Romania)

2 Advanced Materials and New Tehchnologies
Marian Vladescu, University "Politehnica" of Bucharest (Romania)

3 Quantum Technologies
(Communications, Encryption, Computing, etc.)
Razvan Tamas, Maritime University of Constanta (Romania)

4 Sensors, Microsystems, and Instruments
Mona Mihailescu, University "Politehnica" of Bucharest (Romania)
Cosmin Danisor, Maritime University of Constanta (Romania)

5 Micro-Nanophotonics and Micro-Nanotechnologies
Stefania Bucuci, Maritime University of Constanta (Romania)
Andreea Platica, Maritime University of Constanta (Romania)

6 Modelling, Design, and Simulation
Gheorghe Brezeanu, University "Politehnica" of Bucharest (Romania)
Cosmin Danisor, Maritime University of Constanta (Romania)

7 Optics-Inspired Approaches for Non-Optical Applications: Systems, Devices, and Signal Processing
Mirel Paun, Maritime University of Constanta (Romania)
Andreea Platica, Maritime University of Constanta (Romania)

8 Biomedical Optoelectronics, Organic Optoelectronic Materials and Devices; Plasma Methods and Diagnostic Used for Surface Treatments
Adrian Tulbure, Universitatea "1 Decembrie 1918" din Alba Iulia (Romania)
Simona Halunga, University "Politehnica" of Bucharest (Romania)
Ionut-Romeo Schiopu, University "Politehnica" of Bucharest (Romania)

9 Propagation, Reliability, and Security Issues in Wireless and Optical Communication
Alin Danisor, Maritime University of Constanta (Romania)
Octavian Fratu, University "Politehnica" of Bucharest (Romania)
Rodica Constantinescu, University "Politehnica" of Bucharest (Romania)