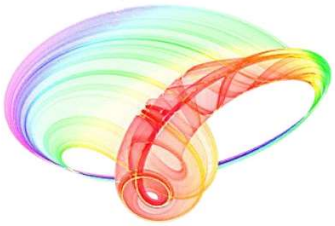
Book of abstracts



IX International School and Conference on Photonics

PHOTONICA2023

with joint events:

Understanding interaction light - biological surfaces: possibility for new electronic materials and devices

&

Biological and bioinspired structures for multispectral surveillance

&

Quantum sensing integration within microfluidic Lab-on-a Chips for biomedical applications

&

Advanced Biophysical Methods for Soil Targeted Fungi-Based Biocontrol Agents

August 28 - September 01, 2023, Belgrade, Serbia

Editors

Jelena Potočnik, Maja Popović, Dušan Božanić

Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade

Belgrade, 2023

ABSTRACTS OF TUTORIAL, KEYNOTE, INVITED LECTURES, PROGRESS REPORTS AND CONTRIBUTED PAPERS

of

IX International School and Conference on Photonics

PHOTONICA2023

August 28 - September 01, 2023, Belgrade, Serbia

Editors
Jelena Potočnik, Maja Popović, Dušan Božanić

Publisher
Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade
Mike Petrovića Alasa 12-14
11351 Vinča, Belgrade, Serbia

Printed by
Serbian Academy of Sciences and Arts

Number of copies
200

ISBN 978-86-7306-165-8
ISBN 978-86-7306-168-9 (Online)

PHOTONICA2023 – IX International School and Conference on Photonics (www.photonica.ac.rs) is organized by Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade (www.vin.bg.ac.rs), Serbian Academy of Sciences and Arts (www.sanu.ac.rs), and Optical Society of Serbia (www.ods.org.rs).

Other institutions that helped the organization of this event are: Institute of Physics Belgrade, University of Belgrade (www.ipb.ac.rs), Faculty of Physics, University of Belgrade (www.ff.bg.ac.rs), School of Electrical Engineering, University of Belgrade (www.etf.bg.ac.rs), Institute of Chemistry, Technology and Metallurgy, University of Belgrade (www.ihtm.bg.ac.rs), Faculty of Technical Sciences, University of Novi Sad (www.ftn.uns.ac.rs), Faculty of Sciences and Mathematics, University of Niš (www.pmf.ni.ac.rs), Faculty of Biology, University of Belgrade (www.bio.bg.ac.rs) and Faculty of Sciences and Mathematics, University of Kragujevac (www.pmf.kg.ac.rs).

PHOTONICA2023 is organized under auspices and with support of the Ministry of Science, Technological Development and Innovation, Republic of Serbia (www.nitra.gov.rs). PHOTONICA2023 is supported and recognized by Optica (Formerly OSA) - The Optical Society (www.optica.org).

Photonic integrated circuits based on linearly coupled waveguide arrays

J. Petrovic
Vinca Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Serbia
e-mail: jovanap@vin.bg.ac.rs

Photonic integrated circuits (PICs) are a promising route towards the next generation of classical and quantum information technologies. The main challenges before their widespread implementation are achievements of the competitive footprint, speed and number of simultaneous operations. This translates into requirements for miniaturization, broad bandwidth and extensive spatial and wavelength multiplexing. Current PIC designs commonly rely on directional couplers for operations and waveguides for information transfer. However, their miniaturization potential is limited by the trade-off between losses and bend radii in the former case and the crosstalk between densely packed waveguides in the latter case. On the other hand, operationally successful nanophotonic inverse designs are achieved only with substantial time and energy resources per device [1,2].
Here, we present and discuss an innovative solution for design of PICs which utilizes the linear crosstalk between waveguides [3]. We demonstrate construction of interconnects, couplers, interferometers, filters and dichroic splitters [4-6]. As the only fundamental assumption is the linear coupling between waveguides, these designs are applicable to all photonic fabrication platforms. We show components in glass, silicon nitride and silicon-on-insulator, and offer strategies for optimization of their footprint and bandwidth. The concept has been experimentally validated by fabrication of equal power splitters in glass. The optimization capability was proven by the achieved negligible insertion loss, large bandwidth and footprint scalability [7].
The proposed PICs are highly cost effective. Our simple semi-analytical design algorithm ensures efficient design, 20-100 times faster than the competing nanodesigns [1,2], and production realizable by any waveguide fabrication technique.
Finally, we show that the quantum walk through the proposed linearly coupled waveguide arrays offers numerous possibilities for exploitation of qudits and construction of quantum logic gates.

REFERENCES
[1] H. Xie *et al.*, IEEE Photon. J. 10, 1 (2018).
[2] A.Y. Piggott *et al.*, Sci. Rep. 7, 1786 (2017).
[3] J. Petrovic, J. Veerman, Ann. Phys. 392, 128 (2018).
[4] J. Petrovic *et al.*, J. Opt. Las. Technol. 163, 109381 (2023).
[5] J. Petrovic, Opt. Lett. 40, 139 (2015).
[6] J. Petrovic *et al.*, Opt. Quantum Electron. 54, 687 (2022).
[8] P. Vildoso *et al.*, Opt. Express 31, 12704 (2023).