2023 TECHNICAL PROGRAM

SPIE. PHOTONICS WEST

28 JANUARY–2 FEBRUARY 2023

THE MOSCONE CENTER | SAN FRANCISCO, CALIFORNIA USA

OPTO DAILY CONFERENCE SCHEDULE

Check the conference schedule frequently for updates
Presentation times are subject to change

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30 January</th><th>TUESDAY
31 January</th><th>WEDNESDAY
1 February</th><th>THURSDAY
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<tr><td colspan="6">Optoelectronic Materials and Devices (Grote, Jiang)</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">12415 Physics and Simulation of Optoelectronic Devices XXXI (Witzigmann, Osinski, Arakawa) Room 156</td></tr>
<tr><td></td><td></td><td colspan="3">12416 Physics, Simulation, and Photonic Engineering of Photovoltaic Devices XII (Freundlich, Collin, Hinzer, Sellers) Room 159</td><td></td></tr>
<tr><td></td><td></td><td colspan="2">12417 Optical Components and Materials XX (Jiang, Digonnet) Room 214</td><td colspan="2">12418 Organic Photonic Materials and Devices XXV (Shensky, Rau, Sugihara) Room 214</td></tr>
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<tr><td></td><td></td><td colspan="3">12420 Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XVI (Sadwick, Yang) Room 160</td><td></td></tr>
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<tr><td></td><td></td><td></td><td colspan="3">12429 Next-Generation Optical Communication: Components, Sub-Systems, and Systems XII (Li, Nakajima, Srivastava) Room 216</td></tr>
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<tr><td></td><td colspan="3">12433 Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XVI (von Freymann, Blasco, Chanda) Room 2018</td><td></td><td></td></tr>
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Automated Calibration of MZI-based Si Optical Switch Matrix

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ABSTRACT

With the rapid growth of the amount of data processed in data centers, there is an emerging need for optical switching systems that can perform desired switching operation in the optical domain in a flexible and disaggregated manner. Many optical switching systems are based on the Mach-Zehnder Interferometer (MZI) which, with the advent of Si Photonics technology, can be realized with a very high integration level. However, due to the process variation, there is an unavoidable uncertainly in the length difference of two arms and, consequently, the initial operation condition of a fabricated MZI. An electrical controller must resolve this uncertainly with initial calibration as well as switching of the MZI directed by the routing requirement. Furthermore, this calibration must be performed in a scalable and efficient manner so that the power consumption can be minimized. We propose a new calibration technique that automatically determines the condition for the maximum optical transmission of the target MZI and confirms its operation with a 4x4 Si Spanke-Benes optical switch matrix where each MZI is controlled with on-chip heaters. For the electrical controller, a FR4-based PCB board is implemented that contains an FPGA, data converters, and photodetectors. Our controller monitors the transmission output of the optical switch matrix at different heater voltages and determines the condition that can set the cross and the bar states with the minimum amount of phase shift. Details of analysis and measurement results of our calibration method will be presented.

Keywords: Si Photonics, MZI switch, Spanke-benes network, FPGA based control