Power-Efficient Coherent Optical Transceiver for Data Centers

Tech ID: 34886 / UC Case 2022-780-0

BACKGROUND

Intra-datacenter traffic has increased significantly in the past few years, placing increasingly stringent cost and power consumption requirements on optical transceivers. As both the start and end point in fiber-optic communications, optoelectronic transceivers have the potential to increase the efficiency of fiber-optic communications; however, current optoelectronic transmitters have limitations imposed by fabrication. Many optoelectronic transmitters are fabricated based on narrow-band ring-resonator modulators, which can be very sensitive to process and temperature variations compared to Mach-Zehnder modulators (MZMs). There is a need for optical transceivers that are power-efficient and can provide high-speed data transfer over long distances.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a scalable optoelectronic transceiver that combines tunable traveling-wave modulation and analog coherent reception to support power-efficient, high-speed optical links. This technology integrates traveling-wave Mach-Zehnder modulators, driver biasing, optical amplification, and wavelength and polarization multiplexing with analog coherent receivers. The receiver separates polarization channels and uses local-oscillator detection and feedback-based control to recover transmitted signals, supporting wavelength-multiplexed communication for data-center networks.

- Patent application: https://patents.google.com/patent/US20240089001A1/en
- Publication: https://ieeexplore.ieee.org/document/9606026

ADVANTAGES

- Enables high-speed, power-efficient data transmission over optical links
- Coherent detection provides greater link margin than conventional intensity-modulation direct detection
- Tunable modulator biasing offers flexibility to balance bandwidth, modulation efficiency, and optical loss
- Supports polarization and wavelength multiplexing to increase link capacity
- O-band operation near the fiber dispersion minimum can reduce digital signal-processing requirements
- Analog coherent detection can avoid the need for highly linear electronics, helping reduce power consumption

APPLICATIONS

- Intra-datacenter optical interconnects and network switches
- Short-reach optical links, including links under 2 km
- High-capacity wavelength-division and polarization-multiplexed networks

CONTACT

Pasquale S. Ferrari
ferrari@tia.ucsb.edu
tel: .

INVENTORS

- Andrade, Hector
- Buckwalter, James F.
- Coldren, Larry A.
- Maharry, Aaron
- Schow, Clint

OTHER INFORMATION

KEYWORDS

Optical, Photonics, Data, Data Center, Communication, Transceiver, Optoelectronic

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Communications**
  - Optical

RELATED CASES

2022-780-0

- Silicon photonics transceivers for scalable data-center infrastructure
- Optical communication systems requiring low energy per bit and high-speed transmission

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20240089001	03/14/2024	2022-780

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Improved Dynamic Range in RF Communication Over Optical Fiber
- Load-Modulation Network for High-Efficiency 5G Power Amplifiers

University of California, Santa Barbara
Office of Technology & Industry Alliances
342 Lagoon Road, ,Santa Barbara,CA 93106-2055 |
https://www.tia.ucsb.edu
Tel: 805-893-2073 | Fax: 805.893.5236 | padilla@tia.ucsb.edu

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