

Applications of Planar Optical Waveguide Chips in Artificial Intelligence



Overview

UCLA researchers developed a versatile platform for creating “smart” waveguides that can be programmed to manipulate light with unprecedented flexibility, opening new possibilities for telecommunications, sensing, and imaging. We report on the realization of an on-chip waveguide platform capable of creating arbitrary two-dimensional refractive index profiles in situ and in real-time. The device exhibits complex multimode dynamics which we train to perform machine learning. We demonstrate use this device as an optical neural network. Many UC-authored scholarly publications are freely available on this site because of the UC's open access. Continuously lateral-coupled integrated waveguide arrays (WAs), by contrast, offer compact systems with no direct free-space analogs, but their static nature has limited their utility. Recently, programmable waveguide arrays (PWAs) have emerged as a promising alternative, combining the Hamiltonian. At the heart of this evolution are planar waveguides, structures that guide light along a specific path on a flat substrate. In this article, we will explore the pivotal role of planar waveguides in shaping the future of photonics, from optical interconnects to biosensing. Los Angeles, CA – A team of researchers at the University of California.

Article Content

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Abstract. Diffractive optical neural networks (DONNs) have exhibited the advantages of parallelization, high speed, and low consumption. However, the existing DONNs based on free-space diffractive

Electronic Chip Package and Co-Packaged Optics

With the growing demand for high-performance computing (HPC), artificial intelligence (AI), and data communication and storage, new chip

Introduction to the Special Issue on Ultralow Loss Planar Waveguides ...

The fifteen papers in this special issue focus on ultra low loss planar waveguides and the applications. Ultra-low loss optical planar waveguide technology is a critical research area driven by

AI-Designed Waveguides Pave the Way for Next

This new technology uses artificial intelligence (AI), specifically deep learning, to design a series of structured surfaces that guide light with high

NTT Research Collaboration Breaks t...

The breakthrough fundamentally alters how nonlinear photonic devices operate, breaking the “one device, one function” paradigm, and

Programmable on-chip nonlinear photonics

Here we present a photonic device with highly programmable nonlinear functionality: an optical slab waveguide with an arbitrarily

Compact planar-waveguide integrated diffractive optical neural network chip

The integrated diffractive optical network (IDNN) chip demonstrates a promising avenue towards scalable and low-power-consumption optical computational chips for optical-artificial

Artificial gauge fields in photonics

Artificial gauge fields bridge vibrant fields of research in optics and photonics across both classical and quantum systems.

A fully programmable on-chip planar waveguide for machine learning

We report on the realization of an on-chip waveguide platform capable of creating arbitrary two-dimensional refractive index profiles in situ and in real-time. The device exhibits

Wideband Reconfigurable Multifunctional Analogue Photonic Chip

This work provides a route for perspective applications of ultrafast optical analogue signal processing. 2 Structure Design and Working Principle The multifunctional tunable planar waveguide

Automated visual position detection and adjustment for optical ...

The alignment coupling between optical waveguide chips and optical fiber arrays is the basis of the alignment coupling of planar optical waveguide devices, and the precise position

Photonic edge intelligence chip for multi-modal sensing ...

Edge devices require real-time processing of high-throughput analog signals. Here, authors present a photonic intelligence chip that fuses multiple analog signal types into optical

Integrated Waveguide-Based Photonic Devices

Waveguide-based devices also have extended into cutting-edge territories including quantum technology, artificial intelligence, virtual reality, 6G and millimeter-wave

Free-standing millimeter-range 3D waveguides for on-chip optical ...

The presented waveguides are suitable for on-chip out-of-plane light coupling as well as non-connected 3D crossings, needed for high density optical circuits.

Planar optical waveguides for sensing applications

Deposition of metal and dielectric layers allows the design of "all optical" device structures which must be capable of surviving harsh working conditions for both civilian and military

Key Technologies of Photonic Artificial Intelligence Chip

Artificial intelligence chips (AICs) are the intersection of integrated circuits and artificial intelligence (AI), involving structure design, algorithm

Optical meta-waveguides for integrated photonics and beyond

Recent years have witnessed substantial potential in allying meta-optics with diverse waveguide platforms to enable exotic manipulation of guided light signals. This review cataloged

Planar Waveguides: The Future of Photonics

In conclusion, planar waveguides are a crucial technology for the future of photonics, enabling high-speed data transfer, biosensing, and other applications. As research continues to

A Fully Programmable On-Chip Planar Waveguide for Machine Learning

We introduce a device containing a planar waveguide whose spatial refractive index profile $n(x, z)$ can be programmed in real time. We demonstrate use this device as an optical neural network.

Integrating planar photonics for multi-beam generation and ...

A planar platform combining photonic integrated circuits and flip-chip bonded metasurfaces for multi-color light projection, beam shaping, and polarization control for compact laser

A Fully Programmable On-Chip Planar Waveguide for

Figure 1: Concept of the programmable planar waveguide. A: Device schematic showing how illuminated pattern on the top of the chip in situ sets the spatial

Programmable photonic waveguide arrays: opportunities and challenges

We examine the theoretical and practical challenges of modeling, fabrication, and control, and propose PWAs as a next-generation architecture for compact, reconfigurable photonic processors.

Optical Waveguides: A Detailed Look at Their Design

Explore the fundamentals of optical waveguides and their pivotal role in modern photonics. Learn about different types of waveguides, such as planar, fiber optic,

Wideband Reconfigurable Multifunctional Analogue Photonic Chip

Currently, photonic devices based on planar waveguides have been widely used in fields such as arrayed waveguide gratings and integrated optical splitters. With the continuous

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