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Trident Shape Metamaterial Taper Based Fiber-to-Chip Edge Coupler

A high-speed, integrated silicon-chip architecture utilizes photonics to rapidly and accurately generate and process radio frequency waveforms for applications ranging from wireless technology to defense electronics.

Photonic methods of radio frequency waveform generation and processing can provide performance advantages and flexibility over electronic methods due to the ultrawide bandwidth offered by the optical carriers. However, implementation of bulk optics suffer from the lack of integration and slow reconfiguration speed.

Researchers at Purdue University have developed an architecture of integrated photonic radio frequency generation and processing that is implemented on a silicon chip fabricated in a semiconductor manufacturing foundry. The miniature device can be fabricated with high-yield and low-cost manufacturing techniques at a commercial CMOS foundry. It also has the potential to be seamlessly integrated with other on-chip components such as high-speed germanium photodetectors, optical frequency combs sources, and control electronics. This device can generate programmable radio frequency bursts or continuous waveforms with only the light source, electrical drives/controls, and detectors being off-chip. It modulates an individual pulse in a radio frequency burst within 4â€‰ns, achieving a reconfiguration speed three orders of magnitude faster than thermal tuning. The on-chip optical delay elements offer an integrated approach to accurately manipulating individual radio frequency waveform features without constraints set by the speed and timing jitter of electronics. Applications range from high-speed wireless technology to defense electronics.

Advantages:

-Uses high yield, low-cost manufacturing techniques

-Potential seamless integration with other on-chip components

-Faster

Technology ID

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Category

Aerospace & Defense/Defense Electronics & Surveillance Technologies

Semiconductors/Devices & Components

Computing/Photonic & Optical Computing Technologies

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-Eliminates speed and timing constraints

Potential Applications:

-High-speed wireless technology

-Defense electronics

-High-speed signal processing

-Other emerging applications

TRL: 4

Intellectual Property:

Provisional-Patent, 2016-11-01, United States | Utility Patent, 2017-10-30, United States | CON-Patent, 2018-11-09, United States

Keywords: Photonic radio frequency generation, integrated photonics, silicon chip, CMOS foundry, optical carriers, ultrawide bandwidth, high-speed wireless technology, defense electronics, high-speed signal processing, on-chip optical delay elements