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Spotlight on “Ultralow crosstalk Nanosecond-scale Nested 2x2 Mach-Zehnder Silicon Photonic Switch”

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Spotlight summary:

Fast switching in silicon photonics gets record performance.

High-performance supercomputing and datacentre networks yearns for energy-efficient solutions for fast and high-capacity data switching in high-port-count nodes. Electronics is the current technology, but it is bound to resort soon to heavy parallelization and power-hungry multi-chip architectures; optical technologies already offer 3D-MEMS switches, which are however too slow for applications that require data-packet reconfiguration. Silicon photonics has the right stuff to become a key technology for low-power switch fabrics operating at nanosecond-scale. Yet, to date, high loss and high optical crosstalk limit the port-count of silicon photonic switches to a handful of I/Os.

In this Optics Letters article, N. Dupuis and coworkers present something that is likely to become a game-changing silicon photonic building block. The idea is rather simple indeed, essentially consisting of 2 × 2 nested-Mach-Zehnder switch where the conventional straight-line phase-shifter integrated in one arm is replaced by a Mach-Zehnder phase shifter. This design enables to fully exploit the energy-efficient and fast switching provided by free-carrier plasma dispersion effect in silicon waveguides, without paying the price of the inherent loss associated with free-carrier absorption. A record crosstalk value of -34.5 dB is achieved, with only 2 dB loss and a remarkably small switching time of 4 ns.

Everything we need is monolithically integrated onto a small silicon chip, hosting the photonic switch, the CMOS driver and interface logic. Another brick in the silicon photonic route towards energy efficient computing networks has been added.

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