Wim Bogaerts

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Title

Programmable Photonic Circuits for Signal Processing

Bio

Wim Bogaerts is a professor in the Photonics Research Group at Ghent University and the IMEC nanotechnology research center in Belgium. He completed his PhD in 2004, pioneering the use of industrial CMOS fabrication tools to build photonic circuits. Between 2000 and 2010, he was the driver behind the buildup of IMEC's silicon photonics technology. In parallel, he started developing design automation tools to implement complex silicon photonic circuits. In 2014, he co-founded Luceda Photonics, bringing the design tool IPKISS to the market. In 2016 he won a research grant from the European Research Council, and since then he is again full-time at Ghent University – IMEC, focusing on the challenges for large-scale photonic circuits and the new field of programmable photonics. He is an IEEE and OPTICA Fellow, and senior member of SPIE.

Abstract

In the past decades, photonic integrated circuits have become entrenched as a key enabling technology for fiber-optic communication. They make it possible to integrate a combination of optical and electrical functions on the surface of a chip, which can be fabricated with the same technologies used for microelectronics. The extremely large bandwidth of optical signals, and the availability of high-speed electro-optic building blocks (modulators, detectors) makes photonics a very suitable platform for the analog processing of optical and microwave signals. This is useful for communication, sensing, analog computing and many other applications. Just like electronic chips have found use in many more domains than basic computing, we expect photonic chips to find their way into these diverse application fields.

One aspect in which photonic chip technology is less advanced than its electronics counterpart is programmability: photonic chips today are fabricated for a single purpose, and each new iteration or experiment needs a new chip design. By making photonic chips programmable, like we know from field-programmable gate arrays (FPGA) in digital electronics, we can accelerate the development and innovation cycles with analog signal processing, opening up the capabilities of photonic chips to a much broader engineering community.

We will introduce different classes of programmable photonic circuits, discuss the state of programmable photonics today, and illustrate this with some recent demonstrations from the work in Ghent University – IMEC. From there, we will take a look at the future, to the key challenges in the technology, but also to the opportunities to create a programmable photonic ecosystem.