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High-speed transceiver electronics for next-generation optical networks

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High-speed electronic integrated circuits are essential to the development of new fiber-optic communication systems. Exponentially increasing data consumption is expanding the applications of optical communication and driving the development of faster and more efficient transceivers. Fiber-optic communication networks operate on very different scales from very short interconnects in datacenters to very long links between cities, countries or continents. Optical fibers are also increasingly used for access networks (e.g. fiber-to-the-home) and for mobile fronthauling and backhauling. Advances in opto-electronic devices, high-volume manufacturing and packaging technologies are driving numerous developments in these diverse applications. Because of the increasing speeds, close integration and co- design of photonic and electronic devices have become a necessity to realize high-performance sub-systems, while such co-design brings new opportunities as well on the sub-system architecture level to break traditional performance-cost trade-offs. There is no single best solution among electrical and optical technologies due to the different technological constraints in terms of distance, footprint, power consumption, cost, etc. Research is approaching this challenge from different angles, with technological improvements on photonic and electronic devices and/or by applying more complex modulation and signal processing. While each application operates on a very different scale (fiber length, number of users) with very different requirements (capacity, signal format, cost, power, etc.), they share one thing, their need for application-specific high-speed electronic transceiver circuits such as driver amplifiers, transimpedance amplifiers, equalizers and clock-and- data recovery circuits. This presentation will illustrate a few recent and ongoing developments from various H2020 projects.

Figure1: 56Gb/s PAM-4 single-mode VCSEL driver array

Figure2: 64Gb/s PAM-4 transimpedance amplifier array

Biography

Johan Bauwelinck received his PhD degree in Applied Sciences, Electronics from Ghent University, Belgium in 2005. Since Oct 2009, he is a Professor in the IDLab research group of the Department of Information Technology (INTEC) at the same university where he is leading the Design lab since 2014. He became a Guest Professor at iMinds in the same year, now IMEC since 2016. His research focuses on high-speed, high-frequency (opto) electronic circuits and systems, and their applications on chip and board level, including transmitter and receiver analog front-ends for wireless, wired and fiber-optic communication or instrumentation systems. He is an active person involved in the EU-funded projects GIANT, POWERNET, PIEMAN, EuroFOS, C3-PO, Mirage, Phoxtrot, Spirit, Flex5Gware, Teraboard, Streams, WIPE and Optima conducting research on advanced electronic integrated circuits for next generation transport, metro, access, datacenter and radio-over-fiber networks. He has promoted 18 PhDs and co-authored more than 200 publications and 10 patents in the field of High-Speed Electronics and Fiber-Optic Communications.

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