

PHD POSITIONS ON RECONFIGURABLE DISTRIBUTED OPTICAL CHIPS FOR REAL-TIME SIGNAL PROCESSING AND SYNTHESIS



Ghent University – IMEC, Photonics Research Group
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We are looking for two motivated PhD candidates to work on photonic integrated circuits (silicon photonics) where light is distributed over many optical paths that are tuned to perform a predefined optical function. Different circuit topologies can be used, such as waveguide meshes that interfere, networks of ring resonators, or cascaded phased arrays. Such distributed circuits can be programmed for different functions, and will also be more robust against point defects.

The objective of this project is to develop circuit architectures for on-chip distributed optics, focusing on applications in signal processing. It has already been proven that a linear optical circuit can perform operations such as Fourier transforms, and more complex operations such as pattern recognition and real-time encryption have already been demonstrated using lens systems. In this project, we will look into the circuit topologies, but also the algorithms to configure and control such circuits. Given the large number of controllable elements, distributed control algorithms will be needed, such as the nature-inspired behavior of flocks or swarms.

Photonic circuits can be used for many applications, such as telecommunication, sensing, spectrometry, diagnostics. This PhD project looks into signal and data-processing applications, where the photonic circuit is used for tasks like real-time pattern recognition (e.g. header recognition for communication packets), real-time encryption, or arbitrary waveform generation.

We are looking for **two PhD candidates** with a background in photonics, applied physics, electrical engineering or information engineering. You should have a good knowledge of optics and electronics, an affinity for information theory and algorithmic thinking, and fairly strong programming skills (Python is the standard language in our lab, but a genuine enthusiasm for programming is more important than the actual language). There will also be experimental work involved, and an open mind and a multi-disciplinary attitude is a must. The research work will involve simulation (electromagnetic and circuits), photonic chip design, implementation of photonic-electronic demonstrations and measurements. Chip fabrication will be based on existing processes executed in IMEC.

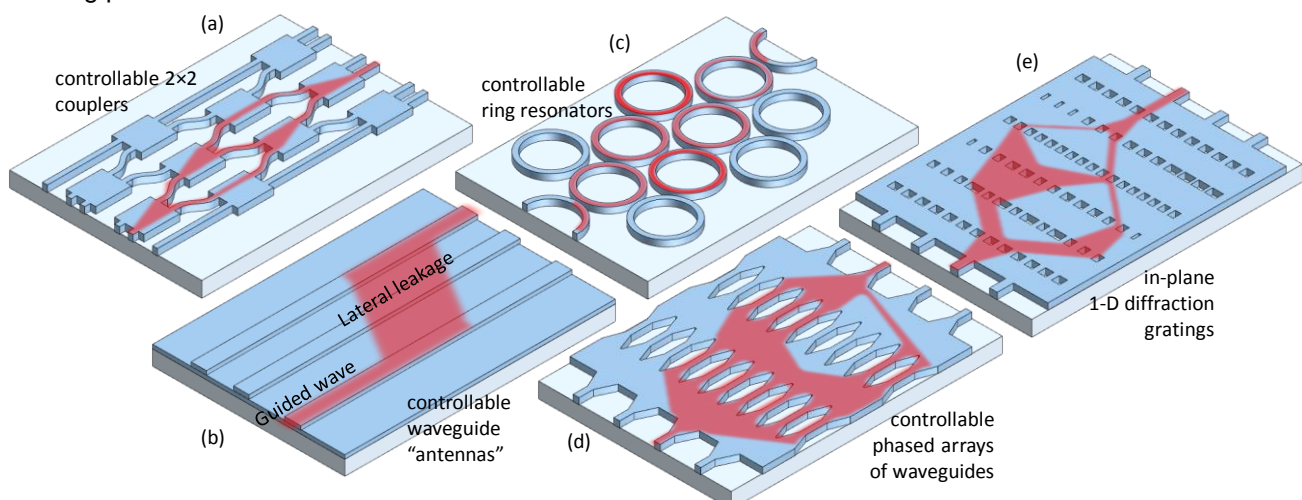


Figure 1: Different circuit topologies for distributed photonics integrated circuits.

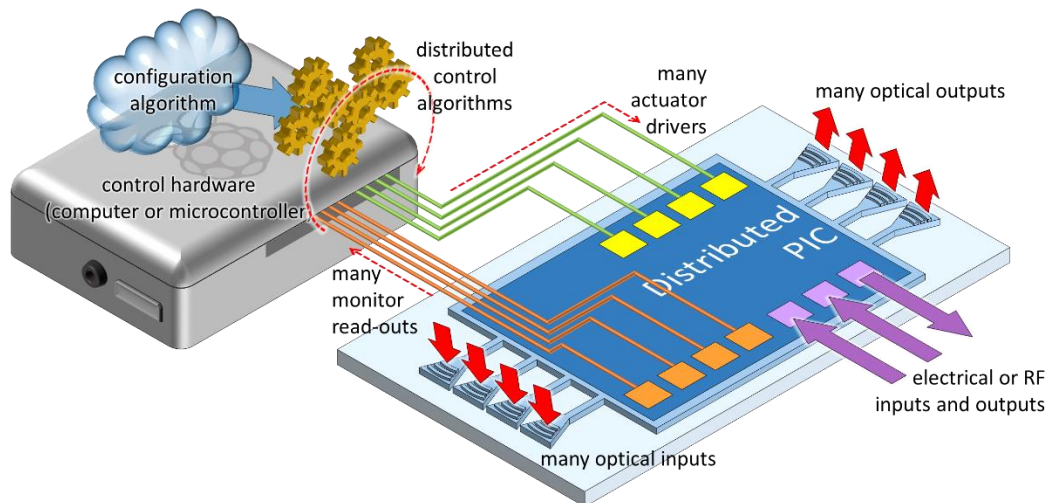


Figure 2: Configuring distributed optical circuits. Many monitors feed different levels of control hardware and software that run parallel localized optimization loops with objectives set by a configuration algorithm.

This PhD project is part of the PhotonicSWARM project, a 5-year consolidator grant funded by the European Research Council (ERC). We offer you the opportunity to work in a large, multi-disciplinary research group that covers a broad spectrum from fundamental to very applied research in the field of integrated photonics. There will be opportunities to collaborate with other groups in Ghent University and in an international context with various partnering research institutes.

APPLICATION:

You can express your interest through this [application form](#).

MORE INFORMATION:

Prof. Wim Bogaerts (wim.bogaerts@ugent.be)

ABOUT THE PHOTONICS RESEARCH GROUP:

The Photonics Research Group (about 85 people) is associated with IMEC, and is part of the Department of Information Technology of Ghent University. The group is headed by Prof. R. Baets and has been active in photonics device research for many years. The other professors in the group are P. Bienstman, W. Bogaerts, B. Kuyken, N. Le Thomas, G. Morthier, G. Roelkens and D. Van Thourhout. The main research directions are silicon nanophotonics, heterogeneous integration, optical communication, photonic (bio)sensors and photonic integrated circuits for biomedical applications in the near-infrared and mid-infrared wavelength range. More in particular, the silicon nanophotonics work focuses on the design and fabrication of SOI-based photonic devices using standard lithographic techniques compatible with CMOS-processing.

The Photonics Research Group has been coordinating the network of excellence ePIXnet and is involved in a number of EU-projects, including the FP7 projects ActPhast, PLAT4M, Cando, and Pocket and the H2020 projects TOPHIT, TeraBoard, PIX4Life, MIRPHAB and Phresco. Furthermore, the group is partner of the Center for Nano- and Biophotonics of Ghent University and the group has been awarded four ERC Independent Researcher Starting Grants, one ERC consolidator grant (this PhotonicSWARM project) and one ERC Advanced Investigator Grant.

ABOUT THE PHOTONICSWARM PROJECT:

The PhotonicSWARM project is a 5-year (2017 – 2022) consolidator grant awarded by the European Research Council (ERC) to Wim Bogaerts. In PhotonicSWARM, Wim Bogaerts researches different architectures for scaling photonic integrated circuits by distributing light over many on-chip optical paths at the same time. This can make optical circuits more robust and create new functionalities that are not possible with simple one-path circuits. Distributed circuits will need some form of control (tuning) to realise the functionality, and as such the system becomes a combination of photonics, electronics and software. PhotonicSWARM looks at different circuit architectures, ways to implement large-scale tuning, and the control algorithms needed to create stable distributed circuits.

