PhD Position as part of a research project:
"Graph-based programming techniques for Programmable Photonic Circuits"

Ghent University, Photonics Research Group and IDLab Network Modeling group

Ghent University – IMEC
Tech Lane Ghent Science Park – Campus A
Technologiepark-Zwijnaarde 126
B-9052 Gent, Belgium

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Opening new horizons

We are looking for a PhD candidate to research new programming architectures for general-purpose programmable photonic circuits. These new chips will enable configurable photonic hardware, that can be used in a similar way as electronic FPGAs. Using graph algorithms, routing and configuration schemes will enable these new programmable photonic chips to perform a variety of functions.

Context

Programmable Photonic Circuits are a new class of photonic integrated circuits that are enabled by the steady improvement of technologies like silicon photonics. In a programmable photonic circuit, the flow of light can be controlled dynamically by a combination of large-scale photonics, complex driver electronics, and programming algorithms. The field of programmable photonics is very young, and the hardware and software architectures are still in full development.

In the context of the new project GRAPHSPAY, funded by the Flemish Research Foundation (FWO-Vlaanderen), we combine the expertise of the *Photonics Research Group* (PRG) and the *IDLab Network Modeling Group* (NetModel) to leverage advanced network design tools and heuristics to construct a programming framework for programmable photonic circuits. Simple routing schemes have already been demonstrated, but more programming routines for more complex functions, especially where the optical phase is important, are largely unexplored.

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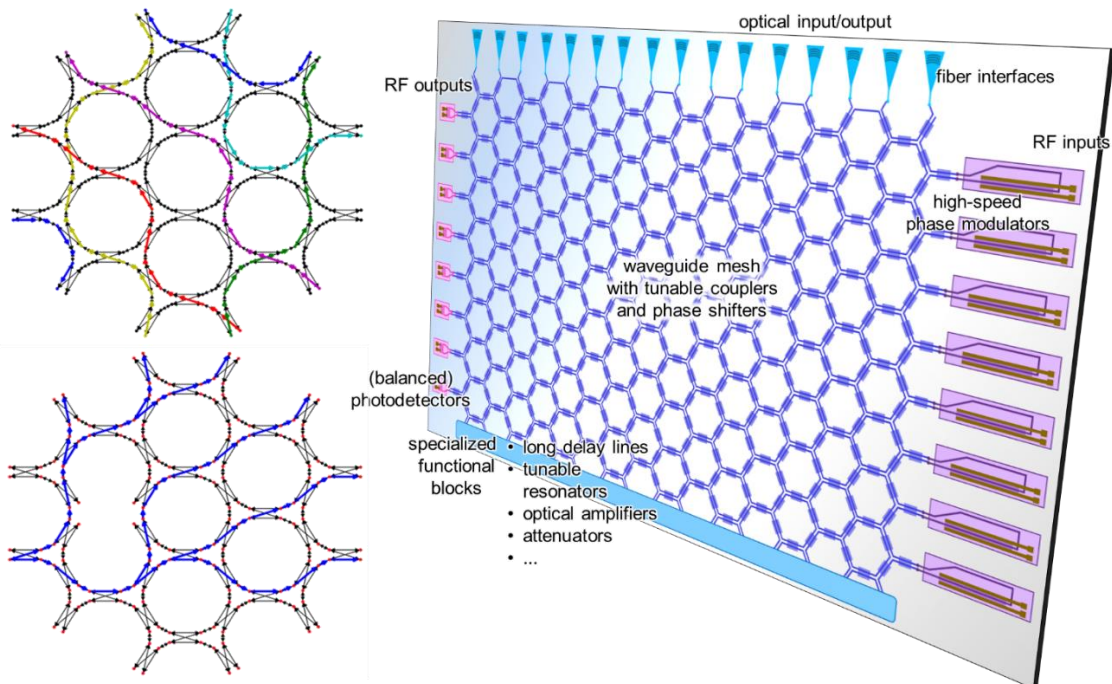
Job description

As a PhD student, you will be involved in the building up a programming framework from the ground up, starting from the fundamentals of photonic circuits, and abstract those into a graph representation. Using multiple techniques from the field of network modeling, configuration routines for programmable photonic circuits will then be tested, first on simulated models, but then on the actual fabricated chips. You will explore different circuit topologies, and contribute to the design of the next-generation circuits. You will be part of the two research groups (with a primary supervisor in the PRG and one in the NetModel group).

Over the course of 4 years, you will develop your research methodologies in line with the objectives of the GRAPHSPAY project. You will also be interacting with colleagues in both research groups, which could lead to contributions to other research projects. As part of Ghent University, you will also support the research group with limited education tasks.

Profile

We are looking for a candidate with a M.Sc. degree in electrical engineering, photonics or computer science, with a strong interest in mathematical and numerical methods. Decent programming skills are definitely a strong point (the core language used is Python). A basic background in photonics is definitely useful, but there will be ample opportunity to acquire this on the job in the first year of the PhD. During the PhD, the students will have the opportunity to familiarize themselves with the overall technologies behind silicon photonics (note that this research will not involve much hands-on processing or clean-room work), photonics design, advanced modeling techniques and graph algorithm design.

Requirements

- M.Sc. degree in Engineering, preferably Electrical Engineering / Photonics / Computer Science.
- Strong analytical skills for designing and implementing abstract models and algorithms.
- Strong interest in photonics and algorithm design
- Decent programming skills
- You can work independently, have a strong feeling of responsibility and are able to commit to timing and milestones set forward by the research project.
- You are a team player and have strong communication skills.
- A good knowledge of English (oral and written) is a must. Any knowledge of Dutch (oral) is a plus.
- This PhD position is available immediately and is open until the vacancy is filled. The position is not open for post-docs.

About the Photonics Research Group (PRG)

The Photonics Research Group at Ghent University develops optical chips for a diverse range of applications, from telecom/datacom over sensing to medical devices. The group with 9 professors and >70 researchers is also an associated lab of the IMEC nanotechnology center in Belgium. The group is considered a leader in the field of silicon photonics, which is demonstrated by its high-impact publication output and the spin-off of multiple start-up companies.

Within the PRG, the team of prof. Wim Bogaerts focuses on the challenges to realise next-generation large-scale photonic circuits, and especially new type of programmable photonic circuits. This research is in part supported by the consolidator grant PhotonicSWARM of the European Research Council.

About the IDLab NetModel Group

The Internet Technology & Data Science Lab (IDLab) is an IMEC research group at Ghent University and the University of Antwerp. IDLab focuses its research on internet technologies and data science, bringing together more than 300 internet experts, we develop technologies outperforming current solutions for communication

subsystems, high speed and low power networking, distributed computing and multimedia processing, machine learning, artificial intelligence and web semantics.

Within IDLab, the NetModel team of prof. Mario Pickavet focuses on the design of novel algorithms and modeling techniques for complex network problems, in various application domains such as communication networks and transport&logistics.

Application

Use the online form: http://photonics.intec.ugent.be/contact/vacancies/Application.htm

More information

- Prof. **Wim Bogaerts** (wim.bogaerts@ugent.be) – Photonics Research Group
  https://photonics.intec.ugent.be/
- Prof. **Mario Pickavet** (mario.pickavet@ugent.be) – IDlab NetModel Group
  https://www.ugent.be/ea/idlab/en
- Tutorial on Programmable Photonic Circuits (with video):
  http://photonics.intec.ugent.be/publications/publications.asp?ID=4623

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