Proposition de SUJET DE STAGE M2R/Ingénieur-3A

Laboratoire : Centre de Nanosciences et de Nanotechnologies (UMR 9001)
Adresse : Bâtiment 220 de l'UFR Sciences / Université Paris-Sud

Contact: Delphine Marris-Morini
Phone number: 01 69 15 78 52
e-mail : delphine.morini@u-psud.fr http://silicon-photonics.ief.u-psud.fr/

Characterization of silicon modulators for Radio over fiber (RoF) applications

Silicon photonics is an emerging research area, as it profits from mature CMOS technology with high production volume to develop high performance photonic integrated circuits. Actually the main application is driven by data communications, and specifically inside data centers. **Data transmission at 40 Gbit/s and more have been demonstrated using silicon photonics-based transceivers and receivers**. The progress in the recent years is such sed on silicon photonics products. Intensive research is now devoted towards the demonstration of multilevel modulation format such as QPSK or PAM modulation format.

In parallel, new applications are emerging for silicon photonics, related to **Radio over Fiber for wireless access such as 5G communications.**

Radio over Fiber consists of modulating an optical carrier by analog electrical signal to carry information on the optical fiber. Therefore, wireless signals are optically distributed to base stations directly at high frequencies and converted from the optical to electrical domain at the base stations before being amplified and radiated by an antenna providing wireless broadband access from base stations. The main building blocks for silicon based- Radio over Fiber transceivers have already been demonstrated for digital data communications; **however the metrics and figures of merits are different. As main parameters, the linearity of the modulator, and the gain of the opto-RF link have to be evaluated.**

In this context, the goal of the internship is to evaluate and compare the performances of different architectures of silicon modulators for Radio over Fiber applications.

The research activity will include:

- **theoretical study and electro/optical simulations** (using commercial software) to evaluate the key metrics of optical modulators

- **experimental characterizations** of silicon modulators already developed within the group in collaboration with ST Microelectronics, to characterize the device bandwidth, eye diagrams (OOK and multilevel modulation, Spurious-Free Dynamic Range

- **design of next generation of devices**

The work is done in strong collaboration with STMicroelectronics. During the internship, the student will be actively involved in the current research activity of the group, collaborating with PhD students, postdocs and researchers of different research backgrounds and nationalities.

This project can be continued and expanded within the frame of a PhD (European Union projects or Doctoral school funding).

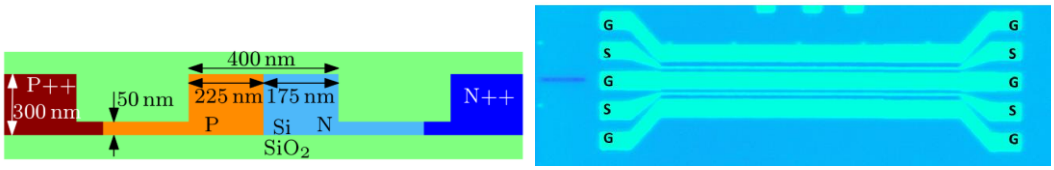

Fig. 1: left: cut view of the active region of a silicon modulator: a PN diode is integrated in the waveguide, to obtain optical modulation by free carrier concentration; right: optical microscope view of a silicon modulator using a Mach Zehnder interferometer to convert the index modulation into intensity modulation.

VALUED QUALITIES IN THE STUDENT

- Curiosity for novel research experiences and fields.

- Creativity and pro-activity in the search for innovative solutions and approaches.

- Capability to communicate and share results in a multidisciplinary and multi-nationality environment.

BIBLIOGRAPHY RELATED TO THE TOPIC

1] D. Pérez-Galacho, C. Baudot, Hirtzlin, S. Messaoudène, N. Vulliet, P. Crozat, F. Boeuf, L. Vivien, D. Marris-Morini, Low voltage 25Gbps silicon Mach-Zehnder modulator in the O-band, Optics Express, 25 (10) 11217 (2017).

https://doi.org/10.1364/OE.25.011217

[2] D. Marris-Morini, L. Virot, C. Baudot, J-M. Fédéli, G. Rasigade, D. Perez-Galacho,J-M. Hartmann, S. Olivier, P. Brindel, P. -mm silicon platform, Optics express (2014), 22 (6), 6674-6679 (2014).

https://doi.org/10.1364/OE.22.006674