Master thesis
Master Recherche / PFE
(5 to 6 month)

Dispersion characterization of active glass waveguides

IMEP-LaHC is working on integrated optics since a few decades and is one of the leading laboratories in the field of photonics on glass. A current objective of the team "PHOTO" of this institute is to develop mode-locked lasers using the glass photonics platform. Mode-locking can be obtained by different methods; the one we have selected uses a fast saturable absorber to form solitons in an optical cavity.

The method to produce those soliton is well known theoretically and requires balancing two effects that occur during the propagation of an optical pulse in the waveguide. The first one is dispersion that comes from both the material and the waveguide. The second effect is a non-linear phenomenon called "self phase modulation (SPM)". Both phenomena need to be precisely characterized for a given technology in order to build an efficient mode-locked laser cavity. The present internship will focus on the precise measurement of the group dispersion of our waveguides.

Dispersion can be measured using an unbalanced Mach-Zehnder (MZ) interferometer whose arms are fabricated with the waveguides to be characterized [1]. A mask containing unbalanced MZ interferometers is already available at the laboratory, the rest is up to the intern !

The internship will be organized as follows:

- Bibliographic study concerning the context (mode-locked lasers architectures, …) and the core subject (dispersion measurement in integrated waveguides)
- Using the provided photolithography mask, fabricate MZ devices using the clean room facilities of the laboratory.
- Characterize the different MZ present on the chip (transmission spectrum).
- Analyze the measured spectra, compare to theory and choose which device is best suited for measuring dispersion.

This internship thus requires a student with an inclination for experimental work (fabrication and characterization). Some knowledge about integrated optics and an experience with clean room environment will be appreciated.

This Master's subject thesis is a preliminary work for a future PhD subject on the same topic, but could also lead to a PhD thesis on another subject within the PHOTO team of IMEP LaHC.

[1] Dulkeith, Eric, et al. "Group index and group velocity dispersion in silicon-on-insulator photonic wires." Optics Express 14.9 (2006): 3853-3863.

Advisors:

Jean-Emmanuel BROQUIN broquin@minatec.grenoble-inp.fr
Lionel BASTARD lionel.bastard@grenoble-inp.fr

laboratoire IMEP – LaHC
MINATEC – INPG, 3 Parvis Louis Néel BP 257 38016 Grenoble Cedex 1 - France