



ERASMUS MUNDUS



MASTER IN PHOTONICS EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

2015-2016

Laboratory : Institut de Microelectrònica de Barcelona (IMB-CNM, CSIC)
City, Country : Barcelona, SPAIN

Title of the master thesis : Phaseguide-based Optofluidic router for lab on a chip applications

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Summary of the subject (maximum 1 page) :

In the last decade, enormous progress has been achieved not only in the microfluidic functionality [1] but also in the detection methods [2] employed in lab-on-a-chip systems. In particular, the use of light as an interrogation mechanism has become a predominant method [2], enabling highly sensitive and noncontact bioanalysis in key applications such as medical diagnostics, drug screening and development, environmental monitoring or food safety. To provide repeatable analysis in such photonic lab-on-a-chip (PhLOC) systems, multiple detection regions on a single chip are often used [3]. This approach has the advantage of increasing both analytical performance and reliability. In addition, sequential screening and multiparametric measurements can be performed. Unfortunately, using multiple detection regions increases the complexity of a measurement significantly, because each region has to be connected to a light source and a detector.

Because of these reasons, it would be highly desirable to have a device at hand, capable of optically addressing several measurement channels of a PhLOC system. Combined with broad-band external light sources, such an optical router device would greatly simplify the operation of a PhLOC system and hence possibly pave the way towards novel high performance laboratory systems which exploit LOC technology and are practical in real field applications.

This master thesis aims to develop a capillary-driven photonic router in which, with the help of phaseguides, temporary liquid mirrors based on tunable air gap mirrors (solid-gas interface) [4] are implemented in specific regions of the structure. This concept allows a sequential screening of the detection regions of a photonic lab on a chip. While reducing the technological and characterization complexity, the router defined in this master will assure a dramatic improvement of PhLoC analytical performance.

In this master, the student will acquire expertise and know-how in the following:

- Design and simulation of capillary-based flat and focusing air mirrors.
- Fabrication and characterization of capillary-based air mirrors.
- Implementation of capillary-based photonic routers.
- Integration of photonic routers with lab on a chip.

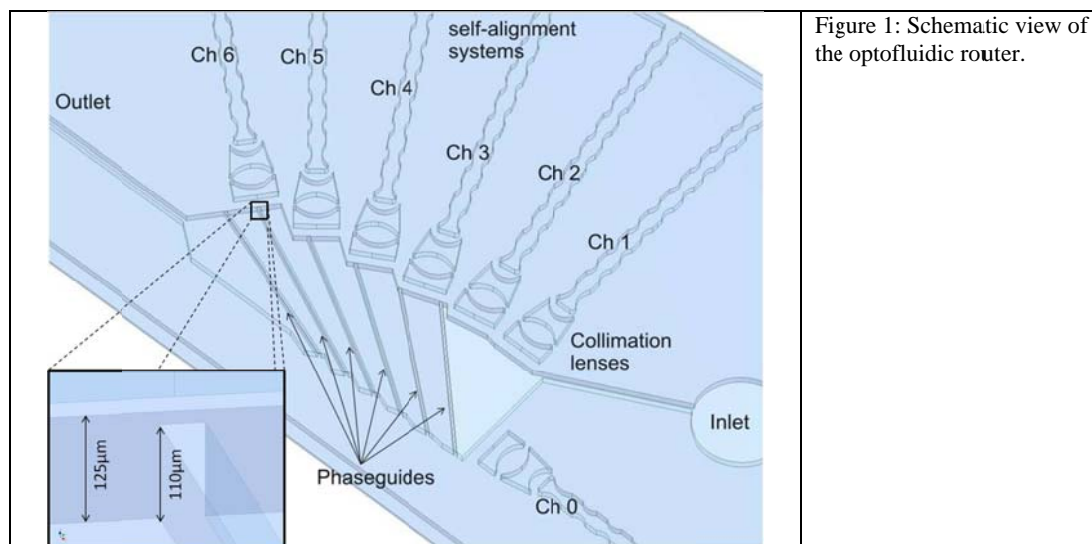


Figure 1: Schematic view of the optofluidic router.

- [1] D. Mark et al., Chem. Soc. Rev., 2009, 39, 1153–1182.
- [2] S. Trietsch et al., Chemom. Intell. Lab. Syst., 2011, 108, 64–75.
- [3] S. Demming et al., Electrophoresis, 2011, 32, 431–9.
- [4] P. Vulto et al Lab Chip, 2011, 11, 1561–1700.

Keywords : Photonic lab on a chip, Biophotonics, polymer technology

Additional information :

- * Required skills :
- * Miscellaneous :