

## PHOTONICS - EUROPHOTONICS MASTER COURSE

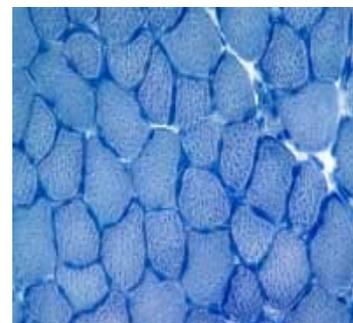
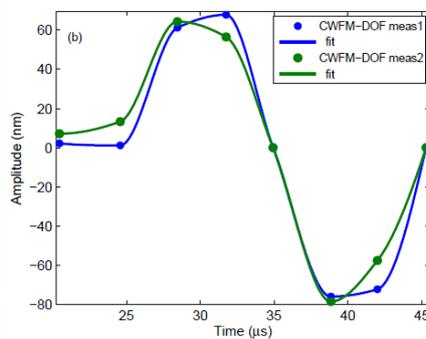
### PROPOSAL FOR A MASTER THESIS

Dates : April 1<sup>st</sup>, 2016 – September 31<sup>th</sup>, 2016

Laboratory : Centre for Sensors, Instrumentation and systems Development (UPC-CD6)  
City, Country : Terrassa, Spain

Title of the master thesis :

**Point-and-shoot microvibrometry for biological applications**



Name of the tutor of the master thesis : **Santiago Royo**

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## **Summary of the subject (maximum 1 page):**

Self-mixing interferometry is a powerful, low-cost optical metrology technique where the nonlinear effects happening within a laser cavity under feedback are used to deliver high-accuracy experimental measurements of position, speed and frequency of vibration. The technique works by simply shining a laser beam against the object to be measured in order to get feedback inside the laser cavity out of the light backscattered at the target. Measurements of 30nm accuracy are obtained with just a laser diode quite easily. Under certain conditions, however, the technique can result in a very high accuracy one, with resolutions down to a few nanometers.

At CD6 a novel approach of applied self-mixing interferometry which incorporates microscopic imaging has been developed, enabling for the first time point-and-measure vibrometry features for known targets. The capacities of the system enable measuring the amplitude of vibration or the change in refractive index of known points in the image.

The student joining this project will implement and characterize a setup for measuring the vibration, or the refractive index changes, of the local spatial changes of samples under the microscope, at different magnifications. First tests will be done using inorganic samples under controlled local excitation, and the project will progress towards the implementation of the measurement of local differences in samples involving vibrometry of living cells.

**Keywords :** Self-mixing interferometry, optical feedback, semiconductor lasers, frequency modulation, optical metrology, NDT.

### **Additional information :**

\* Amount of the monthly allowance (if it is the case):  
To be discussed depending on the value of candidate.

\* Required skills :

Interest in application-driven experimental work for solving real-world problems.  
Basic concepts in optical metrology and optical engineering  
Programming (C++, MatLab) and use of scientific software packages (Zemax, Labview...)  
Search of resources, both scientific and technical  
Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

\* Miscellaneous :

This thesis contents will be considered confidential due to its closeness to market.  
International team with several years of experience in the topic proposed.  
Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.  
Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.  
Early incorporation welcome.