PHOTONICS - EUROPHOTONICS MASTER COURSE

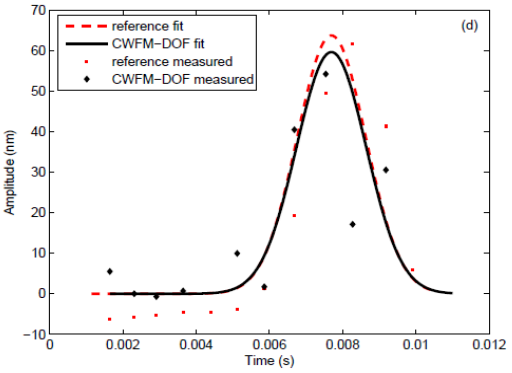
PROPOSAL FOR A MASTER THESIS

Dates : April 1st, 2016 – September 31st, 2016

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

Title of the master thesis :

Dynamic behavior of semiconductor lasers



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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.

One of the approaches used in this high accuracy approach modulates the laser current in order to create fringes in the cavity using the change in wavelength induced by the modulated current injection. This approach enables the measurement of high-frequency events, and paves the way to several low-cost NDT techniques. However, the behaviour of the lasers under this high frequency modulation is not clearly understood, and potential mode-hopping situations can appear.

The student working in this project will analyse the behaviour of at least three different types of laser diodes (VCSELs, Fabry Perot, and DFB) regarding their dynamic behaviour by checking the limits in performance of the different laser families regarding their frequency of modulation, and explore methods for obtaining accurate self-mixing interference signals at the different frequencies. As a final goal, a high-frequency perturbation will be measured in a high accuracy OFI mode.

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 innovation needs, and in hands-on laboratory work.
Basic concepts in optical metrology and optical engineering .
Basic programming skills (C++, MatLab, Zemax, Labview) .
Search of resources and components, both scientific and technical.
Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

* Miscellaneous :
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/Technician/ Project Manager career in case of common interest.
Early start welcome.