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The Institute
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Sciences



Master in Photonics – “PHOTONICS BCN” Master ERASMUS+ “EuroPhotonics”

MASTER THESIS PROPOSAL

Dates: April 2022 - September 2022

Laboratory: Semiconductor laser lab, Dynamics Nonlinear Optics and Lasers (DONLL)

Institution: Universitat Politècnica de Catalunya

City, Country: Terrassa, Barcelona, Spain

Title of the master thesis: Analysis of the contrast of laser-generated speckle patterns

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Keywords: semiconductor lasers, speckle, model simulations

Summary of the subject:

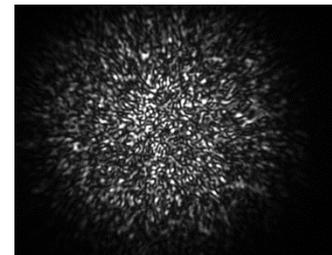
Thanks to unprecedented advances in photonics, machine learning and signal processing tools, remote optical sensors are nowadays used widely. For example, hospitals and industrial spaces require of ventilation systems whose fans are often found in hard-to-reach places, and are monitored with optical sensors that send alarms when vibrations and/or changes in conditions occur, which may be early indicators of malfunction.

In our lab we have implemented a remote “optical microphone” sensor, able to “hear” and recover an audio signal from the analysis of the silent video of the movement of a laser-generated speckle pattern (shown in the figure) [1,2].

To improve the sensor’s performance, we need to identify the laser operation conditions that produce speckle patterns with optimal contrast. The goal of the TFM is to analyse how the speckle contrast varies with the laser’s parameters, by performing simulations of well-known laser models.

[1] C. Barcellona, et al, “Remote recovery of audio signals from videos of optical speckle patterns: a comparative study of signal recovery algorithms”, Opt. Express 28, 8716 (2020).

[2] <https://www.efe.com/efe/espana/destacada/convierten-en-imagenes-los-acordes-de-una-cancion-del-grupo-queen/10011-4300927>



Additional information (if needed):

* Required skills: good programming skills are mandatory.

* The TFM requires simulations that can be performed remotely, in a personal computer.