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PHOTONICS - EUROPHOTONICS MASTER COURSE

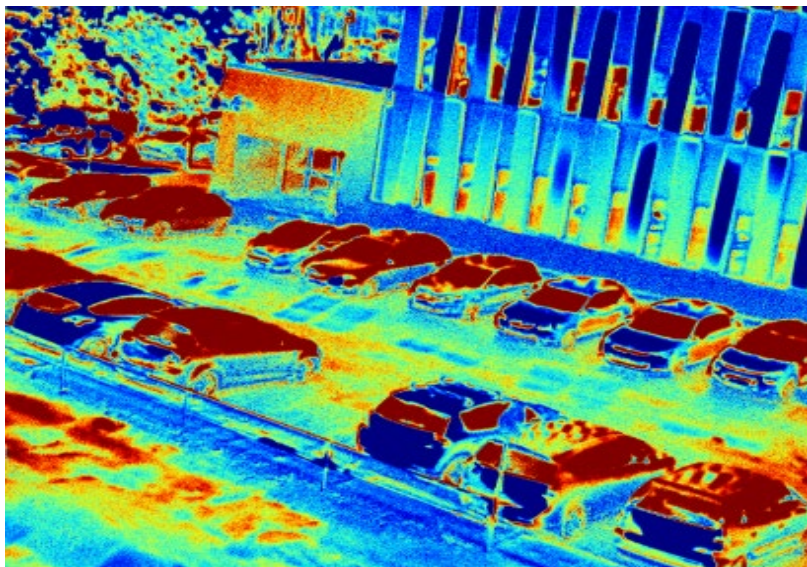
PROPOSAL FOR A MASTER THESIS

Dates: February 1st, 2021 – September 31st, 2021

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

Title of the master thesis:

Comparison of polarimetric calibration methods for full-Stokes snapshot polarimeter



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Summary of the subject:

Aim: To implement an eigenvalue polarization calibration in order to compare its performance with the current polarimetric calibration in a snapshot full-Stokes imager.

Descripton. The full-Stokes snapshot imager developed at CD6 has the potential of recovering the whole polarization state of the scene with immunity to noise perturbation (in specific, Gaussian and Poisson noise). In order to achieve the final polarization image, three levels of calibration need be performed: radiometric calibration, geometric calibration and finally, the polarimetric calibration.

Nowadays, a DRM (Data Reduction Matrix) calibration is implemented and it seems to work well when the imager is used as a Stokes polarimeter. However, our design allows us to transform the Stokes imager into a fast Mueller imager, just by taking only four acquisitions. The acquisition of fast Mueller matrix images let us to participate in a number of different applications such as tissue recognition, medical diagnosis, food industry, industry 4.0 etc. In addition, moving towards Mueller matrix measurement implies to check if the correct calibration procedures are applied for this use. The student will be in charge to implement the eigenvalue calibration procedure and check if together with the geometrical calibration algorithms there is an improvement in performance in comparison with the DRM calibration. (Using the device as Stokes or Mueller imaging polarimeter).

Project: This is an applied project with a strong experimental component. Full time dedication expected. Along the first weeks of the project you will be introduced to the theoretical basis of the project, to gradually prepare for experiments and finally design them, implement them in the lab, and process them. You will have direct support of CD6 staff in all moments.

Keywords: Polarimetric imaging, calibration, Stokes vector, Mueller matrix, sensors, image processing, optical instrumentation, optical engineering

Additional information:

* Monthly allowance possible depending on value of candidate

* Recommended skills:

Interest in application-driven experimental work for solving real-world problems.

Basic concepts in optical engineering and image processing

Programming (C++, MatLab, Python)

Search of resources, both scientific and technical.

Self-motivated, objective-driven, autonomous worker 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.