MASTER IN PHOTONICS – "PHOTONICS BCN"
ERASMUS+ "EUROPHOTONICS"

MASTER THESIS PROPOSAL

Dates: April - September 2019

Laboratory : GOAPI - Applied Optics and Image Processing Group
Institution: Universitat Politècnica de Catalunya - BarcelonaTECH
City, Country : Terrassa (Spain)

Title of the master thesis: Spectral performance of a trifocal intraocular lens

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Keywords : intraocular lens, diffractive lens, optical bench testing, energy efficiency, chromatic aberration, high-order aberrations

Summary of the subject (maximum 1 page) :

In a frequent form of cataract surgery, the crystalline lens is removed and an intraocular lens (IOL) is implanted in the capsular bag. IOLs are commonly designed assuming a light wavelength of 550nm. However, there is a need to understand, describe and characterize the performance of IOLs in the visible spectrum of light.

This project aims to theoretically describe and experimentally measure the spectral performance of a commercial trifocal intraocular lens. The trifocal diffractive-refractive IOL of advanced design is to be studied using and on-bench in-vitro technique, such as the Energy Efficiency Through-Focus (EE-TF), with the sequential illumination of three different wavelengths: red (R), green (G) and blue (B).

Three foci for distance, intermediate and near vision are expected to be formed by the IOL. The RGB EE-TF curves will be measured and from them, the Longitudinal Chromatic Aberration (LCA) that affects each focus will be derived.

The results should be interpreted taking into consideration the available technical information about the IOL design.

Experimental method: The compound system of microscope objective, filters and camera is aimed to serve as the image acquisition unit placed in an optical setup for on bench in-vitro IOL testing (see figure). More specifically, it would acquire the aerial image of a target formed by a model eye where an IOL is inserted.

The project involves the stages of device initialization and alignment on optical bench, use of extensive options for measurement acquisition, logging and analysis via own software application.

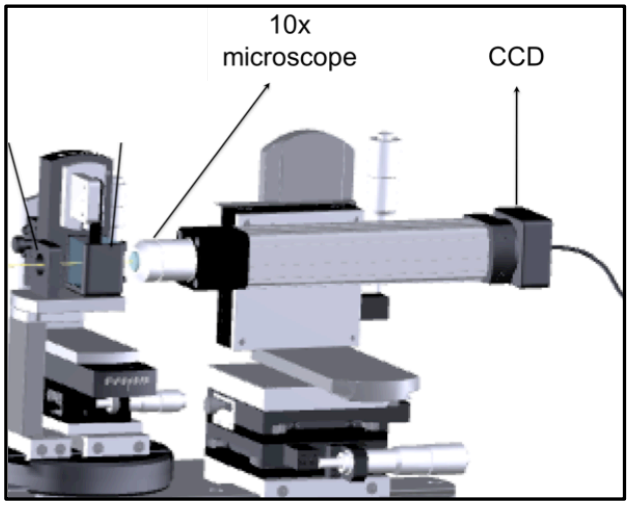

Figure. Scheme of the experimental setup (partial) for IOL testing on optical bench. A model eye unit (left), with an intraocular lens is inserted in a wet cell, forms an aerial image (retinal plane) that is captured by an image acquisition unit (center) consisting of a microscope objective assembled to a CCD sensor camera.

Additional information :

- Required skills: Experimental experience in optical laboratory. Most part of the project is experimental, but some theoretical background on imaging systems, diffractive optics and vision is necessary. Team working and autonomous self-working.
- Miscellaneous: All the optical components, opto-mechanic elements, opto-electronic devices and other resources will be provided by the laboratory on the premises of the Faculty of Optics and Optometry (TR8-UPC).