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ABSTRACTS

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Parameter analysis for LCoS devices as a function of the voltage and wavelength (#522)

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Abstract: A model describing the parameter and wavelength dependencies not only of retardance, but also its flicker in liquid-crystal-on-silicon spatial light modulators (LCoS SLMs), is presented. We provide results for different digital addressing sequences producing different levels of flicker.

1. Introduction

Liquid-crystal-on-silicon spatial light modulators (LCoS SLMs) are microdisplays that can modulate the amplitude, phase, or polarization of light waves spatially and temporally.[1] LCoS SLMs are used to generate different diffractive optical elements (DOEs) for dynamic processes, as well as polarization, amplitude, and phase-only spatial light modulators, where they achieve full phase modulation.[2-3] In this paper we focus on the application of LCoS SLMs to determine the change of the state of polarization of a reflected laser beam through its surface as a function of the voltage provided by the grayscale. We show that this modifies not only the global efficiency of the LCoS but it also exhibit a degradation effect, such as flicker, due to the time variations in the electrical signal addressing as found in LCoS displays. The phase flicker in digital liquid crystal on silicon (LCoS) device introduces temporal phase noise to the phase pattern displayed on the device. Such temporal phase noise could elevate the power of unwanted diffraction orders and ultimately cause crosstalk in optical switches based on the LCoS technology.[4]

It is worth mentioning that we consider two polarimeter setup to measure the three parameters of LCoS devices. We have chosen a very general design, based on a four states of polarization analyzer system, which enables to consider the figures of merit used in optimal polarimetry together with the uncertainty and noise sources influencing the measurement process. Additionally, we use a commercial rotating waveplate polarimeter so that we can compare its experimental results, thus providing further insight about the relevance of the results and their robustness. We also consider the general mathematical structure of a full Stokes polarimeter to provide an optimal polarimetry analysis of the influence of the measurement system. We tried this numerical approach to obtain the value the parameters, applying an optimization procedure, that enables to evaluate the precision and robustness of the polarimeter in the characterization of the LCoS parameters through a series of simulated experiments.

2. Figures

In Fig. 1 we show the diagram for the experimental setup for both methods, Fig. 1 a) correspond to the one based on a four states of polarization analyzer system and Fig. 1 b) shows the setup using a commercial rotating waveplate polarimeter. Fig. 2 we show the graphics as a result of the experimental measurements obtained for both setups. At first sight, there are no remarkable differences, so we can say that it is a reproducible method that can be used in any configuration.

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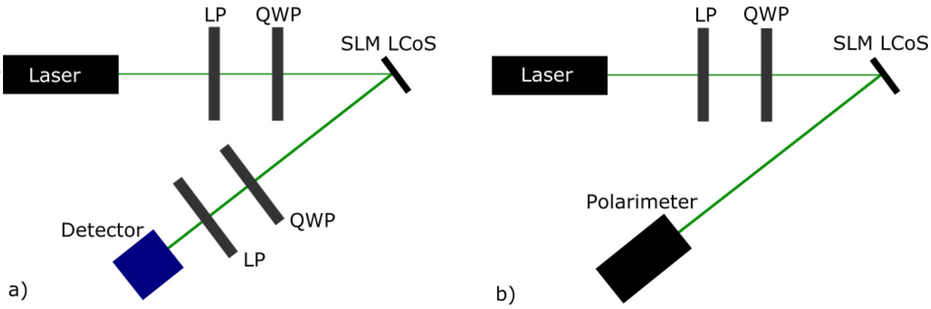
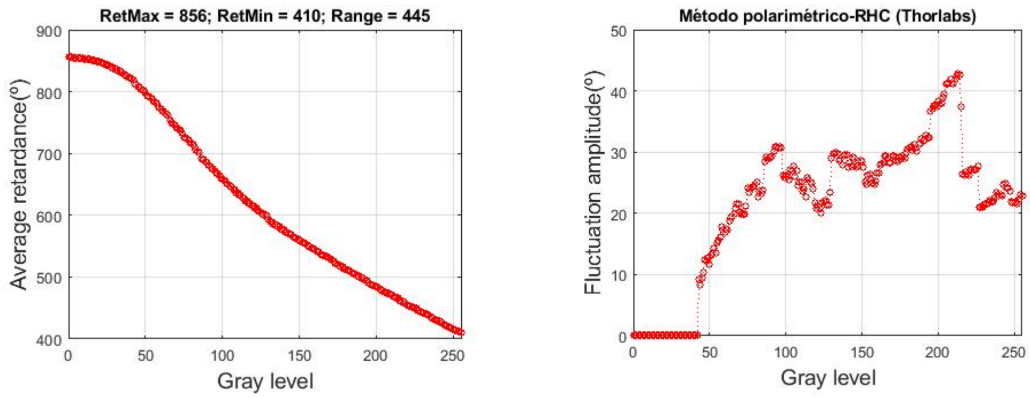


1. Experimental setup used for the parameter analysis. LP refers to the linear polarizer, QWP means quarter wave plate and SLM LCoS refers to the Liquid Crystal on Silicon Spatial Light Modulator. a) Setup based on a four states of polarization analyzer system and b) setup using a commercial rotating waveplate polarimete



2. Experimental results for the retardant and the fluctuation. Fluctuation and DOP for a simulated method.

3. Conclusions

In this paper, an efficient method to analyze the parameters of an SLM LCoS as a function of the voltage and wavelength, has been proposed.

We have demonstrated that for both experimental setups used in the present work, have no remarkable differences so we can say that it is a reproducible method that can be used in any configuration.

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