Optoelectronic device for simultaneously determining the absolute retardance and the optical retarder's angle of rotation

Description

The Applied Optics Complutense Group (AOCG) has developed an optoelectronic device that allows for the measurement of optical retarder characteristics; specifically, it enables the simultaneous determination of the absolute retardance and the fast eigenstate angle of rotation of an optical retarder.

Both the device and the procedure for simultaneously determining absolute retardance and the angle of rotation of the fast eigenstate of an optical retarder using a device as described here are protected by a pending patent application (ES2948491A1)."

How does it work?

This device employs a dual-path interferometer to generate two beams with orthogonal polarization states. The beams are recombined before passing through the optical retarder and impinging on a light detector. By rotating the optical retarder and measuring the changes detected in the light, both properties of the retarder can be characterized. This device has the additional advantage of being able to characterize optical retarders without the need for any other retarder to be characterized in advance. Furthermore, it is a cost-effective system.

Figure 1 shows a simplified diagram of one of the possible constructions, in this case it has the form of a Michelson interferometer: a circularly polarized light source (1), a beam splitter (3), two polarizers at 0 and 90 degrees (11.1 and 11.2), two mirrors, one of them slightly rotated (8 and 9), the optical retarder (4) being measured or characterized, mounted on a rotatable holder (10), a third polarizer (5), a photodetection system (6), and a data processing system (7).

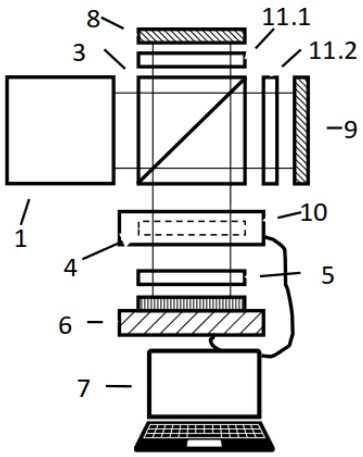

Figure 1

There are several options for designing such a device. In addition to the Michelson interferometer, another option would involve the use of a collimated laser diode, a Young interferometer, a manually rotating holder for the optical retarder, and a one-dimensional array of photodetectors to create a very compact and potentially cost-effective device. A third option would be a system composed of a white light source, a Mach-Zehnder interferometer, a motorized optical path length adjuster, a motorized rotating holder for the optical retarder, and a spectrophotometer to measure retardance and the fast eigenstate angle of rotation for various wavelengths.

Facultad de Medicina. Edificio Entrepabellones 7 y 8.
C/ Doctor Severo Ochoa, 7. 28040 Madrid.
comercia@ucm.es

Advantages

The accurate measurement of the characteristics of optical retarders is of great importance in fields such as Material Analysis, Optics, Biology, and Astrophysics. The devices presented here have the advantage of being able to characterize linear optical retarders without the need for any other retarder to be previously characterized. Furthermore, they are cost-effective systems and can be designed in a compact form.

Where has it been developed?

The foundation of the Applied Optics Complutense Group can be traced back to a shared fascination with the field of Optics, with a specific emphasis on its engineering-related facets.

Due to its growth in size, this group is structured into specialized teams that work on more specific research projects and tasks while maintaining a high level of cross-disciplinary relationships to solve problems and make the most of material and human resources.

In particular, the team that has achieved the results presented here focuses on research lines related to optical position encoders, polarimetric microscopy, the design and manufacturing of diffractive optical elements (DOEs), and the application of spatial statistics in image processing and metrology.

In addition

The various device options mentioned have been initially verified through numerical simulations and subsequently through experimental setups.

We are interested in contacting optical device development companies interested in bringing to market the devices designed by our group. We offer companies the exploitation license for the patent protecting these devices.

Research Team Leaders

Luis Miguel Sánchez Brea: optbrea@ucm.es
Jesús del Hoyo Muñoz: jhoyo@ucm.es
Optics Department
Faculty of Physics