OptiXplorer

Optics Education Kit

HOLOEYE **Pioneers in Photonic Technology**

OPTIXPLORER

The OptiXplorer is an educational kit for both introductory and advanced laboratory courses in optical physics. The main topics covered in the six experimental modules are polarization effects, amplitude modulation, phase modulation and Fourier Optics.

The primary component of the OptiXplorer is a HOLOEYE

spatial light modulator (SLM), which is based on a transmissive twisted-nematic LC display with XGA resolution. Additionally a laser module, two rotatable polarizers and some optomechanical components are included in the kit.

The kit is delivered with a bundle of tailored software: The "OptiXplorer" software permits to display various optical functions on the SLM, including self-designed diffractive optical elements (DOE). The "PhaseCam" software can be used for interferometric phase measurements. The "DynRon" software is a LabVIEW™ program for diffraction measurements at Ronchi gratings. The SLM device control software is a convenient tool for the adjustment of the SLM's device settings.

Together with a theoretical introduction in the handbook and the provided references to additional literature, the six experimental modules make the Optixplorer a powerful and low-cost educational tool that enables the demonstration and active exploration of a wide range of optical phenomena.

Topics & Experiments

In the **AMP module** the SLM is used as dynamic image generator. First the polarization characteristics of the light source and its change by transmission through the SLM are investigated. The basic laws of imaging and separation of illumination and imaging are reviewed to build a simple projector. The image magnification and contrast can be determined.

In the **JON module** the components of the SLM´s Jones matrix will be determined from transmission measurements using the rotatable polarizers. The LC cell´s birefringence, director orientation and twist can be derived from a well explained numerical calculation. Because multiple solutions are obtained, additional measurements with other wavelengths or with addressed grey levels are used to remove the ambiguities.

In the **LIN module** the SLM is first investigated as a static diffraction grating and some of its geometrical parameters can be derived. Using lenses, the far-field diffraction pattern can be observed even with a magnified diffraction angle. Binary linear gratings and 2D-separable gratings which can be used as beam-splitters and array generators are displayed on the SLM and the measured diffraction efficiencies are compared with the theoretical predictions.

In the **RON module** Ronchi gratings of variable greylevel contrast will be addressed and from the measured diffraction efficiencies the phase modulation can be derived. This measurement is first performed for a few gratings using the “OptiXplorer” software to understand the principle of measurement. With a LabView™ software program, this measurement can be repeated in an automated way. Thus, the best choice of orientation of the rotatable polarizers for obtaining high phase modulation can be determined.

In the **CGH module** the “OptiXplorer” software is used to generate dynamic lenses and prisms as well as dynamic CGHs (or DOEs) for user-specified signals using the IFTA algorithm. Using ABCD matrices, the measurements of positions of optical elements and distances to the plane of Fraunhofer diffraction can be compared with theoretical predictions. Superimposed lens and prism functions are used to move the far-field pattern in space and to spatially separate it from the undiffracted light, thereby delivering a levely introduction to the principles of Fourier optics.

In the **INT module** a simple two-beam interferometer is used to create interference fringes which are recorded on a CCD camera. The two beams are mutually phase-shifted by the SLM, which is used to display half-screen images. The spatial fringe-shift can be used to derive the phase modulation. The measurement is first performed with the “OptiXplorer” software in order to understand the principle of measurement. The measurement can be repeated with the provided “PhaseCam” software in an automated fashion yielding more accurate results.

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